November 2022

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Photo on the Cover:
The arrival in downtown Santo Domingo of a Siemens Energy Sea-float, complete with energy storage.
Photo: Siemens Energy

Photo this Page:
Wärtsilä's Kivuwatt FPP floating in and drawing methane from Lake Kiwu, Rwanda, in 2016.
Photo: Wärtsilä

Features

Departments

MICROFOULING MATTERS

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Authors

Bryant

Galdorisi

Goldberg

Gow

Lander

Lundquist

Stoichevski

Tomic

van Hemmen

Bryant
Dennis Bryant is with Bryant's Maritime Consulting, and for 20 years was a contributor to *MR*.

Galdorisi
George Galdorisi is Director of Strategic Assessments for the Naval Information Warfare Center Pacific. He is the author of 15 books, including four New York Times bestsellers.

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

Gow
John Gow has a long career in maritime firefighting, today serving as Technical Director for Marine at Jensen Hughes. He was invited to participate as a member of the expert group on container ship fires convened by IUMI.

Lander
Karl Lander is the Director, Regulatory Compliance and Outreach at Armach Robotics. He joined Armach following 4+ years with Greensea Systems, where he was Director, Hull Robotics.

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

Stoichevski
After a honing the media campaign of Norwegian green group Bellona (current fuels advisors to the European Commission), William Stoichevski began working for the Associated Press. William lives and works in Oslo.

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

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

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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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As 2022 winds down, the maritime sector [and for that matter, nearly every industry everywhere] faces some diverse and fairly stiff headwinds, led by inflation growing globally, continued geopolitical conflict courtesy of Russia's war in the Ukraine, and increasing levels of energy security concerns, particularly in Europe and large swaths of the developing world.

But while there are multiple warning signs and road blocks, I contend there are even more opportunities. Having served in this post now for more than three decades, I've seen more than my fair share of global economic tumult, from a brief recession starting at the end of 1992; to the Asian financial crisis in the late 1990s; to the bursting of the dot.com bubble in the early 2000's; the housing collapse and global economic crisis of 2007/08; to the recent COVID pandemic. The list is long and distinguished, but each time the sun still rises, the world keeps spinning and business keeps churning, admittedly at a different pace.

Tightening emission regulation is here to stay, which subsequently is starting to drive investment in new tonnage that comes with refined existing and emerging technologies that aim to cut air and water emissions. At the SMM exhibition in Hamburg earlier this autumn, we had the chance to sit with **Constantin Baack, CEO, MPC Container Ships**, who discussed his company's recent investment in a pair methanol-powered 1,300-TEU containership newbuilds ordered in July 2022 for delivery in 2024. Methanol is certainly not the final solution to meet and beat emission targets through 2050, but it is a step change moving in that direction, and Baack offers some salient pieces of advice for those mulling alternative fuels.

A niche yet interesting market to watch is the advance of floating power plants, our cover story as reported by William Stoichevski from Oslo. Floating power plants are certainly not a new thing – and not included in this feature but previously published in our pages was a feature on the advent of floating nuclear power plants – but today's modern plants and plan tie the full raft of current issues, from energy security to powering developing countries to renewable energy and green fuels. William's report starts on page 34.

Last, but not least, offshore energy in all of its forms, led by traditional oil & gas and offshore wind. I stopped trying to guess the length and breadth of offshore energy booms and busts many moons ago, but a recent interview I had for our *Offshore Engineer* with **Carl Trowell, CEO, Acteon Group** – who is bullish on both oil & gas and wind – was telling:

"There's going to be more infrastructure going into the sea in the next decade from offshore wind than went in throughout the whole lifetime of oil and gas. If you just look at the number of units, the number of installations, when you start moving to floating wind, it's going to be off the scale of the number of moorings. We're at the beginning of what will be a mega cycle of investment."

To read the full story, scan the QR code.

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 and Chief Operating Officer
Publisher & Editorial Director
Greg Trauthwein
trauthwein@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

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

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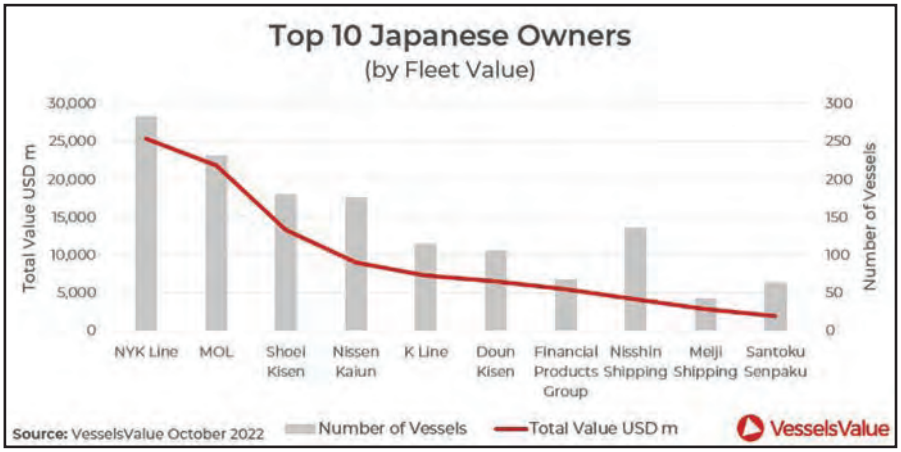
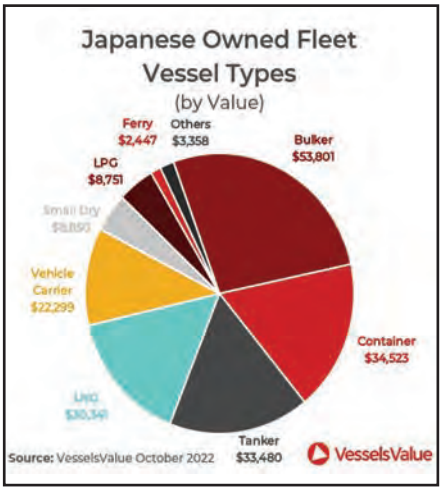
Top 10 Owners

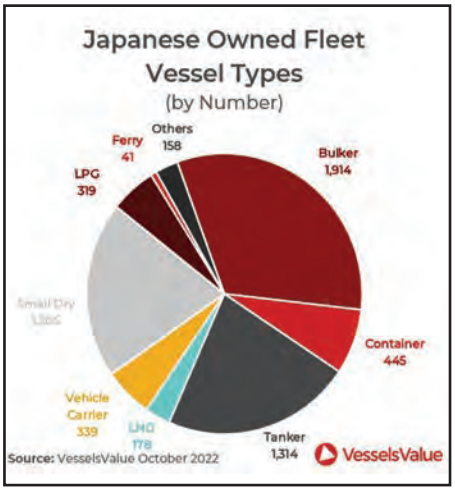
Company	# of Vessels	Total Value ($)
NYK Line	284	25,379
MOL	231	21,863
Shoei Kisen	180	13,306
Nissen Kaiun	176	8,996
K Line	114	7,302
Doun Kisen	105	6,520
Financial Products Group	68	5,462
Nisshin Shipping	135	4,132
Meiji Shipping	43	2,841
Santoku Senpaku	63	1,934



Japanese 2nd Hand Purchases

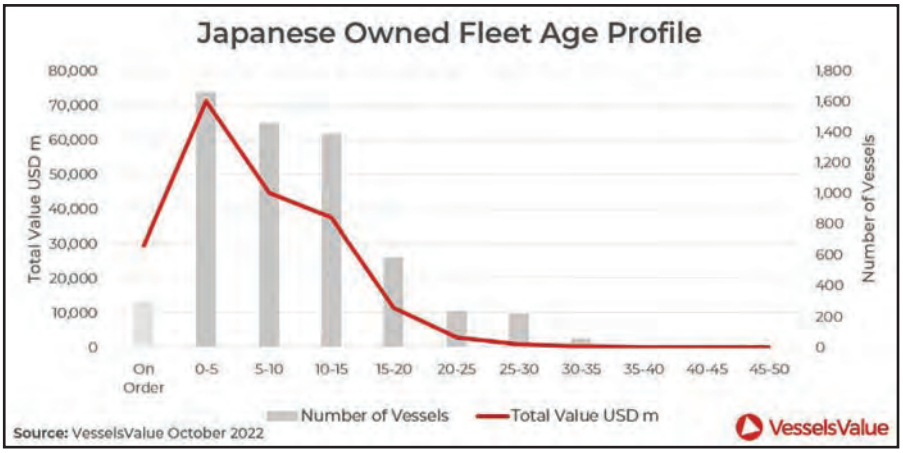
Sale Date	# of Vessels	Total Spent ($)
2010	17	308
2011	13	322
2012	45	977
2013	48	682
2014	58	1,472
2015	68	1,825
2016	90	2,660
2017	123	2,597
2018	104	2,830
2019	138	3,702
2020	117	2,444
2021	107	2,798
YTD 2022	66	2,615





Japanese Owned Fleet Age Profile

Age Group	# of Vessels	Total Value ($)
On Order	300	29,433
0-5	1,658	71,316
5-10	1,459	44,594
10-15	1,388	37,317
15-20	583	11,524
20-25	238	2,697
25-30	216	763
30-35	58	171
35-40	7	24
40-45	5	2
45-50	1	8



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Responder Immunity

The Federal Water Pollution Control Act (FWPCA – also known as the Clean Water Act), as amended by the Oil Pollution Act of 1990 (OPA 90), contains a responder immunity provision. That provision states, in pertinent part:

(A) A person is not liable for removal costs or damages which result from actions taken or omitted to be taken in the course of rendering care, assistance, or advice consistent with the National Contingency Plan or as otherwise directed by the President relating to a discharge or a substantial threat of a discharge of oil or a hazardous substance.

(B) Subparagraph (A) does not apply –

(i) To a responsible party;

(ii) To a response under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seqq.);

(iii) With respect to personal injury or wrongful death; or

(iv) If the person is grossly negligent or engages in willful misconduct.

While there is no recorded instance of a responder being found liable under this provision, there have been a number of instances where a responder have been sued civilly with the plaintiff alleging personal injury or wrongful death and that the responder was grossly negligent or engaged in willful misconduct. Such allegation requires the responder to spend time and money hiring an attorney and mounting a defense.

Responders have contended for years that the immunity provision should be broader, but without success to date. Some individuals were concerned that reopening OPA 90 might lead to other, less desirable changes, while others wanted to ensure that the right to receive compensation by persons suffering actual damages from gross negligence or willful misconduct was not impaired.

This memorandum will attempt to review currently available legal defenses to responder liability and propose a legislative change that might transfer liability elsewhere.

Federal Contractor Immunity

The U.S. Supreme Court first recognized the concept of federal contractor immunity, at least by that name, in Boyle v. United Technologies Corp. Plaintiff sued the designer and builder of a military helicopter. Plaintiff's decedent died when the helicopter in which he was co-pilot crashed at sea and he was unable to egress because the door opened out and he was unable to overcome the water pressure that was keeping the door closed. The court held that in areas involving uniquely federal interests, state civil liability laws may be replaced by federal law. State law is displaced where there is a significant conflict between an identifiable federal policy or interest and the operation of state law or the application of state law would frustrate objectives of federal legislation. In this case, state law which imposed liability for design defects in military equipment was displaced where (a) the United States approved reasonably precise specifications; (b) the equipment conformed to those specifications; and (c) the supplier warned the federal government about dangers in the use of equipment known to the supplier but not to the federal government.

The court held in Yearsley v. W.A. Ross Construction Corp., decided 48 years previously, that if authorization to carry out specific work was validly conferred by a federal agency to a private party, that is, if what was done was within the Constitutional power of the Congress, there is no liability on the part of the contractor for executing the federal agency's will. The remedy, if at all, lies with the federal government through the Court of Claims. In the instant case, defendant contractor had been hired by the U.S. Army Corps of Engineers to make improvements on the Missouri River for the purposes of navigation. The work involved construction of dikes to produce artificial erosion. Some of that artificial erosion removed parts of plaintiff's land. The federal government, not the contractor, was responsible for damages.

These decisions created two different avenues for potential

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federal contractor immunity defenses. If the contractor did what the federal government had contracted it to do, any liability shifted to the federal government. Alternatively, if the federal government knowingly approved of the contractor's work in advance, any liability again shifted to the federal government. The court later added a caveat to the federal contractor immunity defense. In Campbell-Ewald Co. v. Gomez, it ruled that federal contractors do not enjoy derivative absolute immunity where the contractor exceeds its authority and violates federal law

Responders to discharges of oil or hazardous substances are taking their direction from the Federal On-Scene Coordinator (FOSC) in accordance with the National Contingency Plan, not from the responsible party. The federal government has a vital and uniquely federal interest in prompt, thorough, and environmentally responsible responses to these discharges. Application of state civil liability law would frustrate that federal interest. During the federal response, the FOSC provides reasonably precise directions regarding details of the response effort. Equipment utilized during the response has been preapproved by the federal government. During the response effort, the FOSC receives candid advice from the responders as to the various response options available; the FOSC then selects the method to be utilized. This reasoned response to discharges appears to meet the standards of both the Boyle and the Yearsley doctrines.

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FTCA

The Federal Torts Claims Act (FTCA) provides a limited waiver of sovereign immunity and allows private persons to sue the federal government in federal court for most torts committed by persons (federal employees) acting on behalf of the United States. Among the exemptions are claims arising from assault, battery, false imprisonment, false arrest, malicious prosecution, abuse of process, libel, slander, misrepresentation, deceit, or interference with contract rights.

The FTCA only authorizes tort lawsuits against the United States itself; it expressly shields individual federal employees from personal liability for torts that they commit within the scope of their employment. In other words, the FTCA makes the remedy against the United States under the FTCA exclusive of any other civil action or proceeding for money damages that might otherwise be available against the employee whose act or omission gave rise to the claim. Congress prohibited courts from holding federal employees personally liable for torts committed within the scope of their employment in order to avert what Congress perceived as an immediate crisis involving the prospect of personal liability and the threat of protracted personal tort litigation for the entire Federal workforce. The individual employee generally remains immune from tort liability for torts committed within the scope of his or her employment even if a provision of the FTCA forecloses the plaintiff from recovering monetary damages from the United States itself.

Gradually, several court decisions found exceptions to the broad immunity afforded federal employees by the FTCA. The first significant exception was with regard to federal employees utilizing private vehicles on government business. In 1961, Congress responded by enacting the Federal Drivers Act, which granted specific immunity to federal employees for any damage to property or for personal injury, including death, resulting from the operation by any employee of the government of any motor vehicle while acting within the scope of his office or employment.

Then the Supreme Court issued its decision in the case of Westfall v United States, holding that the FTCA, as then worded, applied only to discretionary acts of federal employees. Congress responded by enacting the Federal Employees Liability Reform and Tort Compensation Act of 1988, better known as the Westfall Act. That legislation replaced the Federal Drivers Act and amended the FTCA to override the Supreme Court decision and make it abundantly clear that tort immunity was provided across the board to federal employees acting within the scope of their employment. Interestingly, in the uncodified findings and purposes portion of the legislation, Congress stated:

Recent judicial decisions and particularly the decision of the United States Supreme Court in Westfall v. Erwin, have seriously eroded the common law tort immunity previously available to Federal employees.

The erosion of immunity of Federal employees from common law tort liability has created an immediate crisis involving the prospect of personal liability and the threat of protracted personal tort litigation for the entire Federal workforce.

The prospect of such liability will seriously undermine the morale and well-being of Federal employees, impede the availability of agencies to carry out their missions, and diminish the vitality of the Federal Tort Claims Act as the proper remedy for Federal employee torts.

Congress further stated:

It is the purpose of this Act to protect Federal employees from personal liability for common law torts committed within the scope of their employment, while providing persons injured by the common law torts of Federal employees with appropriate remedy against the United States.

The common law tort immunity provided to federal employees by the FTCA has not been subsequently challenged.

OPA 90

One of the purposes of OPA 90 was to ensure prompt responses to discharges or the substantial threat of discharge of oil or hazardous substances. To that end, Congress requires owners and operators of covered vessels and marine transportation-related shoreside facilities to contract in advance for the provision of such service.

The legislation also provides responders immunity for injury and damages resulting from actions taken or omitted to be taken in accordance with the National Contingency Plan or otherwise directed by the President (who has delegated such authority to the FOSC.

For the same reasons that Congress found it important to grant personal immunity to federal employees for torts committed within the scope of their employment, immunity should be granted in the same manner to responders for torts committed in the course of rendering care, assistance, or advice consistent with the National Contingency Plan or as otherwise directed by the President relating to a discharge or the

substantial threat of a discharge of oil or a hazardous substance.

The absence of broad responder immunity under current law may lead some responders to refrain from taking action directed by an FOSC or from proposing novel approaches to response in a particular situation, especially when the action directed or the novel approach under consideration poses any possibility of increasing the environmental impact. Such hesitation on the part of responders, while understandable, is highly undesirable in a spill response. Congress emphasized in enacting OPA 90 the importance of a timely and effective response. The U.S. Coast Guard reiterated that approach in its regulations implementing OPA 90, particularly with regard to the regulations addressing salvage and marine firefighting (SMFF). Experience indicates that delay in response to a marine spill inevitably results in increased response requirements and increased environmental damages.

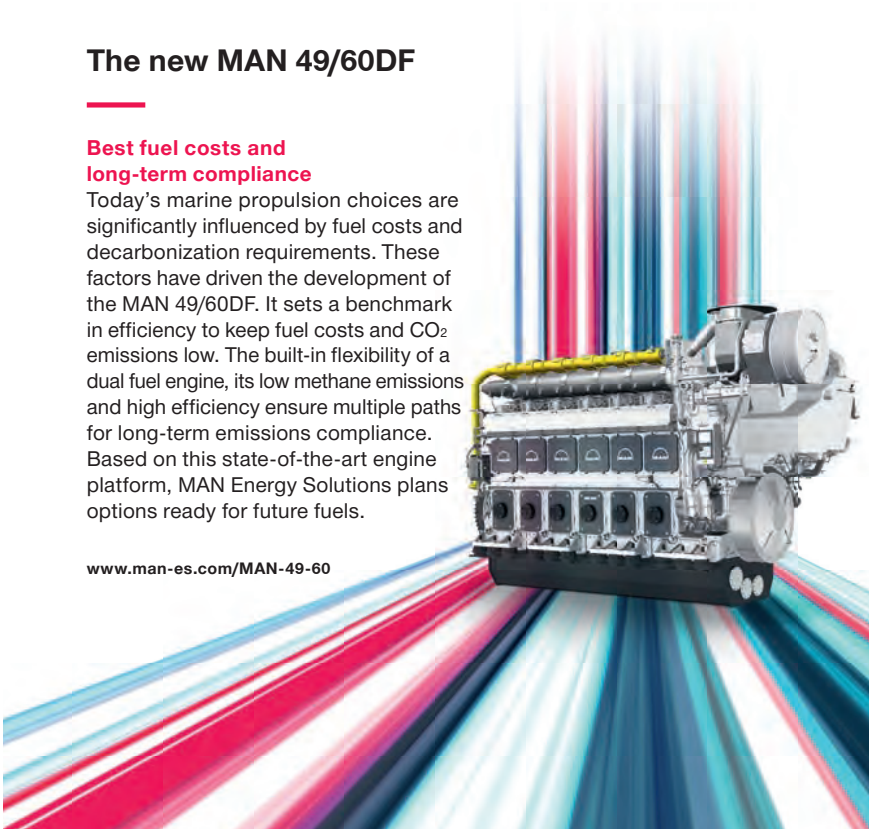
Proposal

Individuals and entities responding to discharges or the substantial threat of discharges of oil or hazardous substances into waters of the United States are acting as federal employees. Their reluctance to become involved due to the risk of tort liability will impede the availability of federal agencies to perform the vital mission of maintaining and enhancing the cleanliness of those waters and the environment. It is proposed that the FTCA be amended to include within its provision of immunity from common law and admiralty tort liability actions (as well as actions involving foreign sovereigns) taken or omitted to be taken in accordance with the National Contingency Plan or otherwise directed by the President or the FOSC by individuals and entities responding to discharges or the substantial threat of discharge of oil or hazardous substances.

The Author

Bryant

Dennis Bryant is with Bryant's Maritime Consulting, and for 20 years was a contributor to *Maritime Reporter & Engineering News.*



Tip #41

Maritime Skills
Who Trains? Who Assesses?

Assessment is a special interest of mine, and it should be at or near the top of the list for anyone involved in maritime training. Why? Two reasons. First, because it is arguably more important than the training itself. And second, because in my experience most training administrators pay 95% of their attention to training, and only 5% to assessment. This means that assessment is often done poorly. So let's turn our attention to some essential tips for assessment in maritime training.

This article presents one simple, but critical, assessment tip for improving the evaluation of skills in your officers and crew: a trainee should be taught and assessed by different people. That is, we should never allow a trainee's trainer to be the same person as their assessor. Let's discuss why this is important.

It is the job of the trainer to ensure a candidate learns all the required skills and knowledge for the job at hand. The assessor has a different job - that of ensuring that no candidate is assigned a job duty they are not prepared for. While these roles are inherently designed to achieve a common purpose, in some ways, they have (and should have) conflicting interests. The trainer is there to support, instruct, and provide resources. Therefore, the trainer should be a "safe" and supportive learning resource for the candidate regardless of the candidate's abilities. The candidate should not feel any judgment from the trainer when they ask questions or practice skills. In contrast, the role of the assessor is not to support the trainee, but to evaluate the trainee. The assessor has a duty to determine if the trainee has the requisite knowledge and skills to perform efficiently and safely - since lives and fleet performance depend on it.

It can be helpful to think of the trainer as a producer and the assessor as a consumer. It is the job of the trainer to produce qualified candidates. It is the job of the assessor to critically

appraise the fitness of these candidates for consumption. If the producer and consumer are the same person, then we have some conflicts which risk creating poor outcomes. It is easy to find examples.

First, if the trainer knows the exact nature of the assessment which is to follow, human nature will cause him/her to "train to the test" because it will reflect well on the trainer if the candidate performs well in the assessment. The problem, however, is that assessments can never be comprehensive. Therefore, trainees must always assume *everything* will be tested, even though this is never the case. By separating trainer and assessor (and keeping knowledge of specific assessment details from the trainer) then we provide a strong incentive for comprehensive training not only for the trainee, but also for the trainer.

Second, if the assessor is also the person who performed the training, then they are in a conflicting position because failing the candidate reflects poorly on their ability as a trainer. Likewise, the relationship they establish with a candidate during training may cause them to be less objective when it comes time for assessment. This is important in the maritime industry where many of the skill-based assessments can be subjective in nature.

And third, if the trainer and assessor are the same person, then there is no clear line between training and assessment. There should be. If not, the candidate will feel (correctly) that they are being assessed during training. This may make them reluctant to ask important questions, seek clarifications, or ask for more practice time for fear that it will reveal their lack of knowledge or abilities. This greatly undermines the effectiveness of the training period.

The solution therefore is an easy one. For any particular candidate, ensure that their trainer and their assessor are two different people, and that each one clearly understands his or her role. Not only does it solve the issues raised above, but it also adds an element of redundancy ensuring that no single failure point will result in the clearance of an unqualified candidate. This is simply good practice, but rarely done.

There is much much more to say on this critically important topic of assessment, and we will cover it again in upcoming editions of Training Tips for Ships. Until then, thank you for reading and sail safely!

The Author

Goldberg

Murray Goldberg is CEO of Marine Learning Systems.

Email: Murray@MarineLS.com

Proactive In-water Cleaning & Inspection

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In the April and August issues, Armach Robotics presented the methodology for, and value in, proactive cleaning using small autonomous robots. The fuel savings and associated reduction in greenhouse gas emissions from proactively maintaining a clean hull make for a compelling argument, yet there is still more value to come from a proactive regimen using Armach's HSR. The routine inspection of the hull completed during an HSR conducted cleaning provides valuable information and insight to the shipowners and vessel managers that can help influence maintenance and operations decisions. Further, the HSR can be outfitted with additional sensors to provide more specific or comprehensive inspections.

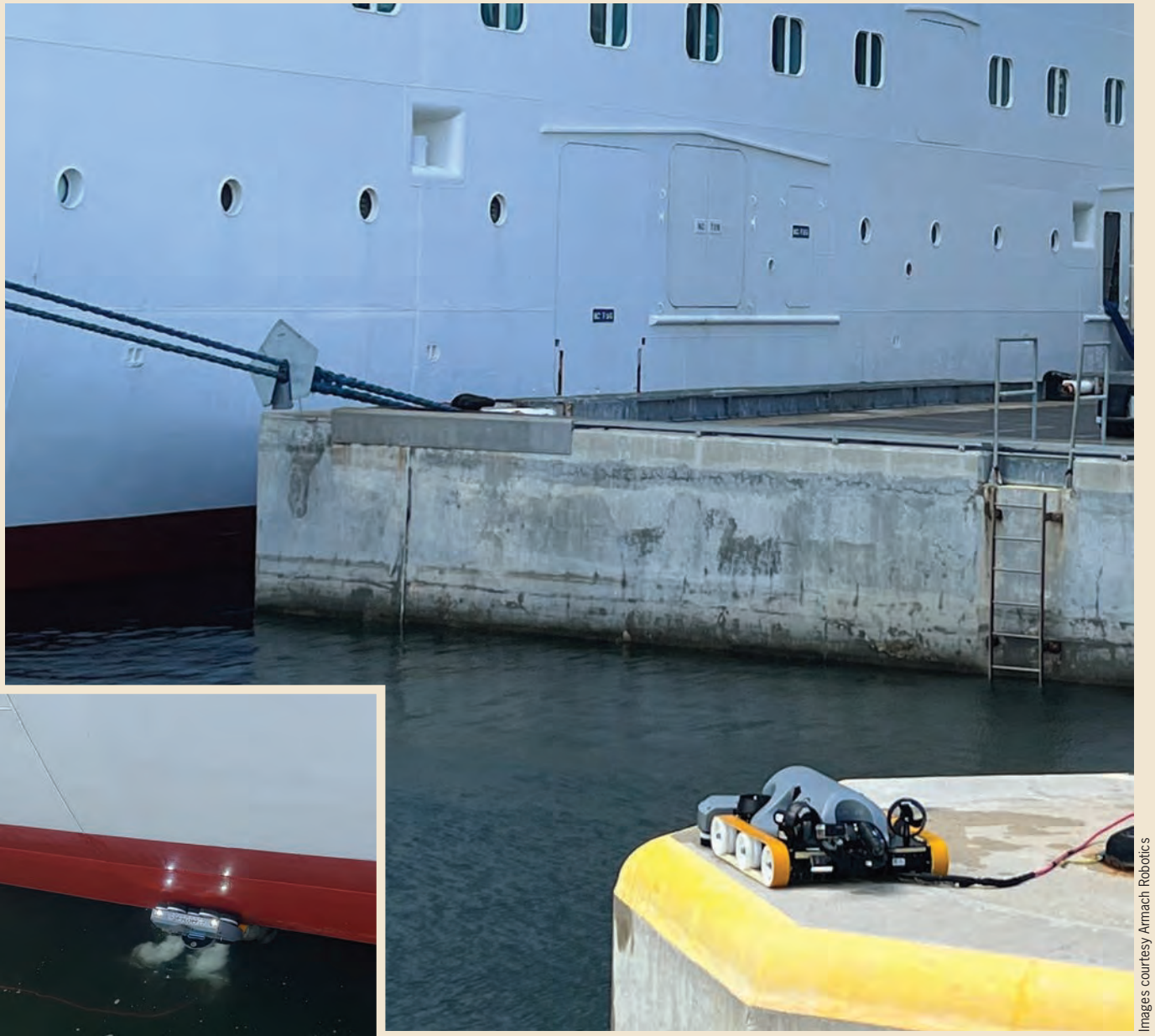
At the risk of repeating the last article, early stage biofouling (microfouling) can increase emissions (via increased fuel consumption) 20% or more. Intelligently and proactively cleaning the hull when microfouling starts to appear will "reset" the hull to clean and eliminate that penalty. The timing between cleanings and the fouling growth rate, as well the vessels current practices (among other factors), will impact the exact savings realized, however a 10% reduction in overall fuel consumption and emissions is a reasonable estimate. 10% is a significant savings, so why not clean at every opportunity? This is where cleaning needs to be done intelligently - "cleaning" a hull devoid of microfouling is unnecessary and worse, potentially harmful to the coating.

At each planned cleaning event, the hull will be inspected to ensure that only the fouled areas are being cleaned and that the coating is not subjected to any unnecessary wear. Advanced sensors will detect fouling in real time and automatically turn the HSR's cleaning tool on and off based on fouling conditions. With the HSR's precision mapping capabilities, the condition of the hull will be documented down to each square foot, identifying the fouling level before and after the cleaning evolution. This intelligence can be used to aid in forecasting the next cleaning evolution - both when it should happen and what portions of the vessel will require cleaning. Additionally, the hull condition data can be provided to advanced vessel monitoring systems to enhance the capabilities and output of those systems, translating to further improved vessel performance.

With a vessel cleaning requiring between 8 and 32 hours robot-hours (hours spent cleaning x # of robots used), the inspection results need to be condensed into a digestible format - no one is going to watch 32 hours of video. Using artificial intelligence (AI) technology, the imagery will be processed to provide a quantitative assessment of the fouling condition which will be graphically reported out via a visual representation of the hull, with links to imagery of the specific hull locations. Imagery of 100% of the inspected portion of the hull will be easily accessible after the fact. This will provide an unprecedented level of detail for an evolution that is traditionally reported out with select representative images of the hull, displaying less than 1% of the total vessel. For vessels calling in bio-sensitive regions (Australian, New Zealand), this report will clearly demonstrate a clean hull and participation in an active biofouling control program.

The post cleaning imagery can also be processed to evaluate the condition of the coating system itself. Paint discoloration can be identified and noted on the inspection report, providing the ships owners and vessel managers with actionable information on the wear rate of, or possible damage to, the coating system. This information will become increasingly important as the coating system ages and its hydrodynamic performance changes. Coating conditions can be fed into the performance monitoring system to allow its algorithms to utilize the most current data available and thus provide a more accurate assessment of overall vessel performance.

All these benefits are inherent with the use of Armach's intelligent proactive cleaning system, but there is still more that



Images courtesy Armach Robotics

can be achieved with the HSR, through a comprehensive Hull Health Program. A robot sitting securely on the hull knowing precisely where it is at all times opens the door to a new range of in-water inspection capabilities. Using a modular ultrasonic thickness tester, a complete detailed scan of hull thickness can be completed and reported in hours, greatly enhancing the Underwater Inspection in Lieu of Drydocking (UWILD) process. This information can also be provided to maintenance planners allowing for critical inspections to be completed prior to dydocking, vice in drydock, saving expensive on-dock days. There is still more that will be able to be done, but this is getting away from the topic of decarbonization.

Proactive in-water cleaning is a bottoms up approach to decarbonization. It is available to all vessels, requiring no expensive retrofitting, and unlike most other solutions, will pay for itself multiple times over. Join the revolution.

The Author

Lander

Karl Lander is the Director, Regulatory Compliance and Outreach at Armach Robotics. He joined Armach following 4+ years with Greensea Systems, where he was Director, Hull Robotics.

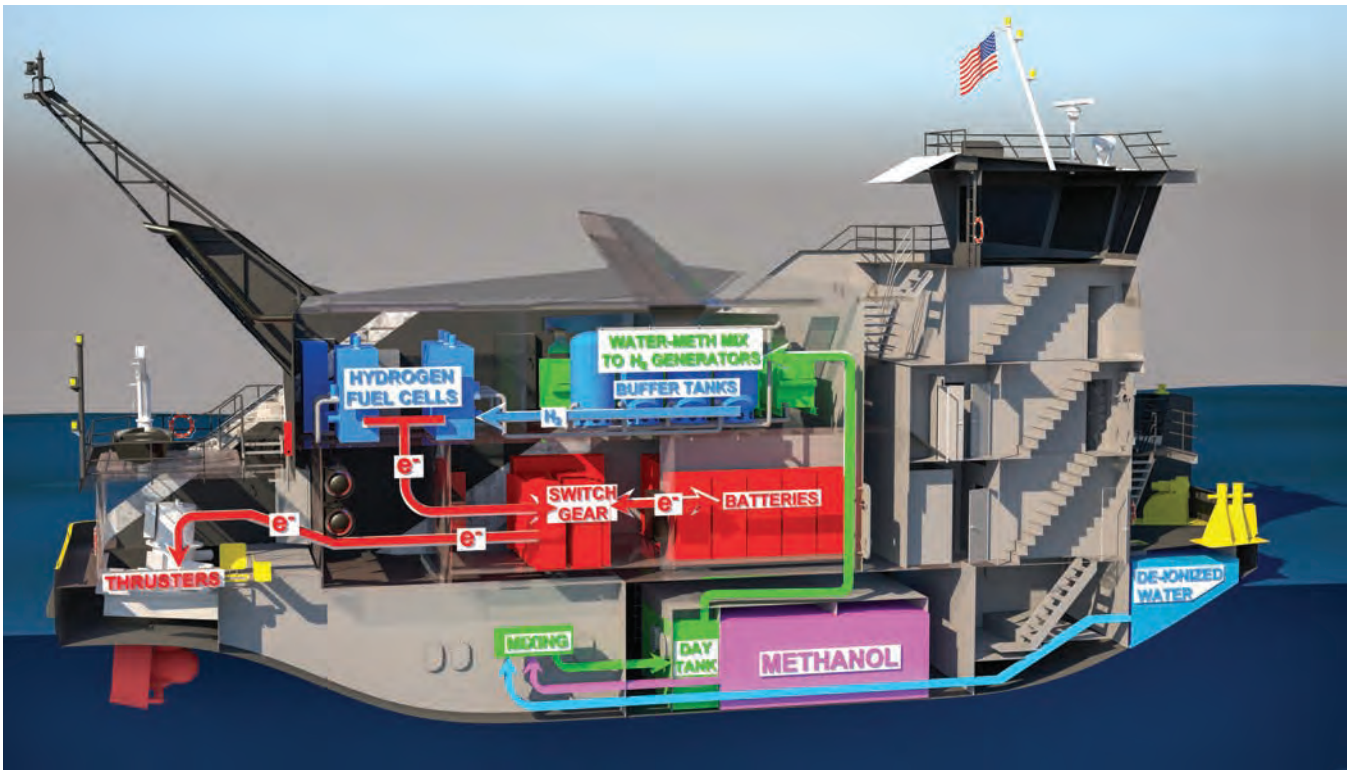


Photo courtesy EBDG

Hydrogen One

By Eric Haun, Editor, *MarineNews*

A towboat named Hydrogen One, set to hit the water in 2023, is being developed by Maritime Partners, the largest lessor of marine equipment in the U.S. It will be the first of its kind globally to run on emissions-reducing methanol-to-hydrogen generator technology, with no diesel propulsion on board. The towboat was designed by Elliott Bay Design Group (EBDG) and will be built at Intracoastal Iron Works in Bourg, La. Other partners in the project include e1 Marine and ABB. Once completed, the vessel will be operated by Jeffersonville, Ind.-headquartered marine transportation company American Commercial Barge Line (ACBL), likely to move petroleum products in and around Louisiana and Texas. "The global shipping industry has been driving to decarbonize itself," Maritime Partners' CEO, Bick Brooks, said at the 2021 International WorkBoat Show in New Orleans in December. "It's a huge challenge given the energy requirements for vessels regardless of application. But the winds of change are blowing, and we want to be at the forefront of that change. We took a blank sheet of paper and laid out all of the available alternatives: liquefied natural gas (LNG), methanol, ammonia, compressed hydrogen, biofuels; and what we came up with was methanol as the fuel of choice for our application. It is widely available throughout the river system and global port infrastructure, it can be distributed in existing fossil fuel distribution infrastructure, and it's safe."

Project @ a Glance

Name	Hydrogen One
Owner	Maritime Parnters
Operator	ACBL
Designer	EBDG
Partners	e1 Marine
	ABB
	RIX Industries
	Power Cell Sweden
	Lloyd's Register

Jack Nash, an analyst with Maritime Partners, said at the WorkBoat Show that the company looked at three primary criteria when evaluating the viability of future fuel options: strong emissions benefits, cost competitiveness and strong performance. "If a fuel doesn't tick all of those boxes, then we struggle to see how it will be adopted," he said. "We were very impressed with hydrogen's emissions benefits, but the challenges with transporting and storing hydrogen increased the cost so significantly that we didn't see compressed hydrogen as a solution moving forward."

That's where e1 Marine came in with a solution that serves as a link allowing easy-to-handle methanol — a top commodity globally, located in bunker quantities at more than 100 ports — to be converted into power-dense and clean hydrogen on board, in real time.

Mike Complita, principal in charge and VP of strategic

expansion at EBDG, said the solution is a good fit for Hydrogen One based on the vessel's operational profile. While pure hydrogen can be difficult to carry in quantity and get distance, methanol—which is readily available and routinely carried on U.S. inland waterways—is very similar to fueling conventional diesel, Complita said. "You bunker it from a truck or a terminal through a hose. It does not take any special permitting, unlike hydrogen and ammonia and some other alternative fuels," Complita said. "Methanol, in my opinion, is probably the safest alternative fuel to transfer to the vessel beyond diesel and biodiesel."

According to Complita, "The other benefit of methanol is that, similar to diesel, it gives you relatively unlimited range. . . So, we can build a boat that can get similar range to diesel with methanol fuel. That's not something you can do with electricity [alone]. That's not something you can do with liquid or gas hydrogen. Other options like ammonia are starting to come online to do that as well, but they are a lot farther out in having the technology ready for that."

e1 Marine, a joint venture between Maritime Partners, Irish tanker owner Ardmore Shipping and Bend, Ore.-based hydrogen generation specialist ELEMENT 1 Corporation, will supply a methanol-to-hydrogen generator technology for the Hydrogen One. The system will convert methanol and water into pure hydrogen that will run through fuel cells to create electricity for the vessel's motors, which drive dual L-drive azimuth thrusters. e1 Marine has tapped RIX Industries to manufacture Hyrdogen One's M18 reformers and PowerCell Sweden AB to supply the PowerCellution Marine System 200 fuel cells. The vessel will also be equipped with batteries that provide additional power when needed, both while underway and for hotel power.

Robert Schluter, managing director of e1 Marine, noted that the technology is already proven but has typically been used in smaller scale power generation applications — less than 10 kW of fuel cell power. Through the years, the system has been scaled up and is now ready to support the multimegawatt power needs of marine vessels. Hydrogen One will be in the 2,000-horsepower range, but as the technology continues to evolve, towboats could become more powerful using similar methanol-to-hydrogen systems.

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U.S. Navy photo by Mass Communication Specialist 2nd Class Gwendelyn L. Ohrazda

The Amazon Model in Global Naval Deterrence

By Rik van Hemmen

IMO announced that the Indian Ocean High Risk Area (HRA) will be removed on 01 Jan 2023.

It was a rare but really reassuring example that international cooperation can be successful. Meanwhile at the time of this writing, the war in Ukraine carries on. Ukranian resistance has been bolstered by very significant western democracy support in the form of weapons supply that have done a great job of stopping Russia in its tracks. However, the Ukranian Crisis shows it is extremely difficult to provide support against powerful foreign invaders to non-treaty friendly nations.

If a friendly supporter is not willing to commit actual fighting forces, the only support that can be provided is the supply of arms to the country defending itself against a potential invader.

The reality is that these arms are only useful if an invasion occurs, and when a threatened country is inherently weaker than the potential invader, the country cannot bring these arms to bear effectively to stop the invasion.

This conundrum can be solved if one were to take a different approach to arms supply that

Arleigh Burke-class guided-missile destroyer USS Chafee (DDG 90) launches an SM-2 missile as part of a surface to air missile exercise during Rim of the Pacific (RIMPAC) 2022, July 19, 2022.

more closely resembles a Just in Time, or more accurately, an Amazon home delivery approach.

Instead of shipping missiles to a country, it makes more sense to have the arms supplier warehouse the arms at a readily available distribution point from which the threatened country can order arms for ready deployment as needed.

In real terms this would mean that an arms supplier would position a suitably loaded ship (or truck or aircraft) with arms and arms deployment gear near the threatened country, and, after proper financial arrangements have been made, the threatened country can ask the arms supplier to deliver ordinance and missiles to locations they select within their country only when needed. If an invasion occurs, the arms supplier would simply light off missiles, etc. for the delivery location within the invaded country.

The arms supplier does not select where the arms go within the customer country, and they do not have to know why these arms are being deployed within the customer's country.

I first suggested this idea to my maritime colleagues in my office who sounded skeptical, but further discussion made them realize that while this approach is novel to say the least, it appears to fit within reasonable international standards of trade, law and warfare.

Let's further define what would take place. Let's say an Arleigh Burke destroyer is parked off the coast of Ukraine with a nice and flexible collection of missiles.

The Ukrainian government has a purchase agreement for these missiles, but asks the US to keep them stored aboard their vessel until they are needed.

The US will never launch these missiles to target countries that do not agree to have them explode within their own country. As such, in the Ukranian war they would not land in Russia since that would be an act of war. However, when Russian forces cross into Ukraine, there is no restriction of law for Ukraine to ask these missiles to be delivered on targets they select anywhere within their borders.

The US delivers the missiles to coordinates or objectives selected by Ukraine within Ukraine, and no other countries can make any claim with regard to acts of aggression or acts of war by the US or Ukraine.

Russia may choose to engage the US delivery ship, but that is a violation of international trade and an act of war no different than intercepting a US ship that is delivering an arms shipment to a Ukrainian port.

The only difference between the delivery of arms to Ukraine's border, and delivery of the arms to locations within the country selected by Ukraine is that this just-in-time Amazon approach by the Arleigh Burke is more efficient and effective.

A similar approach can be taken with drone aircraft from carriers. The drones are owned and operated by Ukrainians, but serviced and armed by the arms supplier.

While this approach is scary to say the least once the shooting has started, interestingly the prior international establishment of this approach can be extremely effective as a deterrent against foreign invasion in the future.

This approach takes little treaty work and can be very fluid, which tends to be a game theory advantage. As such, if internationally accepted, any country can provide this approach to any other country of their borders are threatened. If this approach had been in place, Ukraine could have invited friendly countries to provide arms stores in international waters in the form of international navy ships with various missile loads and this would have been an additional reason for Russia to think twice about invading Ukraine.

Oddly, in concept, this approach is not dissimilar to the international Navy approach in fighting pirates. When closely considered, it is not new law, but rather an extension of international law due to newly developed delivery approaches.

If this concept is certified under international law, any country with a delivery capability can assist any country with a

PHILIPPINE SEA (Aug. 28, 2022) The Arleigh Burke-class guided-missile destroyer USS Barry (DDG 52) launches a Standard Missile (SM) 2 during a live-fire missile exercise as part of Pacific Vanguard (PV) 22 while operating in the Philippine Sea. PV22 is an exercise with a focus on interoperability and the advanced training and integration of allied maritime forces.

U.S. Navy photo by Mass Communication Specialist 1st Class Greg Johnson

targeting capability against invasion. This means that a small country can contract with a larger country, or a group of countries, to overwhelmingly provide this service against an invasion of their territory.

Since this force cannot be projected outside a contracting country's territory, it is a purely defensive deterrent and, as such, a stabilizing force and deterrence against invasion. Interestingly this approach is more effective as far as defensive certification is concerned than conventionally supplying arms to a threatened country before the invasions starts, since, once the arms are conventionally delivered to a country they can also be used for offensive purposes outside their country, which can then be interpreted as aggression by opponents.

Furthermore, this approach serves any country equally, Russia can as easily use it against invasion of their territory (or territory of their friends) as the United States or China can. (Although it does require friendly nations and that by itself is an interesting reason to keep a nice collection of capable friends.)

If the United States adopts this approach as part of their defense doctrine (which actually is a minor extension of the NATO doctrine, without all the treaty and cost issues) it would effectively remove any argument that another country can make against the US (or NATO) as a potential aggressor. Interestingly this approach would have allowed the invasion of Afghanistan, but not the invasion of Iraq, which, in hindsight, would have served us well.

While I claim no specialized knowledge in the legal details, from a game theory point of view this approach has many attractive features and warrants further study.

The real significance in this approach lies with the fact that it can only deal with invasions of sovereign territory. This Amazon approach to warfare strongly enhances deterrence against border violations and invasions, but does not extend to, or involve itself in civil wars or existing border disputes. However, it is an inexpensive and direct force against international aggression.

It would not inherently prevent Russia from remotely bombing Ukraine into submission, but it would prevent, or at least make it very unattractive for Russia to occupy the territory.

It would also significantly change Naval Design doctrines.

Let the discussion begin.

Fredrik Högberg

President of Volvo Penta North America

As he takes the helm leading Volvo Penta North America, Fredrik Högberg discusses the tech and the talent that will drive Volvo Penta in the marine business in 2023 and beyond.

By Greg Trauthwein

All photos courtesy Volvo Penta

Fredrik, to start, can you provide a by-the-numbers look at Volvo Penta footprint in the marine business?

I've been part of the Volvo Group for a long time, and Volvo Penta has great longevity, since 1907, with a network footprint of roughly 3,500 dealers in 130 countries. Volvo Penta has wholly owned plants in Vara (Sweden) for manufacturing our marine D4/D6 and heavy-duty engine ranges and Lexington, Tennessee, for manufacturing gasoline engines. Volvo Penta launched the industry's first fully integrated Assisted Docking system in 2021. We also pull from the greater Volvo Group which is about 95,000 people and roughly $44 billion in revenue. [The big number though is zero], as the journey that we have set ourself out on is to reach net zero carbon emissions by 2040. And while I can't go into details when it comes to numbers, we have a lot of pilot programs and new initiatives with renewable fuels and different drive lines that will bring us into the future.

From what I understand, much of your career with the company has been spent on the truck side of the business. Can you provide insight on why you saw a move to the marine side a good one at this time?

Starting with my career in the company, I've been with the truck brands for 28 years on four continents. This job opened, and it was very appealing to see what we can bring from a truck perspective into the marine sector to further strengthen uptime, customer focus, connectivity, reliability, and essentially giving the customer an unprecedented experience.

When you look at the team you lead in Americas, what do you see as the primary strengths?

There are many strengths, but to start, it's a relentless focus on the customers; that's number one. This is throughout the entire organization, it's inherent, you can feel it in the walls. Second, and I'm still learning because this is a fairly complex industry, overall we have a very good understanding what it takes to be successful in the marine commercial arena. [Another strength is] the Volvo Penta organization here in North America, a strong network with the power centers that has support capabilities and functions for our customers. From a port perspective, we have a very good footprint both in Europe and the US when it comes to port availability and port logistics.

As you're coming into your new post, what are your top priorities in the coming 12 to 24 months?

Right now the top priorities are supply chain issues, logistic issues, clearing bottlenecks in order to deliver to our customers. That is priority number one, two and three for sure. Then we need to continue to work on what we call transformation, whether that be drive lines or human interfaces, connectivity, etc. to make sure that we have the right solutions for today and for the future. I mentioned before the power centers, making sure that we push the knowledge that sits in Chesapeake, Va. and in Sweden out to our dealers and power centers. I think that's key to get closer to the customers, because as the techni-

"Right now the top priorities are supply chain issues, logistic issues, clearing bottlenecks in order to deliver to our customers. That is priority number one, two and three for sure."

Fredrik Högberg
President of Volvo Penta North America

All photos courtesy Volvo Penta

MarineNews editor Eric Haun rode onboard Kvitbjørn off Svalbard earlier this year, and this unique boat was the cover story of the July 2023 edition of MarineNews.
To read the full article, scan the QR code to the right.

cal solutions gets more complicated, we need to invest more in our partners to make sure they're up to speed.

Can you give us an overview of focus today at the R&D center and what specifically can commercial owners expect in the coming year?

Across R&D right now is a heavy focus on more sustainable solutions, whether that be fully electric or [alternative] fuels. Volvo Penta now uses HVO fuel in all demo and test boats. Since this shift, Krossholmen's demo boats have moved from consuming more than 116,000 liters of diesel annually to all running on HVO 100. Our journey towards electrifying the marine sector continues. Our partnership with Danfoss Editron is helping drive a new wave of innovation in design, and our first hybrid pilot vessels are already at sea and functioning well. We are also looking ahead to the needs of tomorrow – working towards compatibility with renewable fuels such as hydrogen and green methanol, as well as fuel cell technology. [We are working across the technology spectrum] including working with partners to make sure we bring the right solutions to the market right now. Essentially, there is no technology that we say is 'out of bounds' right now.

These are interesting times, with logistics snarls, inflation and geopolitical unrest. Can you discuss the impact that these factors have had on Volvo Penta in terms of delivering engines and parts, and what specifically is your strategy to mitigate that risk?

Everybody has been hurt by this, including our customers, because we've not been able to deliver on-time all of the time. We're investing in an 'over capacity' in terms of people in plants and logistics in order to expedite everything once we get the material; to get it out to the customers as soon as possible. So we have taken decision to overinvest right now in terms of resources to make sure we can deliver on our customer promises.

The Volvo Penta DPI package features a hydraulic clutch for silent and smooth shifting at low engine speeds, as well as added maneuverability. With steer-by-wire technology, the joystick functionality is also precise, delivering greater control. Kvitbjørn also has a joystick on the aft deck so a guide can steer the vessel from outside during a tour.

So when you look at the market, where do you see the best opportunities for Volvo Penta in the Americas today?

I see good opportunities in most segments. I think the offshore wind market is a very interesting one, [as it leverages not only our technical solutions, but our corporate values, too]. I think the pilot boat industry is interesting too, and I was out on a pilot boat [recently] to understand the reliability, quality and power needed. In summary, we are present in the most important commercial marine segments. Our unique IMO III solutions can also be considered for barge applications, and markets we serve include: Fishing, Tug and push boats, Pilot boats, Parasails, Barges, Crew transfer, Patrol boats, Fire boats, Taxi boats and Passenger vessels.

This audience likes a good case study. Is there a vessel installation or some type of case study that you believe exhibits the strength of the Volvo Penta's offer to the commercial maritime market?

There is one, but I only watched it on video: Kvitbjørn the hybrid vessel that we have in Svalbard at the North Arctic. That's a best-in-class example of where we're headed for the future. It's a hybrid vessel with a top speed about 30-32 knots and cruising speed of 24-25 knots with a range of 500 nautical miles. And it's really impressive considering it's a hybrid technology, it's fairly new and it's in pretty tough conditions. Here we are piloting an electromobility as a service business model, where the customer is paying per usage – by the kW hour. In addition to the hybrid solution onboard, we have enabled our joystick and Dynamic Positioning features to work in electric mode.

This gives the operator the ultimate comfort – docking and slow cruising in low-speed mode in silence.

We're looking at the bigger picture here; testing our solutions in this extreme environment and trialing new business models will enable us to continue to innovate and explore – all with the aim to deliver an unrivaled experience on the water – in this case, helping to enable the ultimate adventure at sea.

FIREFIGHTING AT SEA – TOWARDS A SAFE SHIP CONCEPT

By John Gow, Technical Director Marine and Senior Investigator at Jensen Hughes Forensics

The most important of all international maritime safety conventions is the International Convention for the Safety of Life at Sea (SOLAS). The first version was adopted at a conference in London in 1914. The catalyst for this conference was the sinking of the Titanic on her first voyage in April 1912, which cost the lives of more than 1,500 passengers. This was the beginning of the journey that put in place a regulatory framework to protect those who work and travel by sea.

While the sinking of the Titanic was not fire-related, the convention introduced new international requirements dealing with, among other things, the provision of fire-resistant bulkheads, fire prevention devices and firefighting appliances on passenger ships. The convention came into force in July 1915, some three years after the loss of the Titanic.

In 1948, the convention expanded to include the maintenance of essential services in emergencies, structural fire protection - including the introduction of alternative methods of subdivision by means of structural fire protection - and the enclosure of main stairways. It was at this time that an International Safety Equipment Certificate was introduced for cargo ships over 500 gross tons.

It wasn't until the introduction of the 1960 SOLAS Convention that many safety measures applying only to passenger ships were extended to cargo ships, including those dealing with emergency power, lighting and fire protection. Regulations dealing with construction and fire protection were also revised. Following the 1960 SOLAS conference, an agreement was reached to implement a unified international code dealing with the carriage of dangerous goods. The Maritime Dangerous Goods Code came into force five years later.

The SOLAS convention continues to develop. Chapter IX: Management for the Safe Operation of Ships, a new chapter to the convention, was added in May 1994, and the International Code for Fire Safety Systems (FSS) was adopted in December 2000.

It is clear that progress is often slow and change usually follows a disaster. It would be fair to say that a more risk-based approach has been adopted on land. A building's performance and the principles of fire compartmentation, protection and response are considered at the design stage, with fire modelling used to evaluate and inform design approaches.

This brings me back to the title of this article, "Firefighting at Sea – Towards a Safe Ship Concept." What does this mean? While this is a concept that should apply to all vessels, the focus of this article is cargo ships. Cargo carrying capacity is increasing, as is the size of the vessel. Combined with smaller crew sizes, there is no doubt that the potential for more shipping disasters exists. Therefore, the intent of this article is to consider some of the key elements of a Safe Ship Concept.

This includes:

- Regulatory framework
- Ship design
- Fire protection
- Safe carriage of cargo
- Crew competence

Regulatory Framework

Relevant regulation is set out in Chapter II-2 of the International Convention, SOLAS (Part A, Regulation 2), which sets out the (1) fire safety objectives and (2) applicable functional requirements . It is clear from this regulation that the principles of prevention, detection, compartmentation and life safety are all included. And so the question arises, is it the regulatory framework that is lacking or does the problem lie elsewhere? The regulatory framework must continue to evolve and be ready for the risks of tomorrow.

Ship Design

Fire safety objectives shall be achieved by ensuring compliance with prescriptive requirements. Given the concern now being expressed by insurers and others regarding the alarming number of containership fires, it would appear that these fire safety objectives are not being met. Therefore, the problem, at least in part, may lie with ship design.

In any emergency situation, especially a fire or explosion, the ship must continue to function. The heart (engine room) and the mind (command bridge) of the vessel must be protected to ensure continuous safe operation for as long as is foreseeably possible. Whilst the engine room is fairly well-protected with automatic fire detection and protection measures, the challenge is maintaining essential air supplies to sustain propulsion and power to vital equipment. Dangerous goods, declared or not, should not be stored in proximity to these two areas as they pose the greatest risk to the ship's safety. The guidance, on risk based stowage, produced by CINS in 2019, provides good advice on this topic .

A ship's hold can be compared to a high-bay warehouse with the added disadvantage of cargo stuffed in separate compartments (containers). As such, the early stages of a fire may not be detected due to the lack of buoyant fire gases. Once established, the fire can spread forward and aft with little in the way of structural containment to retard the flow of heat, flame and smoke.

Moreover, as ships grow in size, so does the stowage space. More rows and higher tiers equal more combustibles. Movement on deck takes longer, increasing deployment time and the physical effort required to attack a growing fire. Any delay in controlling the developing fire will expose an increased fuel load below and above deck.

Fire Protection

Passive Fire Protection. Passive fire protection measures are integral structural components designed to contain the spread of fire, heat and smoke, providing more time for a fire response and safe evacuation of occupants. At sea, the crew will not evacuate the ship, except in the most serious of circumstances. They are also the only fire brigade available to attend to the fire. Consequently, passive measures must be designed in a way that slows the spread of fire, heat and smoke, allowing for a timely deployment of firefighting resources.

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Passive fire protection can include, among other things, structural bulkheads or automatic curtains that drop when alarms sound or heat is detected (examples of which can be seen in any modern shopping center). Assessing the risk at the design stage should inform what passive measures are appropriate. Solutions must be practical and effective as well as proportionate in cost.

Active Fire Protection. Active fire protection measures require an action to detect, alert, stop or contain a fire. This action can be either automatic or manual. A common misconception is that active measures, such as sprinklers, are designed to extinguish a fire. While sprinklers can often extinguish a small fire, they are actually a mechanism to slow fire spread and give time for an emergency response to be deployed.

Although most spaces have some degree of fire detection or protection, the major gap in this provision is on deck. The absence of active fire protection increases the risk of a fire growing beyond its incipient stages before either smoke or flame is discovered. Larger fires ultimately require greater resource requirements to bring the fire under control. The earlier a fire is detected the better.

The accommodation block and the command bridge are particularly vulnerable to external fire attack. A measure often adopted for buildings is the installation of external water drenchers to create a water curtain, which flows down the outside of the structure. Windows and doors may need additional protection to direct water over the opening.

The absence of any detection or protection on deck all too often results in a fire developing beyond incipient stages before it is discovered. Installing sensors, such as infra-red cameras, and remote-operated water monitors - in combination with water curtain or drenchers on lashing bridges - could provide separation between stacks, retard spread and provide remote means for attacking the fire whilst crew resources are put in place.

Fire detection in ships holds relies on technology designed in 1918 for open cargo holds. However, cargo is now carried in many containers, which are stacked in a hold similar in size and volume to a large warehouse. Fire in its incipient stages may produce smoke that has to vent from a container into a space where the ambient temperature is still relatively low and the smoke plume less buoyant.

The smoke must be drawn into the smoke detection system before travelling a considerable distance to the actual smoke detector which is often located within the CO2 room. The issue here is the considerable lag time between fire initiation and detection, during which fire growth continues.

The principal method of attacking a fire within a ships hold is the release of specified quantities of CO2. Holds are not hermetically sealed, and CO2 requires prompt release and

frequent top up, according to manufacturer's instructions. CO2 has limited cooling effect and boundary cooling needs to be employed.

Whilst CO2 is an effective extinguishing medium, alternative means should be explored, such as high-pressure water mist which has high latent heat capacity and can displace oxygen. Research may be needed to ascertain the capability of this method of fire control and the possible advantages compared to sprinklers, drenchers, or flooding.

Safe Carriage of Cargo

The biggest risk to crew and ship safety is the carriage of mis-declared cargo. Some shippers have already implemented measures that may, in time, make the carriage of cargo safer. However, these initiatives must be industry wide.

As the culprits who put safety at risk melt into the night, the industry should look at the benefits of trusted trader schemes with those not participating, subject to greater scrutiny. Additionally, since technology already offers the ability to track individual containers, it may be time to explore methods for integrating temperature monitoring into tracking or other devices to assist the early detection of fire.

Crew Competence

Seafarers are facing ever increasing challenges, too many to discuss in this article. The prospect of new propulsion methods and the risks associated with lithium-ion batteries, electrical vehicles, and undeclared dangerous goods bring new challenges to their working lives. It is clear that the training syllabus needs to change to prepare them for future risk.

Conclusion

Although much is being done to tackle the problem of fires on board cargo ships, there is still much to do. The industry now appears to be of one voice demanding change. Whilst I have offered some insight and possibly some solutions, others will have a contribution to make. However, I have no doubt that a safe ship concept encompassing a holistic approach is central to any long-term solution building upon the standards needed to meet challenges in the shipping world of today and tomorrow.

The Author

Gow

John Gow, currently Technical Director for Marine at Jensen Hughes, has a long career training seafarers on STCW basic and advanced fire fighting courses. He was invited to participate as a member of the expert group on container ship fires convened by IUMI.

FLOATING POWER

Electricity & Future Fuels

Methane-driven: Wärtsilä's triumphal Kivuwatt FPP floating in and drawing methane from Lake Kiwu, Rwanda, in 2016.

Wärtsilä

Beyond shoreside hotel power, there's floating, utility-sized power, or floating power plants. At the core of these are some familiar names in marine propulsion and national grid power — Wartsila, Siemens Energy, MAN Energy Solutions. Challenging the status quo and working with these paradigm power producers are consortia of companies from the renewables and offshore sectors. Driving development are developing-world demand, the renewal of diesel plants, subsidy and electricity shortages worldwide. Sweetening the pot is a chance to produce unproven fuels hydrogen and ammonia.

By William Stoichevski

Low-water marks in reservoirs that once provided the cheapest electricity in Europe now trigger electricity price shocks and national power-bill bailouts in the world's richest country. The government action here and everywhere during the 2022 energy crisis are stirring new faith in power projects. What follows is a survey of floating power players and projects with heavy backing.

In Norway, going greener has pushed bewildered politicians into supporting the electrification of oil platforms from land. That has helped jack-up power bills, as the raw, equivalent diesel power required by an offshore oilfield can be equated to the power needs of a city. The solution, says a coalition of companies in Norway, is floating gas-fired power plant, or FGPP, that captures and injects carbon-dioxide into subsea reservoirs and can send power to shore.

As elsewhere with emergent floating power, Siemens Energy is at the core of Norwegian designs to float a gas-fired power plant, or FGPP, out to somewhere between land and power-hungry offshore platforms. Together with gas process engineers, Kanfa, Siemens Energy is part of the Blaa Stroem (Blue Power) alliance that aims to put a GPP aboard a Sevan cylindrical rig and sequester and pump the CO2 it produces, its flue gasses, into the oilfield reservoir as "gas lift" to keep pressure and oil production up and increase reserves: or just to store the maligned gas permanently in a saline aquifer. The floater's tanks could be used to store fuel, CO2, well stream or, conceivably, hydrogen — turning "grey" (flue-gas derived) hydrogen "blue" (produced via steam methane reforming, or SMR, with carbon capture and storage/sequestration, or CCS). H2 can also be derived from heated sea water (electrolysis) or directly from natural gas.

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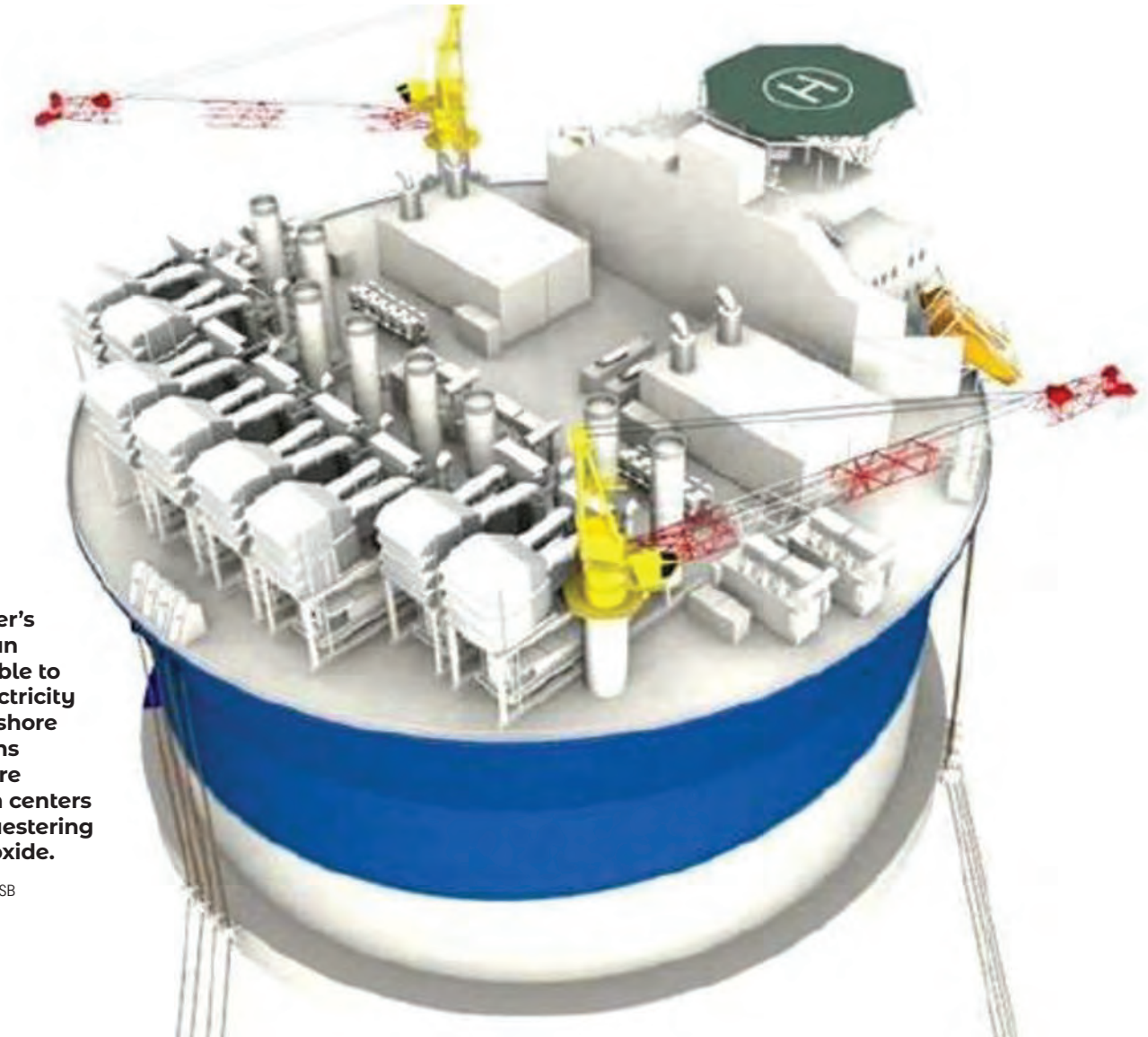
Floating Gas Plant

Yet, there's much more to the idea's potential than meets the eye. A Sevan SSP engineer Maritime Reporter spoke to says the concept is very scalable for shoreside power production if desired. Conceived by Erling Ronglan (who studied at Norway's answer to MIT, NTNU), the project's heart is technology from a "start-up" called Ocean GeoLoop, part of a greater alliance that includes Siemens Energy and others under the Blaa Stroem umbrella.

"The business model is to connect with (offshore or grid) operators in order to provide offshore power to their installations," Ronglan says. "There's a discussion in Norway right now on power from shore to sites offshore, but this is an alternative and a better way of utilizing electricity and producing it locally and using it locally."

Launched two years ago, the combined Ocean GeoLoop carbon capture storage and utilization tech, or CCSU, and the floating offshore or nearshore GPP attracted shareholder Chevron in September. Yet the plan — to power the platforms and, possibly shore — offers the chance to produce "blue H2" and "blue power". Hydrogen is central to an EU scheme to get largescale (but very modular) H2-electrolyzers produc-



Dual-use: An engineer's design of an SSB GPP able to supply electricity to both offshore installations and onshore population centers while sequestering carbon-dioxide.

Illustration: Sevan SSB

ing ammonia fuel and H2 fuel cells onto BMW's — ASAP.

Chevron's $10 million investment in the concept gives the major greener hydrocarbon production and, if desired, upstream and downstream gas and electricity — or even tradable carbon credits for the sequestered CO2 — plus the inherent earnings.

Ronglan, an FPSO expert with Sevan, is aware that Siemens already has a number of floating barge power concepts (keep reading!). The Ocean GeoLoop/Ocean-Power CCSU tech can alone, or with a GPP, also be barge-mounted. In the Blue consortia, Siemens Energy is providing engineering plus the floater's grid equipment and FGPP's combined heat and power gas- and steam turbines and generators.

The FLPP-produced electricity offshore is seen costing from about $0.03 to $0.05 per kilowatt hour, or far less than prices charged by Norway's land-based gas-fired power plants. Current electricity prices on land soared recently to as much as $0.70, before settling back down with government to about $0.27/kWh, on average.

CCS-to-Power

The cylindrical FPSO-style FGPP would bring CCS offshore while sourcing gas fields for fuel.

"CCS … and yes power, because the idea of a GPP is to sell electricity and get fuel gas from a nearby host and produce electricity to sell to nearby platforms. But, also onshore. There is that possibility. Power cable is for any purpose, including power to shore. What we're providing the Blue Power partners is electricity sales."

Using traditional gas turbines, "There is nothing new in that, but the exhaust from those turbines is where we use the GeoLoop tech in order to capture CO2 from the exhaust," Rogland says.

A barge of the same tech would work nearshore. The FGPP's draft can be reduced, and plant weight is but a fraction of a storage tank. Its (beam) is "very small".

"The draft is no problem. You can keep it quayside," he says, when asked if it could function in FGPP-only mode.

With Siemens turbines providing primary gas-fired power, or heat and power, Ocean GeoLoop's CCS tech may also provide surplus electricity. While still in the pilot-stage, well-entrenched backers can rejoice at the Ocean GeoLoop's successful capture of phosphorous from a papermill's water supply, another aspect of the loop. The turbine tech also seems to show that any flue gas can be captured and "burned" for electricity production. The papermill pilot is succeeding in parallel with an industrial-scale CCS build-up. The "applied CCS", or CCUS — "utilization" — is partly aimed at offering industry extra electricity.

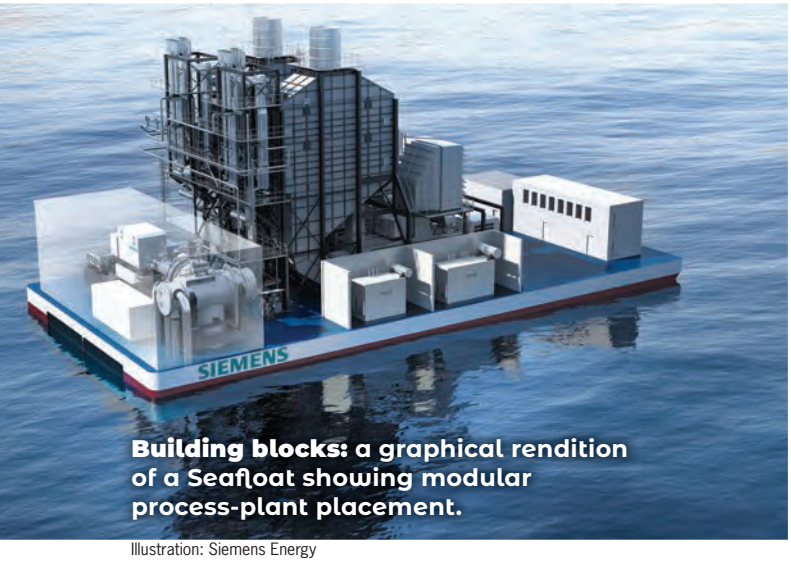
Self-Finance

"We've not indicated a timeline for this second generating technology, whether onshore or offshore, it's the early sprint from the design stage," said Ocean GeoLoop CEO, Oddgeir Lademo, who cautions that, "It's too early to say how the system will link to CCS. The CCS-power-generation part is a work in progress." Moreover, "Utilization of the e-Loop is expected to provide significant positive cash-flow effects through sale of surplus energy to the emitters and/or downstream users."

Company documents laud the "embedded electricity generating capacity of the e-Loop", from which surplus power is derived from the "100-percent" of flue gases captured by its "point-source" process unit. "The technology is designed to achieve … unprecedented capacities," including being "100-percent self-financed" plant, where Ocean Power or its industrial clients can produce electricity to cover its operation with a surplus sold to clients. The process plant, the company says, «mimics nature» by using small heat differences between liquids and gases to power a hydropower turbine.

Floating power: the arrival in downtown Santo Domingo of a Siemens Energy Seafloat, complete with energy storage.

Siemens Energy



Building blocks: a graphical rendition of a Seafloat showing modular process-plant placement.

Illustration: Siemens Energy

Siemens Energy

While the Norwegians look offshore with concepts that also serve shoreside industry and potentially "regions", Siemens Energy's flagship FGPP, Seafloat, keeps evolving and "is relevant for all locations with access to the sea or large river systems".

"SeaFloat can replace conventional power barges which often run on diesel or heavy oil," says Siemens Energy SeaFloat sales lead, power plants, Stavros Zissis. The most recent SeaFloat, the del Mar III, was put together in Singapore by shipyard and gas plant fabrication crews. Modular Siemens plant was hoisted onto a fabricated barge which was no match for the season Sinaporeans accustomed to mammoth semisubmersible builds. The voyage of Estrella del Mar III showed it piggybacking onto a heavy lift vessel and passing on its barge through narrow canals.

Seafloat

"You cannot simply put a gas turbine constructed for land-based applications on a floating vessel," Zissis says, adding that SeaFloat GPPs are "marinized" tech "optimized" and specially made "to withstand motions, accelerations, and hull deflections".

"The gas turbine and steam turbine packages are installed on three-point mounted frames, forming single-lift structures that facilitate and expedite the installation and erection efforts at the shipyard. It's like putting together big LEGO bricks," he says. SeaFloats, he adds, are "wet- or dry-towed" from the shipyard. The barge's layout and size are dependent on whether the unit is fully integrated with LNG storage, regasification and power plant — the Siemens FSRP concept — or related to power output.

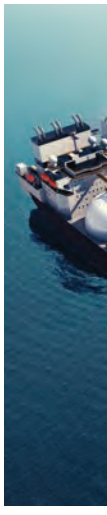
The 150-megawatt (MW) combined-cycle Estrella del Mar III began powering the Dominican Republic with its two SGT 800 gas turbines in 2022, two years after being ordered. It has "5 to 10 megawatts" of power from energy storage onboard for "primary frequency response". SeaFloats mainly come in

Shipyard-capable: The Seafloat hull as it appeared in 2021 when completed in Singapore.

Siemens Energy

At-anchor: a mooring dolphin used to secure a FPP.

Greens Bayou Pipe Mill



145/150 MW, 220 MW, and 300 MW models — increasable by lifting aboard more "blocks", modules that might in future be hydrogen electrolysers to enable both H2 and ammonia production. The LNG storage capacity can reach 180,000 m3. The barge itself can be floating, fixed, or bound to a mooring dolphin, a steel construction piledriven into the sea or river bed and visible above water.

The Estrella del Mar III is reportedly "quieter" than downtown Santo Domingo, where it's moored. Its size — 80m x 35m — is half the size of a comparable, land-based plant.

Propulsion Players

Propulsion powerhouse Wärtsilä is also a major provider of grid power in the United States.

Wärtsilä delivered the FPP Dominican II to the same Caribbean nation. The Finland-based company has also delivered diesel FPPs, and now gas or dual-fuel power plants are sought, as they allow for the switching of fuels as markets and supplies swing. Combined cycle heat and power steam turbines and desalination are offered as options. "When required, various NOx and SOX reduction options are available," a commercial note says. "When natural gas becomes available, plant can be converted". How's that for flexible fuel!

Like the other barge and cylindrical "drum" FGPPs, Wärtsilä points to "short construction time" for barges that range in length from 64.8 m to 90 m. All are 27.4 m across.

Air intake filters below exhaust outlets, roof-mounted ventilation and radiators make models like the Wartsila 32 Power Barge ideal for the tropics. Between 1990 and 2011, FGPPs in Bangladesh and Papua New Guinea joined two in the Dominican Republic on the Wartsila hot weather, salt water client list.

MAN Energy Solutions

MAN Energy Solutions also offer flexible dual-fuel or gas engines (as well as trusted diesel models). MAN bases its LNG-to-power floater concept on the flexibility premise, as

Integrated plant: inbound LNG, an LNG terminal and a FGPP.

Illustration: Siemens Energy

well as efficient gas turbines that deliver 10 MW to 300 MW. It's about "low-cost energy production" and "independence from gas suppliers", both super-topical in November 2022.

MAN gas turbines of from 6 MW to 13 MW offer gas-fired power generation fed from centrifugal pumps transferring LNG to a vaporizer "injecting" natural gas. Condensing turbines or steam turbines offer the ability to produce electricity from a variety of energy feedstocks, where turbines are either "backpressure" or "saturated" types in modules meant to work with some of the types of innovations we've obliquely referred to. The MAN steam turbines target combined heat and power; biomass production and burning; steam from concentrated solar power; geothermal energy (the Icelandic government is an Ocean GeoLoop partner); waste-to-energy and regeneration in energy storage. The MAN steam turbine power-generation portfolio — turbines like the new, "urban and industrial" MGT6000 — covers the range up to 180 MW, or the equivalent of a medium-sized hydropower dam.

Hydrogen PP

In the most technologically advanced states, especially in Northern Europe, "green, blue and pink" hydrogen are touted as the future, and gas plant that can burn gas now and hydrogen later is seen as the right backstop.

"With our H2-ready concept, we can confirm we are in the planning phase for new power plants suitable for future use with hydrogen," Zissis says. "As a turbine manufacturer, we ensure the burners and combustion chambers are designed for H2, as this has different combustion properties than natural gas. In addition, other auxiliary systems, such as piping and explosion protection, must be designed … The independent certification body TÜV SÜD issues certificates for H2 readiness in a power plant's design phase," he says.

So, there's a FGPP's readiness to take on hydrogen as a fuel. There's also a hydrogen supply chain, including bunkering for and by vessels that'll service floating hydrogen power plants. Hydrogen supplier networks, some only in name, have mushroomed across Europe in imitation of the Boston medical cluster (much lauded in these parts). Norway alone has several "zero-emission supply chains". "Centers of excellence" address energy transition strategies, and hydrogen "learning" is on the agenda all across the Continent.

Still, Class informed the Norwegian Arena Ocean Hyway Cluster that "there are uncertainties" in H2 infrastructure. From handling to the production of compressed hydrogen, liquid hydrogen and ammonia.

Water-to-Fuel

It's in the Far East, however, where a certain hydrogen PP offers clarity on the future path of "floating HPPs".

September 2022 saw Keppel Energy decide to build a $526 million, 600 MW advanced PP based on a combined-cycle gas turbine. Mitsubishi will engineer and build the Keppel Sakdra Cogen plant as "the first hydrogen-ready power plant in Singapore", a communique heralds. "Running initially on natural gas as primary fuel, the (plant)) is also designed to operate on fuels with 30-percent (H2) content and has the capability of shifting to run entirely on (H2). Starting in 2026, its produced steam will bolster industry energy and chemicals customers on Jurong Island.

Illustration: Ocean GeoLoop

Point of capture: a graphical drawing showing the theoretical layout of CCS and CCSU capture tech.

As certain fuels are banned (at least in emissions-control areas, or ECAs), the ability of FPPs to produce future fuels, like ammonia, might become "standard". The Keppel deal includes an "aside" MOU with Mitsubishi Heavy Industries for "a feasibility study on the development of a 100-percent ammonia-fuelled power plant on a selected site in Singapore". That's 3-for-1: gas-firing at the same plant gives way to H2 either from water or natural gas, which is then converted to ammonia. Energy trilemma solved.

"When completed, this asset will grow Keppel's power generation portfolio from the current 1,300 MW to 1,900 MW," Keppel says, although Mitsubishi Power CEO, Osamu Ono, adds, "Mitsubishi … looks forward to supplying … Sakra Cogen …with our hydrogen-ready JAC gas turbine." The race is on.

There's no word on whether compressed or liquefied hydrogen will be the goal at Sakra, or whether refrigerated or pressurized liquid ammonia will be made. There's no certainty, either. "Today 95 percent of (H) is produced from fossil fuels, more than half is used for ammonia production, and almost 90-percent (of that) is used to produce fertilizers," the Lloyd's Register report says (for perspective).

Capture loop

As for the Ocean GeoLoop? The Norwegians whose designs and capital have helped fabricate many a gargantuan, super-complex, Singaporean floater newbuild are already building a small and a large pilot, at least of the CCS.

Whether a Sevan cylindrical semisub with GPP on top, or a barge, ship and fabrication yards are in our survey are not expected to have difficulty building FPP floaties or their associate plant (although Siemens suggests the "controlled environment of Singapore" for a newbuild FPP). The plant providers have perfected their module stacking procedures, so "a crane" and secure wet dock are all the physical pieces that need to be in place (followed by heavy lift availability).

Forecasts

"We haven't done any benchmarking, but for a newbuild like this — with all the facilities available at a typical yard — it should be cheaper than purpose-building (a GPP with CCS) somewhere on land, where they might be lacking in (key) people and (vital) equipment," Rongland says, adding, "The hull doesn't drive costs much, and inshore, we might change to a different hull to be cheaper to construct."

The Blue Power partnership comprises many parts. "We provide the electricity and the transport (of gas and the FPP with CCS). We can even own and operate the installation if required."

Indeed, looking around the North Sea and elsewhere, offshore and grid operators seem to like that model. So do certain national governments.

MPC Container Ships

A Methanol Future

*Maritime's path to future fuels and decarbonization is neither straight nor short, but **Constantin Baack, CEO, MPC Container Ships (MPCC)**, a regional container carrier aims to be the tip of the spear on maritime decarbonization and the creation of 'green corridors'. Baack's words are backed by action in the form of a pair methanol-powered 1,300-TEU containership newbuilds ordered in July 2022 for delivery in 2024.*

By Greg Trauthwein

Greg Trauthwein

Chris Chatterton, COO, Methanol Institute and Constantin Baack, CEO, MPC Container Ships, at SMM 2022 in Hamburg.

Oslo-based MPCC was launched in 2017, aiming to become a regional container shipping powerhouse in its own right, while fostering a new 'green corridor' in Northwest Europe. According to Baack, MPCC today owns and operates 68 container ships – units in size up to 5,500 TEU – and the company has a market capitalization of about $1 billion, trading mainly intra-Asian trades, intra-European trades, and intra-Americas trades. "That means connecting Southeast Asia with China, feeding into the hubs, the main lane hubs of container shipping, being Shanghai to Europe or Shanghai to the U.S., or just connecting the region," said Baack. "Interconnectivity in container shipping terms has increased significantly recently."

The choice to center on dual fuel methanol for the pair of newbuilds was fairly straight for Baack and his team, as he reasoned "there is new, tighter regulation, and a bigger awareness and transparency about emissions in general, but also efficiency devices. When it comes to fleet renewal and the question about the future fuels, it's a technology question that is answered for certain fuels. For methanol, for example, at least main engines are available. You can build a ship, so technology-wise everything is there. It's the supply of green methanol."

MPCC contracted the 1,300 TEU containership pair for $39m each at Taizhou Sanfu Ship Engineering in China for delivery in the second half of 2024. The vessels come with a dual fuel engine setup which enables operation on methanol as well as conventional MGO. The vessel owning entities will be majority owned by MPCC (90.1%) together with Topeka MPC Maritime AS (9.9%), a joint venture between Topeka Holding AS (zero emission shipping company owned by Wilhelmsen Group) and MPC Capital AG.

"We have two vessels ordered now and we are looking at various other projects," said Baack. "We believe that the fuel constellation also depends on where you trade. In Europe, at the moment, the trend is more towards methanol if you look at intra-regional trades. If you look at their main lane trades, the large vessels, it's still LNG because there's the infrastructure available and infrastructure and fuel availability are the two main question marks as an owner and operator. But in our regions, I think it's all about establishing green corridors, having smaller volumes where you can possibly get the methanol earlier, have the infrastructure."

The advantage in container shipping is the ship owner and operator know where the vessel will bunker via its clear trading pattern. "So we have our vessels, for example, trading Rotterdam, Hamburg, and then along Norway where there's certain methanol production potentially to be built up in the short to midterm."

According to Baack, key to the creation of 'green corridors' is to have in place strong partnerships to support. "We also

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involved the cargo side, which is very unusual, on a 15-year contract. We are the owner and we have a charterer and we have a cargo provider, and we all have a 15-year commitment." The 15-year time charters are to North Sea Container Line AS (NCL), backed by CoAs from various parties, including a 15-year CoA with Norwegian industrial group Elkem ASA. The 15-year time charter with NCL is at an initial rate of EUR ~16,300/day, before inflationary adjustment mechanisms. "Long term commitments helps because you know what cargo will be transported. It's not that the vessel will trade in Asia tomorrow. It will trade in Europe. It is designed for this trade."

While Baack and the MPCC team have centered on methanol, he knows all too well the mantra that there is no 'Silver Bullet' solution in terms of future fuel choice. "I think it's still about maintaining flexibility and optionality," said Baack. "Dual fuel is a key word here because the solutions are not as mature on the supply side of fuel, to the point where you can just go all-in on methanol, for example."

He adds: "you will not be able to solve it on your own. We partnered with the cargo side and a charterer to ensure we have a joint understanding of what the vessel is doing and why, and where it trades, because having this certainty (helps

MPC Container Ships

out in getting green fuels for specific routes).

Finally, it comes down to technology, and specifically engine availability. "Pre-2008 we had a phase where main engines were not available because we had so many people ordering ships. We are entering into a phase again where availability of the right engines and the right technology is (becoming) a bottleneck. So you need to make sure what is available in order to bring the whole vessel together."

METHANOL AVAILABILITY

For its part, the Methanol Institute is 35-years-old, the global trade association for the methanol industry originally founded in Washington, DC. According to Chris Chatterton, COO, Methanol Institute, the organization has evolved globally, and today its headquarters are in Singapore, with offices in Beijing, Brussels, New Delhi and Washington DC. "We have 76 members, and I think it's relevant to say that over the past 12-18 months, we've almost doubled our membership numbers, and mainly on the back of the marine uptake for methanol as a fuel," said Chatterton.

While maritime is embarked on its own decarbonization trek, it's sometimes easy to forget that most over industries, too, are on the same path, and competition for alternative fuels could be fierce as capability builds out, particularly for 'green' versions of the fuel. Here the Methanol Institute's Chatterton lends perspective.

"There's been a buildup the past three years when we started tracking carbon neutral methanol," said Chatterton. "We're approaching maybe 4 million tons – not all built yet, not producing yet— but the trend is clearly there and it's a bit based on maritime push for decarbonization." But he points out that methanol is used as a petrochemical building block, and "there is a lot of pull from the chemical sector where it's used in thousands of different products and hundreds of different processes for different performance compounds, resin, glues, fabrics, and so forth."

Ultimately, as always, it comes down to both market and regulatory drivers, and the Methanol Institute is keen to throw in it's expertise on the latter. "We need to have clearer policy. We can't keep moving forward to find the perfect solution because there is no perfect policy package. So we're looking to have more consistency across these regulatory packages that are being proposed, and maybe it would be useful to just maybe pick out some of the more simple initiatives – such as a carbon levy – just to get it out there and allow the market to take that in, process it and using market-based measures, move forward."

Chatterton tips his cap to Baack and MPCC for taking the initiative to actually order ships. "I mean to build ships takes time to make that decision, it's taking a bit of risk," he said. "And then the infrastructure isn't all in place, it's still a bit of "the chicken and the egg. So now I think we've crossed that bridge and now we're looking at how to prepare the infrastructure so that these ships, when they're commissioned in another 18 months, have the necessary infrastructure to support (operations)."

"I think the regulation is key here, but I think the fuel will follow the ships (and the regulation)," said Baack. "There have been some front runners like Maersk on methanol, a very positive development because in the end, (it helps to create a greater) demand for methanol."

At the start, according to Baack, it's not necessarily critical that it all be 'green' or some other colorful form of methanol, as regardless of its source and emission profile, it can be blended, which he sees as "smart because it allows you to transition over time."

A riverine command boat operates alongside the amphibious transport dock ship USS New York (LPD 21) in the U.S. 5th Fleet area of responsibility.

U.S. Navy photo by Mass Communication Specialist 2nd Class Zane Ecklund

The Swedish Combat Boat 90 is a Warrior and a Workhorse

By Edward Lundquist

The Swedish-built Combat Boat 90 (CB 90) has established itself with military forces around the world as both a warrior and a workhorse. The 52-foot boats first entered service in 1991 as troop carriers with the Swedish Marines, which is still procuring them. There are more than 250 operating worldwide today.

These rugged boats are optimized for high-speed / shallow-draft operations in and around Sweden's many coastal islands, but they have also proven to be ideal for a variety of other applications and operating environments.

The CB 90 is 52 feet long, with a draft of just 2 feet 7 inches. Standard displacement is about 17 tons. It's powered by a pair of 625 hp Scania V8 diesels and Kamewa waterjets, so they're both fast—40 knots plus--and maneuverable. In fact, there are control surfaces in the waterjet tunnels which improve maneuverability.

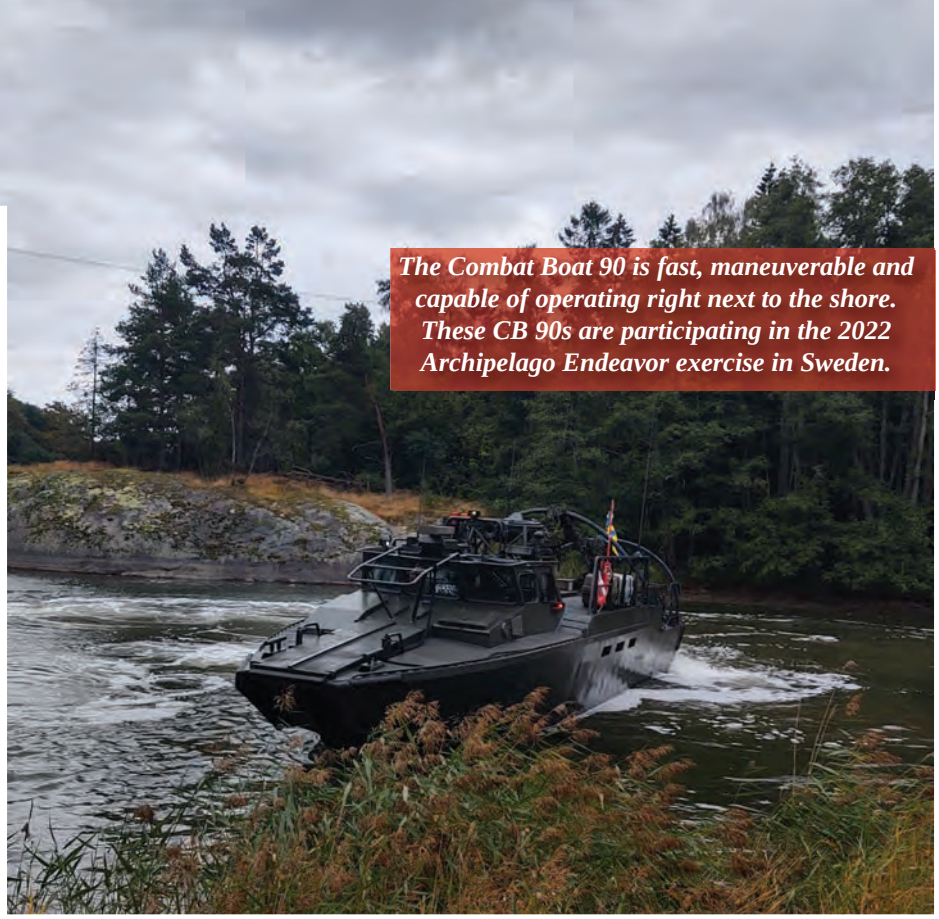
The CB 90s are built at Dockstavarvet shipyard on Sweden's east coast. The company was acquired by Saab Defense in 2017. The Storebro SB90E civilian and export version is made by Storebro Bruks AB.

Dockstavarvet describes the CB 90 as "an all-aluminum fast assault craft, heavily reinforced for forceful landing on unprepared beaches."

The basic troop carrier version usually has a crew of three and can carry about 18 to 20 combat equipped troops, or carry 4.5 tons of cargo. The CB90 can make a direct approach to a beach or shore line and discharge personnel through the bow ramp. The boats can be carried on larger ships or transportable by land.

Operators include Swedish Police, Swedish Sea Rescue Society, Hellenic Army, Hellenic Coast Guard, Mexican Navy, Malaysian Navy and the Marina de Guerra in Peru. The Royal Navy leased four boats for several years.

The boats can be outfitted for water sampling or other environmental protection missions. Boats that will be operating in the tropics can have upgraded power systems for air conditioning and fuel cooling.



The Combat Boat 90 is fast, maneuverable and capable of operating right next to the shore. These CB 90s are participating in the 2022 Archipelago Endeavor exercise in Sweden.

Photos by Edward Lundquist

The Royal Danish Navy operates the SB90E aboard the Absalon-class ASW frigates / flexible support ships, as well modified versions capable of operating in and around ice for the Knud Rasmussen class of Arctic Offshore Patrol Vessels, patrol vessel.

The U.S. Navy operated six CB 90s, which they called Riverine Command Boats as part of the Navy Expeditionary Combat Command (NECC). The U.S. boats were built by Safeboat International of Port Orchard, Washington. The heavily armed RCBs were based in Bahrain where they provided high-value ship escort duties, usually operating in pairs.

The American RCB version is equipped with several universal topside mounts for machine guns or grenade launchers, as well as a remote-operated small arms mount (ROSAM). The RCB has a crew of four to eight, which are required to operate the boat and the weapons, but can also carry addition troops. The U.S. version also has The RCB armored cockpit and engine compartment protects the crew and systems against small arms fire or shrapnel. The U.S. Navy phased out the RCBs in favor of the larger MK VI patrol boats, which are also being phased out.

Sweden is by far the biggest user with more than 200 craft, and the boats are still in production. The newest variant, the Docksta CB 90HSM, is being offered by Saab. It features "a robust weapons platform can include stabilized turntables, smaller missile systems and remote weapon stations like Saab Trackfire."

According to Saab, an adjusted placement of the engine makes the boat more stable, faster and quieter. Saab said the new version has improved speed, maneuverability, attack power and surveillance capabilities.

The Swedish Marines are skilled at navigating their CB 90s at high speed in confined waters between the many islands of the archipelago. The Naval Base at Berga, about 20 miles south of Stockholm, is home to dozens of them. At the recent Archipelago Endeavor exercises, Swedish and U.S. Marines relied on the CB 90 for movement around and between the many islands, and used the boats to launch unmanned vehicles.

Are Unmanned Surface Vessels the Key to a 500-Ship U.S. Navy?

By George Galdorisi

In an era of great power competition, navies – by virtue of their ability to span the globe and effectively deliver combat power – are likely to be the sine qua non of military power. This leads, naturally, to the tendency to count numbers of ship hulls when comparing the strength of navies. Lost on no one is the fact that the size of China's Navy now exceeds that of the U.S. Navy, and the gap in ship numbers is growing.

During the Cold War, while the quality of their ships might not have been equal to that of the U.S. Navy, the Soviet Union boasted a far larger Navy than the United States and professed the intention to use it against the United States and its NATO allies. As a result, at the height of what has become known as the Reagan Defense Buildup in the 1980s, the U.S. Navy evolved a strategy to build a "600-ship Navy." That effort resulted in a total number of Navy ships that reached 594 in 1987.

Recently, the U.S. Chief of Naval Operations, Admiral Michael Gilday, revealed the Navy's goal to reach 500 ships, calling for over 350 manned ships and 150 large unmanned maritime vehicles in order to be able to fulfill the Navy's global commitments, especially in a potential conflict with China.

While the U.S Navy has the aspiration of using unmanned maritime vessels to increase the size of the Fleet, the U.S. Congress has been increasingly reluctant to authorize the Navy's planned investment of billions of dollars on USVs until the service can come up with a concept of operations (CONOPS) for using them. Congress has a point. Unless the Navy can evolve such a CONOPS, it is unlikely that a 500-ship fleet populated by 150 unmanned surface vehicles will ever reach fruition.

A Concept of Operations for Unmanned Surface Vehicles

The concept of operations proposed is to marry various size unmanned surface, subsurface and aerial unmanned vehicles to perform missions that the U.S. Navy has—and will continue to have—as the Navy-After-Next evolves. Simply put, the Navy can use the evolving large unmanned surface vehicle as a "truck" to move smaller USVs, UUVs and UAVs into the battle space.

While there are a plethora of important Navy missions this combination of unmanned platforms can accomplish, this article will focus on two: intelligence surveillance and reconnaissance (ISR) and mine countermeasures (MCM), two critically important Navy missions. The technical challenge remains to ensure that the multiple sized UxSs associated with these missions can be adapted to work together toward a common goal.

This article offers concrete examples, using commercial-off-the shelf (COTS) unmanned systems that have been employed in recent Navy and Marine Corps exercises. In each case, these systems not only demonstrated mission accom-

plishment, but also the hull, mechanical and electrical (HME) maturity that Congress is demanding before proceeding ahead with robust acquisition of Navy unmanned systems.

While there are a wide range of medium unmanned surface vehicles (MUSVs) that can potentially meet the U.S. Navy's needs, there are three that appear to be furthest along in the development cycle. These MUSVs cover a range of sizes, hull types and capabilities. They are:

- The Vigor Industrial Sea Hunter is the largest of the three. The Sea Hunter is a 132-foot-long ***trimaran*** (a central hull with two outriggers).
- The Textron ***monohull*** Common Unmanned Surface Vessel (CUSV) features a modular, open architecture design.
- The Maritime Tactical Systems Inc. (MARTAC), ***catamaran*** hull, unmanned surface vehicles (USV) includes the MANTAS T12 and the Devil Ray T24, T38 and T50 craft. All four USVs feature a modular and open architecture design.

All these MUSVs are viable candidates to be part of an integrated unmanned solution CONOPS. I will use the MANTAS and Devil Ray craft for a number of reasons. First, they come in different sizes with the same HME attributes. Second, the Sea Hunter is simply too large to fit into the LUSVs the Navy is considering. Third, the CUSV is the MUSV of choice for the Littoral Combat Ship (LCS) Mine-Countermeasures Mission Package, and all CUSVs scheduled to be procured are committed to this program.

Part of evolving and operational concept for employing unmanned surface vehicles involves placing them in the environment where they can perform their missions of ISR and MCM. This is not a trivial task, especially since the United States must be prepared to deal with peer and near-peer adversaries with robust anti-access and area denial (A2/AD) capabilities.

If the U.S. Navy wants to keep its multi-billion-dollar capital ships out of harm's way, it will need to surge unmanned maritime vehicles into the contested battlespace while its manned ships stay out of range of adversary A2/AD systems. Small and medium USVs, UAVs and UUVs need a large USV (LUSV) to deliver them to an area near the battlespace. The Navy envisions LUSVs as being 200 feet to 300 feet in length and having full load displacements of 1,000 tons to 2,000 tons.

Depending on the size that is ultimately procured, the LUSV can carry a number of T38 Devil Ray unmanned surface vehicles and deliver them, largely covertly, to a point near the intended area of operations. The T38 can then be dispatched to perform the ISR mission, or alternatively, can launch one or more T12 MANTAS USVs to perform this mission.

For the MCM mission, the LUSV can deliver several T38s equipped as with mine-hunting and mine-clearing systems (all of which are COTS platforms tested extensively in Navy exercises). These vessels can then undertake the "dull, dirty and dangerous" work previously conducted by Sailors who had to operate in the minefield.

The Future of Unmanned Surface Vehicles

This is not a platform-specific solution, but rather a concept. When Navy operators see a capability with different size unmanned COTS platforms in the water successfully performing the missions presented in this article, they will likely press industry to produce even more-capable platforms to perform these tasks.

While evolutionary in nature, this disruptive capability delivered using emerging technologies can provide the U.S. Navy with near-term solutions to vexing operational challenges, while demonstrating to a skeptical Congress that the Navy does have a concept-of-operations for the unmanned systems it wants to procure.

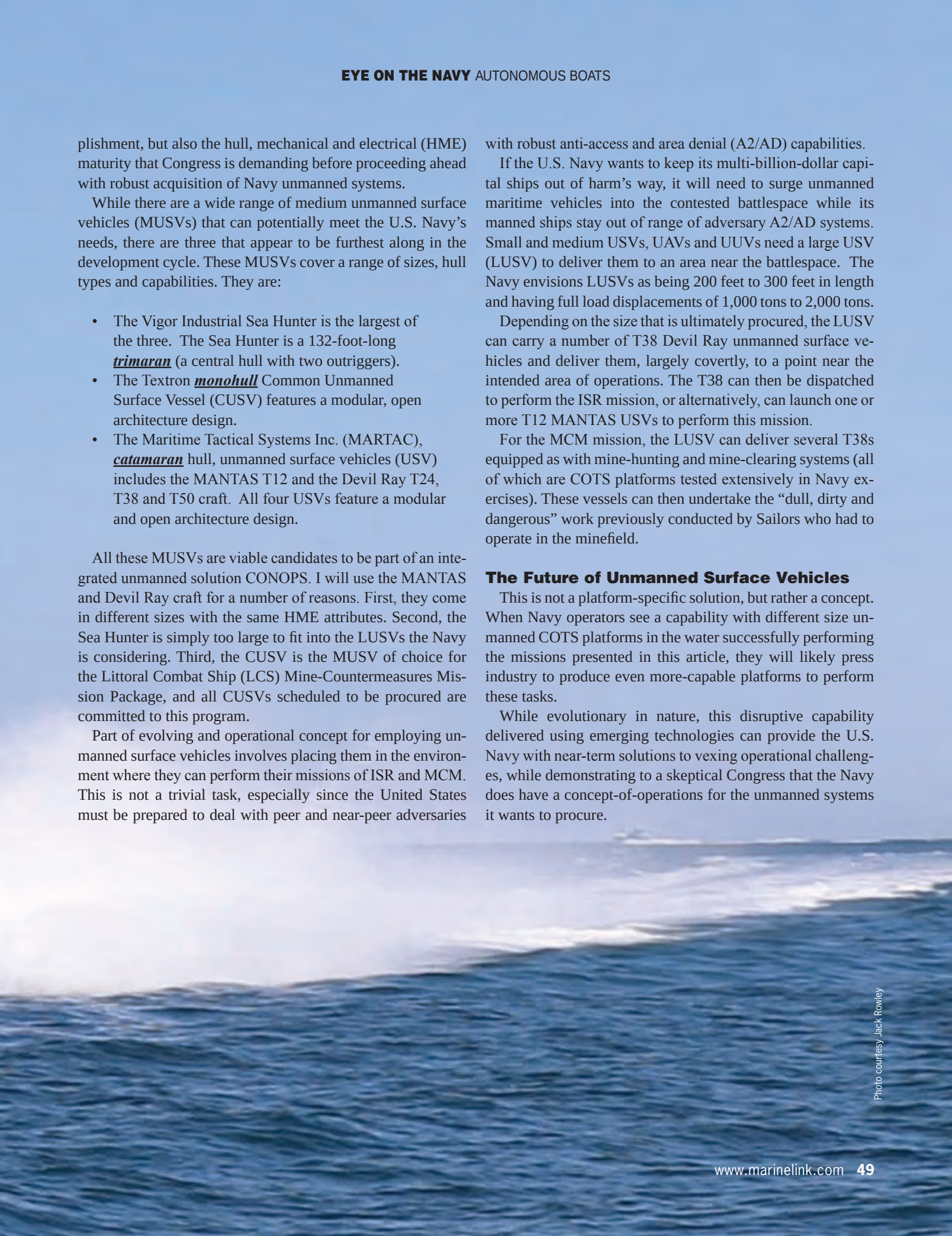


Photo courtesy Jack Rowley

Heavy Lifters

Heavy lift equipment, from moving vessels on land to deploying and retrieving assets from vessels, are key to efficient, safe ops. Following are updates from a few leaders in the field.

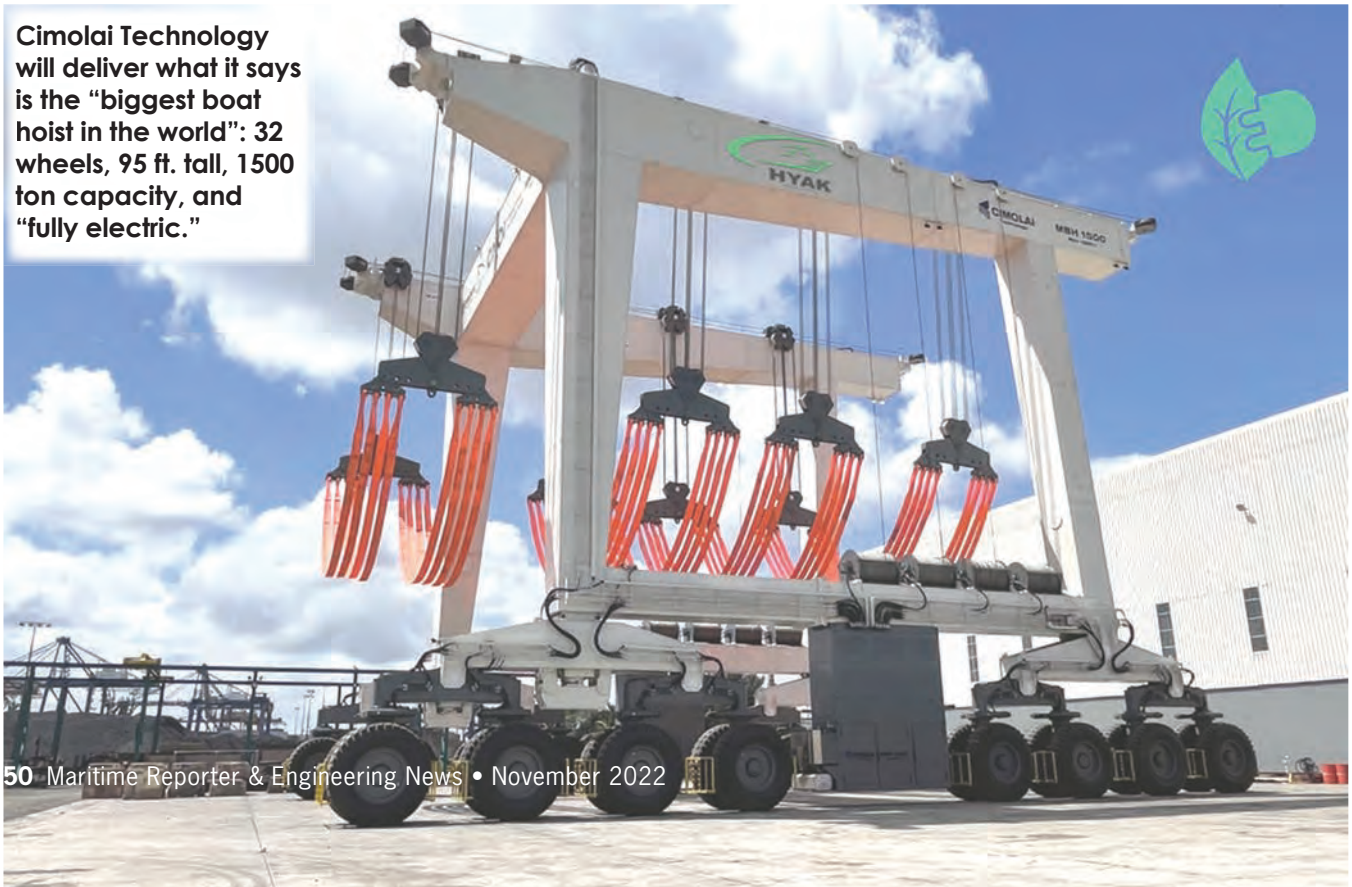
Cimolai Technology won the contract to supply a new full-electric 1500-ton Mobile Boat Hoist that will be installed in the industrial and maritime park Hyak Tongue Point in Astoria, Oregon. With 32 wheels, standing 95-ft. tall, with its 1500-ton capacity, the company says this is going to be the biggest boat hoist in the world.

The electrical system has a useful power of 1200 kWh and a BMS system to monitor the status of the battery packs. It can be charged via the electric network and only takes a short time to recharge. Steering of the wheels is achieved via Electrical Powered Slew Drives controlled by a position sensor and processed by a PLC microprocessor which automatically commands the various steering degrees.

Motorization for traveling is operated by brake motors, whereas the electric hoisting winches are independent and synchronized. An integrated self-regenerative system allows the recharging of the batteries when the load is lowered with longer available duty cycles. The unit will work in a strategic area for the Pacific NW industry: Hyak Tongue Point is located close to the mouth of the Columbia River and its position is easily accessible to commercial workboats and barges, Alaska-based fishing vessels and offshore tugs and commercial crafts.

Markey Machinery is a storied marine company, starting operations in 1907, when a Charles Markey launched the C.H. Markey Machinery Company serving both the marine and logging industries. Today Markey Machinery is a leader in the marine deck equipment and winch industry, a position that it seeks to grow with the announcement that it closed outside investment with Christian Schiller and Brian Bogen to take the company to the next level. To its maritime client base, Markey will look much the same, continuing to operate from its current Seattle production facility and office, with all employees remaining on board. Blaine Dempke, CEO, will continue leading the business as CEO and will participate on the Markey board as a "significant" shareholder. Jeff Dempke, who has been with Markey since 2006, will assume the new role of General Manager and become a shareholder. Robert LeCoque will remain actively involved, providing assistance to Markey's customers, and working with the Engineering & Sales group.

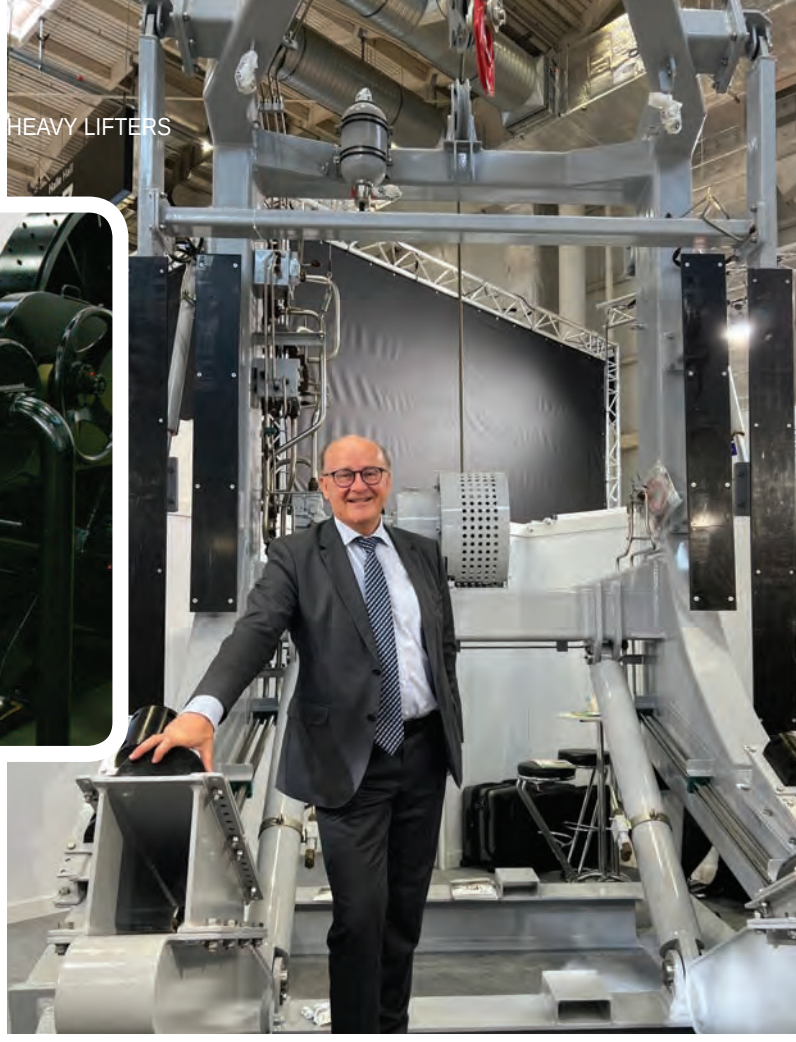
According to Blaine Dempke, initial plans to deploy the new investment include "looking immediately to expand our sales and engineering staff to meet demand. Expansion of our R&D budget will be ongoing in our efforts to support our customers and their missions."



Cimolai Technology will deliver what it says is the "biggest boat hoist in the world": 32 wheels, 95 ft. tall, 1500 ton capacity, and "fully electric."

Photo below: Markey Machinery - Photo right: Greg Trauthwein

Above: Blaine Dempke (L) and Robert LeCoque started working with Markey as teenagers. They bought out the Markey family in 1999.



Right: Rolf Andreas Wingard, MD, Vestdavit in front of the PLR-5000 davit @ SMM Hamburg.

Blaine Dempke and LeCoque started working with Markey as teenagers and rose through the engineering department and machine shop ranks. They took over management of the company in 1996 and bought out the Markey family in 1999.

Dempke reports that "business has been good over the last year and looks positive moving forward." While there are many projects in process, he specifically noted that two which are coming to fruition include equipment for Seaspan vessels being built at Sanmar Shipyards; plus design and production for a suite of Class III AGILE Escort & Tow Winches for Signet Maritime.

Vestdavit made a splash SMM in Hamburg in September showcasing a full-size PLR-5000 davit on its stand. Normally mounted on the decks of naval or coastguard vessels for launch of smaller craft, the davit sports a 5000kg lifting capacity.

The year 2021 was a strong sales year for the company, including a pair of signature orders. Vestdavit booked an order with the Norwegian Coast Guard (NCG) for a total of six PLR-5003KV systems being supplied for a series of three Jan Mayen-class polar patrol vessels now under construction at Norway's Vard Langsten yard, of which the first is due for delivery this year. Each of the newbuild will have two specially designed PLR systems intended to meet the NCG's requirement for 330 days a year of operational availability in up to Sea State 5 and temperatures as low as -25C.

Rolf Andreas Wingard, Managing Director, Vestdavit, discussed the latest contract. "We won a big contract from Esvagt, the Danish shipowner who earlier this year ordered from Cemre Shipyard the world's first SOV to operate on green fuels under a joint newbuild project with Ørsted. Powered by batteries and dual-fuel engines, the 93m long vessel will be capable of sailing on renewable e-methanol produced from wind energy and biogenic carbon. Vestdavit was selected by Esvagt to provide a total of five davit systems for the vessel - two large FF-30000 dual-point workboat davits featuring a unique solution for flexible hook distance, as well as a pair of L-3500 liferaft davits and one PLRH-5000 davit for fast rescue craft."

Overall, Wingard sees strong potential in the rebounding oil and gas market, the emerging offshore wind market, and especially in the naval market.

"(A boost in) naval and coastguard ship building started way before the war in Ukraine, with Trump pushing NATO countries to increase their military spending and with the Chinese being aggressive in the China Sea and Pacific area, military spending has gone up," said Wingard. "There are a lot of programs with naval ships, warships, and patrol ships where boat handling becomes an important capability. We are involved in more projects than we have ever been in all our major markets, and the major markets being the NATO countries and what you can call the Western world, (including) Australia, New Zealand, and Japan.

New Products

Innovative products, technologies and concepts

Sønnavind drone and boligfoto

VIKING Life-Saving Equipment and maritime electric motor systems developer Evoy launched an electrically powered 6.55m rescue boat, the VIKING Norsafe E-Mako-655. The Mako-655 is an existing rescue boat design that, up until now, has only been offered with traditional engine propulsion due to the current IMO/SOLAS regulation which states that rescue boats of this type must have at least one internal combustion engine.

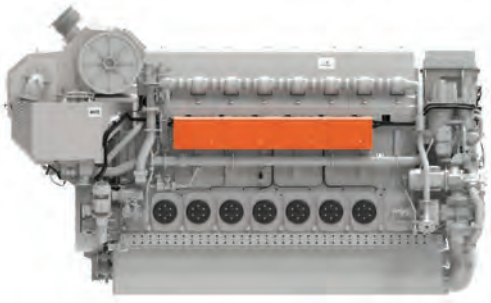
VIKING Norsafe and Evoy are challenging what they call a "somewhat out of date convention" with their medium to long-term goal of overturning the existing rule with the assistance of DNV, who have submitted a SOLAS Novel Design application in support of the new technology.

"Standards and regulations require a lifeboat to be started and stopped routinely to verify that they are operational," said Erik Mostert, head of R&D, VIKING Norsafe. "Evoy´s electric motors and battery systems eliminate the potential risks of wear and deterioration of internal combustion engines in association with this start/stop process."

New SpillGuard Leak Recognition System Provides Early Warning of Leaks

DENIOS introduces the SpillGuard Leak Recognition System which instantly alerts users when a leak is detected. This unique, FM-approved technology is placed within the sump of a spill containment device, or near the equipment to be monitored, and alerts users with an audible and visual alarm for a minimum of 24 hours when contact is made with a liquid. It is easy to use - just switch it on and place it into position. Designed for use with all essential and common liquid hazardous substances, the explosion-proof SpillGuard features intelligent, robust sensor technology in a highly resistant, electrically conductive housing. The battery lasts up to 5 years and provides an audible signal to alert users of the need to replace it. Ideal for use with temperatures from 32°F (0°C) to 104°F (40°C), with a red LED light to indicate that the unit is operating safely. In stock for immediate shipment, SpillGuard provides an economical early warning of leaky containers and equipment. It is ideal for use with containers and sumps of all sizes and types, as well as along pipelines, next to heating or cooling systems, beside hydraulic equipment, near industrial washing machines, adjacent to pump stations, or anywhere liquids are used or stored.

DENIOS



© Wärtsilä Corporation

Wärtsilä 25

Wärtsilä introduce its new Wärtsilä 25 medium-speed 4-stroke engine. The engine is already capable of operating on diesel, LNG, or on either gas or liquid carbon-neutral biofuels, and can be upgraded to operate with future carbon-free fuels as they become available. The flexibility of having different valve timing options is a key enabler for future fuels and emissions optimization. The Wärtsilä 25 is intended to be the first Wärtsilä engine to run on Ammonia as a fuel.

The Wärtsilä 25 features a robust turbocharging system with a high pressure ratio. It is now available in 6L, 7L, 8L and 9L cylinder configurations, while the dual-fuel (DF) version has a power output ranging from 1.9 to 3.1 MW, and the diesel version from 2.0 to 3.4 MW. The common-rail high pressure fuel injection technology optimises combustion and the fuel-injection settings at all loads. This in turn promotes smoke-free operation.

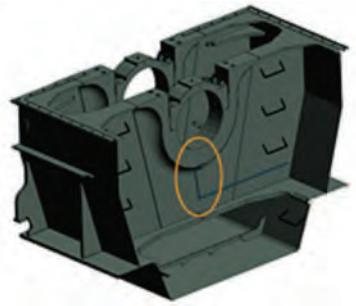
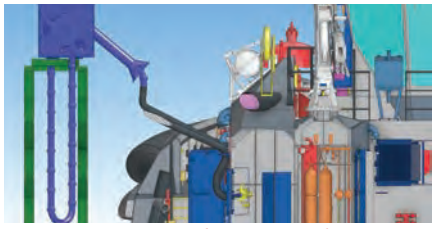


Image courtesy NYK

New Ship Maintenance Method

NYK and MTI Co., Ltd. received approval from ClassNK for a new condition-based maintenance (CBM) method implemented on NYK-owned coal carrier Noshiro Maru. The certified CBM is a method for monitoring the condition of bearings of large marine diesel engines through temperature data, a method that was adopted in the "CBM Guidelines, Second Edition"4 issued by ClassNK in 2021.

In addition, the Diesel Engine Main Bearing Condition Monitoring System, which visualizes bearing temperature data that can be obtained through sensors installed on the main bearings and ship operation data, has been developed and implemented on the NYK-owned coal carrier Noshiro Maru.

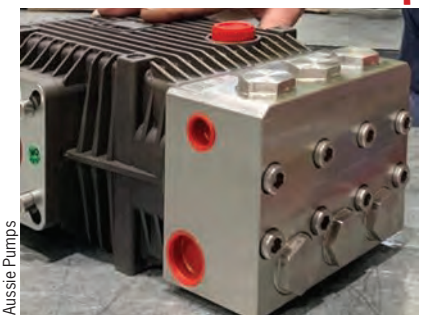


IGUS/Sanmar

Electric Bunkering System

Sanmar Shipyards and IGUS will develop and build a new electric bunkering system, designed to be compact and able to supply a variety vessel types with onshore power. To this end, the companies have designed and built the Shore Power Dispenser System which can be operated by just one crew member. It allows an extension of the dispenser system to provide higher charging power capacities; each module can handle 500A current capacity (up to 1000V AC).

New Desalination Pump

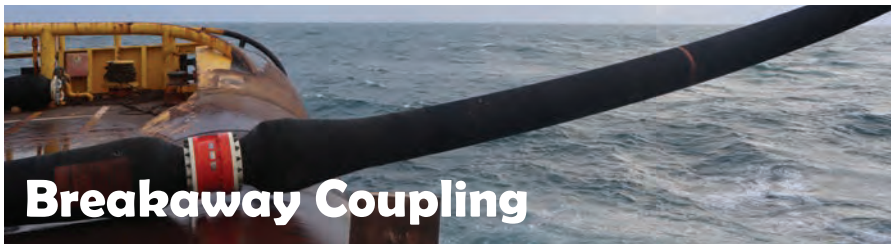


Aussie Pumps

Aussie Pumps introduced a new desalination pump, capable of both high pressure and high flows. Manufactured by Bertolini in Northern Italy, it features heavy duty AISI 316 stainless steel construction.

This material makes it suitable for Reverse Osmosis, desalination, food industry, pharmaceutical, marine and even chemical applications. The pump can be used as a direct drive with electric motor in the 1,450rpm range (4 pole), and alternatively, can be close coupled to a gearbox, or pulley's or driven by a gasoline or diesel engine.

Called the Big Berty KA4815, the pump reaches a pressure of 150bar (2,175psi) and flows as high as 48lpm. It is compact and fitted with a heavy duty 316 SS head capable of handling sustained performance. For maximum performance at 1,450rpm, the pump requires a drive system producing up to 14kw.



Gall Thomson

Gall Thomson has announced the latest evolution in Marine Breakaway Couplings (MBC): PetalC, which reduces axial loads on the most exposed break studs by up to 30% and reduces MBC install length by 60%. Gall Thomson MBCs are fitted to marine hoses used in offshore operations to transfer petroleum products and are designed to separate and close in an emergency such as vessel drift or extreme and damaging pressure surge events. Gall Thomson MBCs are therefore designed to protect operations, people, assets and the environment.

PetalC is an evolution of the Gall Thomson Petal Valve MBC and uses tried and tested technology that has delivered reliable performance for more than 40 years. This evolution is informed by knowledge gained from over 340 successful MBC activations. It is this unique collation of field verified MBC activation experience that has enabled this new standard of performance for MBC technology.

SAAM to build RAL-design Electra 2300-SX

SAAM Towage closed an agreement with Teck & Neptune Terminals that will allow the deployment of the first two electric tugs to its fleet. The ElectRA 2300SX tugs are designed by Vancouver-based Robert Allan Ltd. and will be built at Sanmar Shipyards in Turkey. Scheduled for delivery during the second half of 2023, the new tugs will each be powered by two separate battery lithium-ion energy storage systems, making them 100% electric and zero-emissions ships. They will be charged by British Columbia's

"With an overall length of 23 meters and a 70 tons bollard pull performance, the tugs will be highly capable of delivering services to all terminals in the Port of Vancouver," said Sander Bikkers, president and country manager of SAAM Towage Canada.

SAAM's fleet of ship-docking tugs in Vancouver is very well-utilized and requires a battery electric tug to have a large battery capacity to meet their service needs. Time between missions can be short, again suggesting high battery capacity and relatively quick recharging periods.

Space between the port's "finger piers" is limited, thus requiring a tug of compact dimensions and exceptional maneuverability, yet also high bollard pull to meet the needs of handling ever-larger commercial vessels.

With a nominal battery capacity of 3,616 kWh, this compact, 23m length design delivers exceptional endurance. Zero-emission mission endurance is several hours for normal operations, or it can deliver its bollard pull of 70 tons for up to a full hour.

ElectRA 2300-SX Facts & Figures:

Length, o.a.	23.4m
Beam, molded	11.85m
Depth, least molded	4.94m
Maximum draft	5.5m
Gross tonnage	295 tons
Bollard pull	70 tons
Battery capacity	3,616 kWh nominal at beginning of life

Image courtesy Robert Allan Ltd.

A customized skeg, specifically tuned to SAAM's exacting preferences for maneuverability and controllability, is a major achievement of the design, according to RAL. After surveying SAAM's local crews for the most desirable characteristics, Robert Allan Ltd. undertook a sea trials program on two tugs in their local fleet, then built and validated dynamic maneuvering models using computational fluid dynamics (CFD).

Airborne emissions of CO2 and other products of combustion will be zero when operating on the batteries, which will be charged at dock from the local hydroelectric power grid. This charging capacity is customizable on all ElectRA in accordance with customer needs.

The deckhands aboard will find a flush working deck forward with a double-drum electric hawser winch. There is ample space to work and minimal clutter, in part due to the availability of an aft anchoring option. The Masters will revel at the excellent sightlines afforded from the steering position, including that of the large diameter cylindrical fender forward.

That fender extends well aft, thus providing excellent cushioning for bow, bow quarter, and side contact with an assisted vessel. The fendering system is also designed to be exceptionally soft, with both 20 and 25 tons per square meter (at full bollard pull) options available for selection.

Another option available on the design is an FFV1 fire-fighting notation (2,400 m3/hr.) with both water spray and foam. A pair of 940 ekW, IMO Tier III emissions compliant generators are aboard for powering this optional system and other ancillary functions.

In the Shipyard

Latest Deliveries, Contracts and Designs

Sunstone takes Expedition Cruise Ship Pair from Chinese Yard

SunStone Maritime Group A/S took delivery of two Infinity class ships – Sylvia Earle and Ocean Odyssey – from the CMHI Shipyard in Haimen, China. The pair are the fourth and the fifth of the Infinity class delivered from China Merchant Heavy Industries, and both will be on long-term, year-round charter: the Sylvia Earle with Aurora Expeditions, and the Ocean Odyssey with Vantage Deluxe World Travel. The Infinity series of ships represents a collaboration between European design and technology and Chinese shipbuilding.

Infinity class ships measure 104 x 18m with a 5.1m draft. They feature a passenger capacity between 130-200 and a crew capacity between 85 and 115. The vessels are Ice Class 1A, Polar Code 6 and are being built with Safe Return to Port, Dynamic Positioning and zero speed stabilizers. The ships feature the distinctive X-Bow by Ulstein Design & Solutions, and are designed to be small enough to give an exclusive atmosphere and yet large enough to yield all expected services and facilities such as a swimming pool, bar and restaurants, lounges, boutique, gym, spa, and sauna. The next ship scheduled to be delivered is Ocean Albatros in March 2023.

Image courtesy SunStone Maritime

Israel Shipyards debuts SAAR Class Corvette

Israel Shipyards (ISL) unveiled a new corvette- SAAR S-80. The S80 vessel is based on ISL's S-72 platform, from which several designs have been evolved, including the Israeli Navy Light Patrol Corvette – the RESHEF Class an advanced multi-role vessel.

The new generation of the S-80 class features greater versatility and higher payload capacity, with increased weapon suite capacity and wider spread of Electronic Warfare (EW) systems as part of the platform offensive advantages. The S80 length is 80m, powered by four diesel engines, two shaft lines, and equipped with controllable pitch propellor system and the top speed exceeds 28 knots. The S80 will be equipped with state-of-the-art ship control system, a health management system and she will be capable of being equipped with the combat systems made by the Israeli defense industries or and any equivalent systems according to the customer requirements. The S-80 can be adjusted to accommodate Corvette or as an OPV version, depending on the operational requirements. The S-80 allows longer range and endurance for extended periods with reduced detection risks. Similar to the current Naval vessels of Israel Shipyards, the new Corvette is also supporting unique possibilities of deploying Special Forces units.

Image courtesy Israel Shipyards

Working Boats: An Inside Look at Ten Amazing Watercraft, by Tom Crestodina

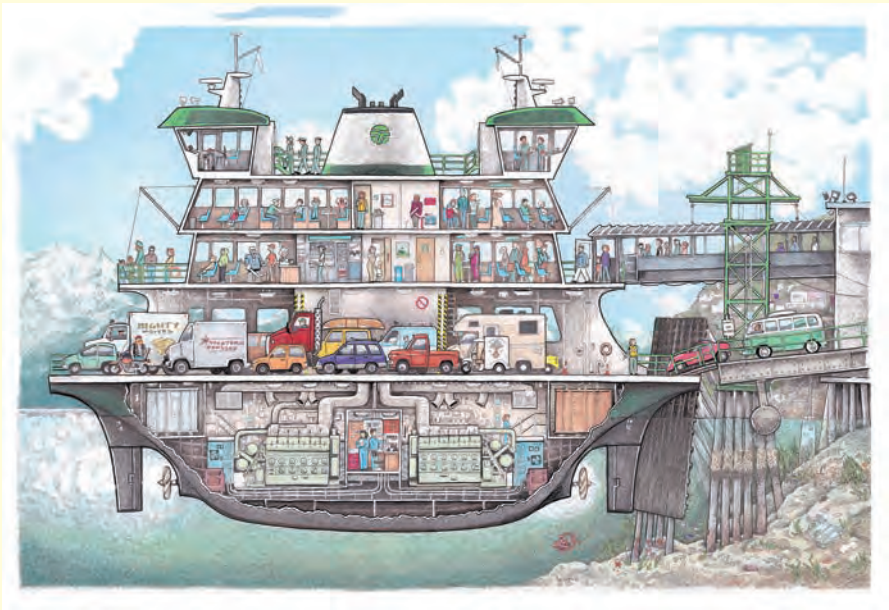


Image courtesy Alan Haig-Brown from the "Working Boats" book

Reviewed by
Alan Haig-Brown, Sept. 2022

When I was a young boy, I had a big book of ships that included cut-away images of some of the vessels. The British, Atlantic, passenger ship Queen Mary was one. I was fascinated to see, not only the luxury salons, but the engine room and propeller shafts. I still find such representation of vessels uniquely fascinating.

As a youngster I was also something of a wharf rat and occasionally talked my way onto fishing boats and tugs to see their inner workings. Now, thanks to seine-boat skipper and illustrator extraordinaire Tom Crestodina I can indulge my fascination to my heart's content in the pages of his recently published book Working Boats: An Inside Look at Ten Amazing Watercraft.

Capt. Crestodina has been known amongst the Alaska fishing fleet for his often-humorous representation of trollers, seiners, tenders, and others. Many of his framed prints grace the fishermen's homes and those of appreciative collectors. Tom's booth at the annual Pacific Marine Expo in Seattle is an ever-popular hang-out.

It isn't only fishing boats that get the Crestodina treatment. Most of the vessel types, from ferries to fire boats, familiar to the people who work the waters from Puget Sound to Alaska are represented in the book. Two big beefy Caterpillar-powered tugs inspired by the Western Towboat company fleet are shown. Graphic descriptions of their Z-drive propulsion and a container barge are provided along with the workings of a diesel engine.

Five types of west coast fishing boats are illustrated with cutaways showing great detail. Three of these; troller, seiner, and Bristol Bay gillnetter, fish for salmon and Crestodina provides knowledgeable detailed drawings of the workings of each gear type. He gives similarly detailed illustrations and text for a Bering Sea king crabber and a classic Norwegian style, wooden, halibut, longline schooner.

If a photo illustration is worth a thousand words, Crestodina's cutaway drawings give us more like five thousand words each. This has allowed him to squeeze more information into 56 pages than can be seen anywhere, except for a technical paper for heart surgeons. Where a cutaway view of the boat's profile isn't enough, additional drawings and text are employed to provide information on navigation, safety at sea, and the dangers of icing up in winter storms.

The largest vessels included are a car ferry and a NOA research ship. A coast guard cutter is paired with illustrations of their role in rescues at sea. As with the other boats, the author/artist doesn't stop with a simple profile but illustrates and explains the role and function of each vessel through additional drawings as required. It is no cliché to say that, for the mariner inclined, from eight to eighty this is the one book that does it all.

THE MARITIME NETWORK

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f. Total Distribution (Sum of 15c and e) ▶			14078	14794
g. Copies not Distributed (See Instructions to Publishers #4, (page #3)) ▶			377	382
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i. Percent Paid and/or Requested Circulation (15c divided by 15f times 100) ▶			96.6%	97.7%

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18. Signature and Title of Editor, Publisher, Business Manager, or Owner: Kathleen Hickey — Date: 9/20/2022

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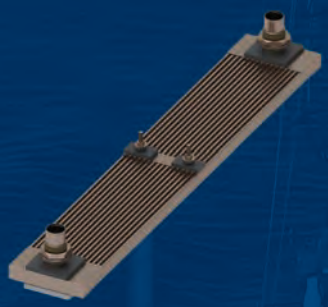

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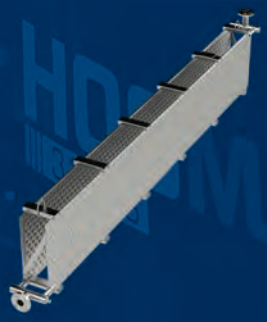

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