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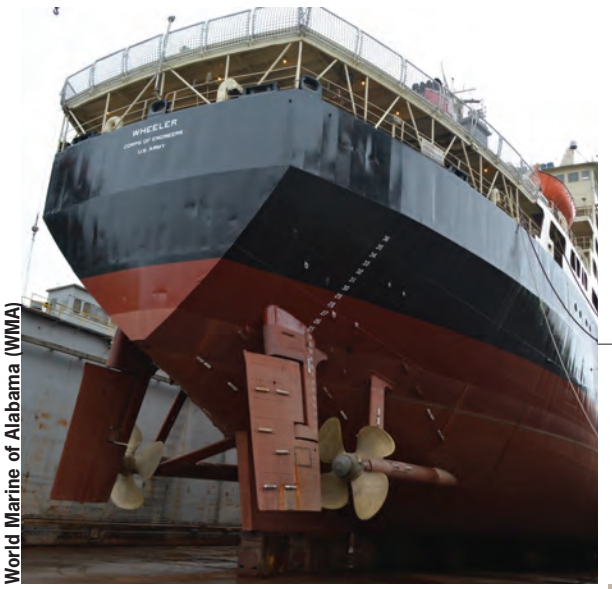

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THE COVER

Get Your Piece of the $2.9 Billion VW Settlement Pie
The U.S. maritime sector could be the big winner in tapping cleaner propulsion tech courtesy of Volkswagen's 'Dieselgate' settlement. Patricia Keefe, starting on page 36, informs on how to get started.

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MARITIME REPORTER AND ENGINEERING NEWS
MARINELINK.COM

ISSN-0025-3448
USPS-016-750
No. 3 Vol. 80

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

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

SUBSCRIPTION INFORMATION

In U.S.:
One full year (12 issues) $84.00; two years (24 issues) $125.00

Rest of the World:
One full year (12 issues) $110.00; two years $190.00 (24 issues) including postage and handling.

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Show Me the Money

While the March 2018 edition serves as our Annual World Yearbook, complete with several feature shorts and near-term insights on key market sectors, **unofficially it is the "Show me the Money" edition**, yelled in full "Jerry Maguire" style.

This business – all business – ultimately comes down to the common denominator of money, and on a final read through of the March 2018 edition that common theme came through loud and clear. Whether talk starts with the U.S. inland waterway infrastructure, or talk turns to the United States Coast Guard and the dearth of a capable icebreaking fleet, or talk turns to the United States Navy and its mission to grow its fleet to 355 ships; there are many obvious needs and fine plans, but questions on how it all will be funded?

Starting as we like to with "On Point with Joe Keefe" on page 10, Joe in his typical Keefe style takes us on a **"Perilous Trip Down the River"** in discussing how the Trump administration, which came to office on the pledge of a mega-infrastructure spend, has punted the funding needs to rebuild a crumbling inland waterway infrastructure to "Public Private Partnerships," essentially taking it off the ledger of the Federal Government. As Joe writes, this potentially puts tremendous financial pressure on inland operators "at a time when they can least afford it."

Next talk turns to the **United States Coast Guard and its so-called icebreaker fleet**, a topic taken by another familiar face in our pages, Dennis Bryant. The state of the U.S. Arctic presence, if you can call it that, has been well recorded in our pages and many others. In short the U.S. icebreaker fleet is leaky, creaky and old, with Congressional funding for the purchase of polar icebreakers for the USCG last coming in the 1970s. (And yes, if you're wondering, that story short at the bottom of page 8 regarding the latest new Russian icebreaker was no coincidence. Russian icebreaking dominance in the Arctic space is overwhelming). While progress is coming – and surely will be a key point of concern for the 26th Coast Guard Commandant, which at press time it was announced that President Trump had nominated Vice Adm. Karl L. Schultz for the top spot – the U.S. cannot afford to wait any longer, and must seek a long-term solution to shoring up its presence in the Arctic.

Finally, and predictably, talk turns to the U.S. Navy and the path toward a 355 ship fleet. With the recent run on USN seamanship mishaps and resulting accidents – both embarrassing and deadly – suffice it to say that the Navy has plenty on its plate, including the need for a top to bottom overhaul of proficiency training and evaluation. That said, a long-term plan to fund a ramp up to 355 ships must be devised in a time when prospects for such funding is bleak.

Finally, and on a more positive note, Patricia Keefe delivers insight on a story that could potentially have enormous, immediate impact on the U.S. maritime market as a whole, and specifically on U.S. vessel owner's bottom lines.

In the wake of the Volkswagen 'dieselgate' scandal, as a part of the **"unprecedented" settlement $2.9 billion in VW money is being doled out** to all 50 states, tribal lands and Puerto Rico. The money is earmarked for projects which will have a favorable environmental impact, money that could be used to fund in whole are in part a massive upgrade of tug and ferry engines nationwide. As with anything that involves billions of dollars and state governments, the path is neither straight nor clear. In her story starting on page 36, Patricia seeks to help you formulate a road map with insight and advice to clarify the $2.9 billion path ahead.

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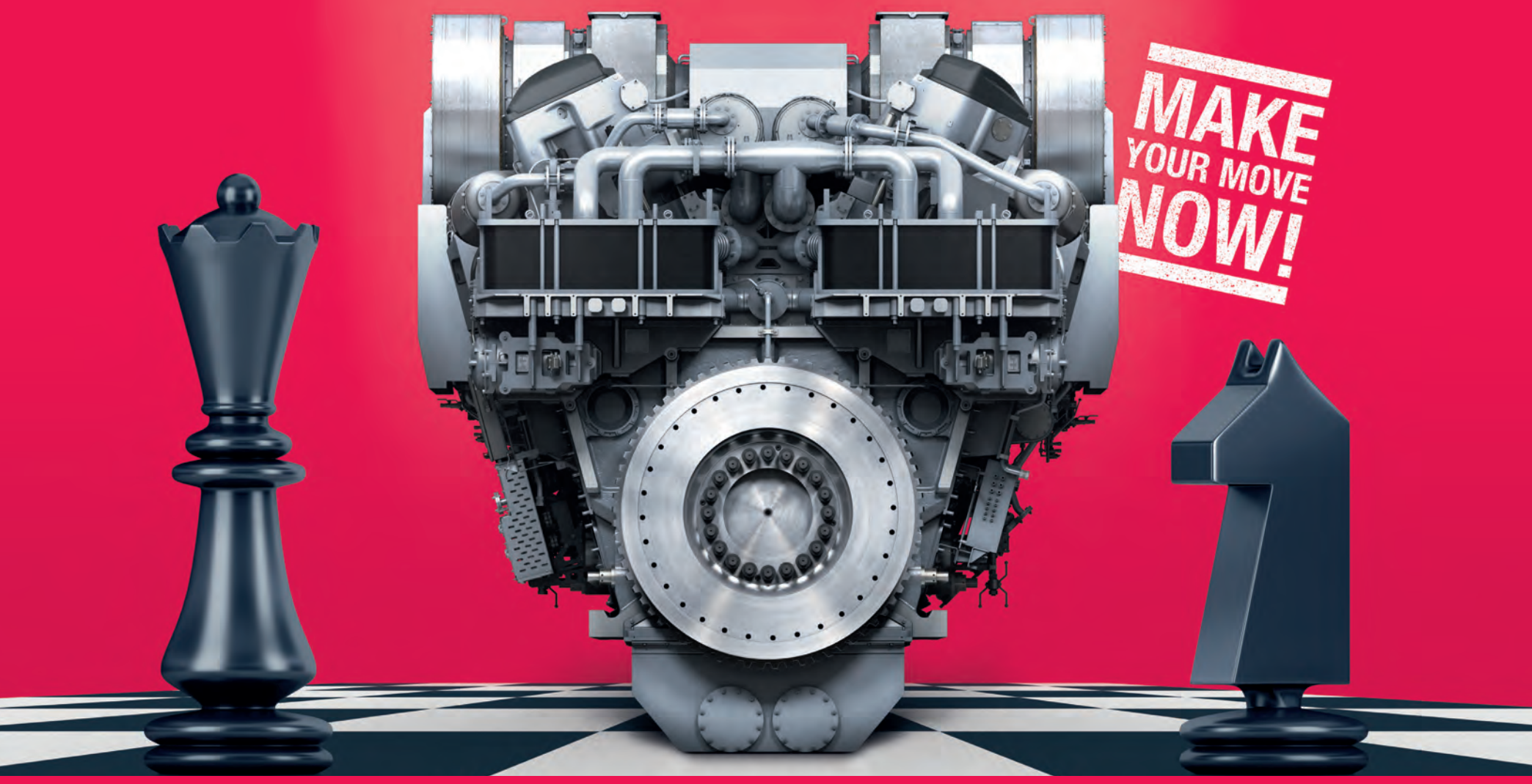

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See the Light

UV-LED Tech to Prevent Fouling

AkzoNobel and Royal Philips are teaming to develop a fouling prevention technology which uses ultraviolet light-emitting diodes (UV-LED), a solution applied to underwater surfaces to eliminate fouling growth. The two companies are aiming to develop an economically viable solution for underwater fouling prevention, an innovation that integrates UV light-emitting diodes in a protective coating scheme which will allow for the UV light to be emitted from the coating surface, providing the total prevention of biofouling accumulation on the surface of the protected area. Initially, the focus will be on applications for ships, yachts and offshore assets. The company will initially market the system, and will consider licensing it out to third parties.

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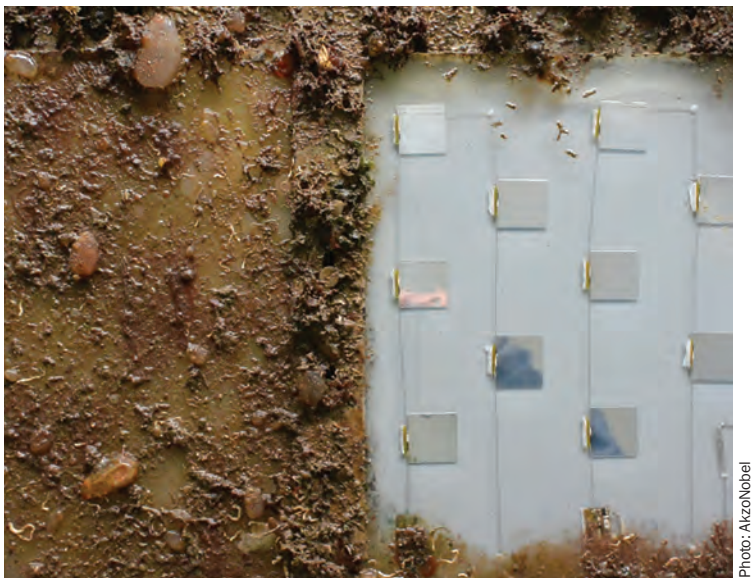

Photo: AkzoNobel

(Another) Russian Icebreaker

Photos: Sovcomflot

New Russian Icebreaker

While the U.S. has struggled to fund icebreaker construction since the 1970s (see "Government Update" on p. 12), Russia continues to dominate the space, punctuated with a ceremony on February 3, 2018, in Saint Petersburg naming a new multifunctional icebreaking platform supply vessel, Yevgeny Primakov. The vessel was built by Arctech Helsinki Shipyard, a subsidiary of the United Shipbuilding Corporation; technical supervision was carried out by the Russian Maritime Register of Shipping (RS), which assigned the vessel a high ice class – Icebreaker6. The 3,670 dwt Yevegeny Primakov measures 104.4 x 21m, with a 7.9m draft. The vessel's propulsion system is comprised of two Azipod units with a total capacity of 13 MW, allowing it to sail through ice up to 1.5 m thick with a snow cover of up to 20 cm. It also has a large passenger capacity, as Yevgeny Primakov can normally provide sleeping accommodation for 70 (besides her crew), and in the event of an emergency can accommodate up to 150.

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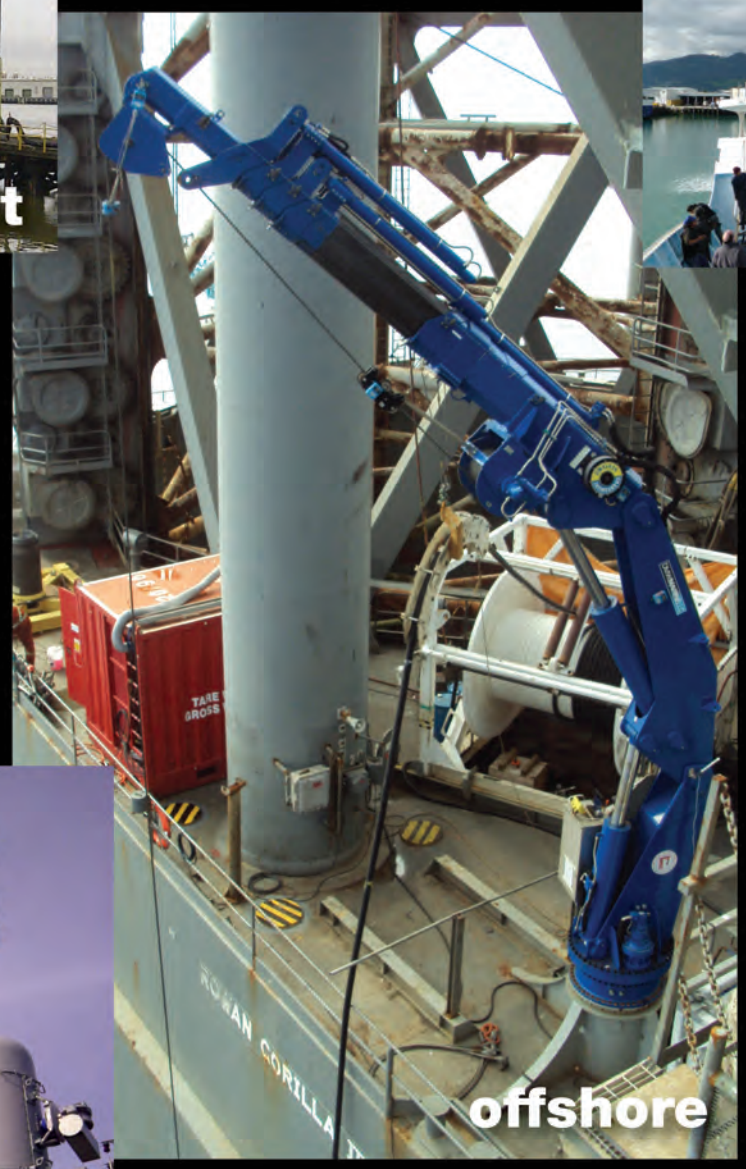

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A Perilous Trip Down the River for Inland Operators

Has the inland waterway system been left out of the Trump Administration's Infrastructure Funding

About the Author

Joseph Keefe is a 1980 (Deck) graduate of the Massachusetts Maritime Academy and the editor of both Maritime Logistics Professional and MarineNews magazines. He can be reached at keefe@marinelink.com

Washington, DC: At the National Press Club late last month, Waterways Council President and CEO Michael Toohey provided a stark view of the task ahead of inland stakeholders as they look to build on recent funding and infrastructure renewal successes. That's because the much-touted Trump administration infrastructure plan promises much, aims to change how that value is delivered, and potentially increases the considerable financial pressure already on inland operators at a time when they can least afford it.

The release of the long-awaited Trump Administration infrastructure principles, and then the release of President Trump's FY 2019 budget request have inland advocates on edge. And, with good reason. The President has, at various times, promised to ramp up renovation of the "dilapidated system of locks and dams that are more than half a century old." But, as with all things in Washington, the Devil is in the details. Trump's massive funding initiative, as it turns out, relies heavily on so-called P3 – or Public Private Partnerships – in order to make it work.

From the cheap seats, the President's campaign promise and current initiative sounds good. So many different sectors of the domestic economy await good news on this front. These include recreational boaters, commercial fishermen, and those who benefit from hydropower generation, municipal and industrial water supply, flood control and national security sectors. But, currently, commercial waterways operators – approximately 400 companies across the entire national waterway system – are the only ones contributing a 29-cents-per-gallon diesel fuel tax to a dedicated Inland Waterways Trust Fund. Those funds are matched by General Treasury Funds that pays for the costs of construction and major rehabilitation of the system. Everyone else is riding for free.

In a well-publicized visit to the river system, the President promised, "Together, we will fix it. We will create the first-class infrastructure our country and our people deserve." As the details of how that would come together emerge, it is clear that his vision includes far less in federal support, and significantly more in private and local state money to do just that. So-called P3 projects leverage commercial funds and investors, who would then have skin in the game and typically involve tolls and/or user fees, spread out over a fixed time frame.

In his talk to a gathered group of perhaps 20 journalists, Toohey reminded us that "the inland industry is already involved with a P3 partnership with the federal government." As the only stakeholder already contributing significant funds to the effort, he also lamented that, sometimes, "no good deed goes unpunished." And, looking ahead to the possibility that the P3 route could produce additional tolls and lockage fees, he had some stark predications of what could come to pass, if they do.

For starters, any additional tolls or fees imposed on a fragile inland marine transportation sector – already mired in a state of low freight rates – he said, would drive traffic off the rivers and onto trucks. Or, in other words: exactly the outcome that the U.S. Department of Transportation's Maritime Administration doesn't want to see. Beyond the increased congestion and accelerated deterioration of the nation's interstate highways that this would create, the migration of freight from the intermodal equation's cleanest mode onto one of its dirtiest – trucking – would be a major setback for America's aggressive drive to clean up the air that we breathe.

As P3 projects across the fruited plain drive up costs for consumers everywhere, drivers along just one ten mile stretch of I-66 near Washington, DC are now facing $46 roundtrip DAILY commuting bills. Translating that metric to the nation's waterways would be a tragic blunder, a disaster for the nation's heartland (which is already in a fierce battle with South American grain producers for broader access to global markets), creating new and increased highway maintenance costs while at the same time dealing a body blow to the environment. Doesn't sound like a good idea to me.

At a time when the Democrats are not looking to give their colleagues across the aisle any additional legislative victories, the task of steering public policy back onto the right course has never been more difficult. Nevertheless, says Toohey, bipartisan support is what produced the successes of 2014, WRDA, and the successes that for inland infrastructure that will follow. Arguably, this will be his most difficult task yet as he leads the Waterways Council in its advocacy role. "Compromise," he said, "will be the key."

Toohey correctly asserts that since the founding of the United States, the Federal government has played a role in operating and maintaining the inland waterways because the system is a national treasure, and does not belong to one state or entity. More recently, and since the end of 2014, through the advocacy of Waterways Council, Inc., (WCI), inland waterways carrier and shipper members increased their contributions to the diesel fuel tax (by 45%) deposited into the Inland Waterways Trust Fund for increased investment to the system. Today, inland waterways carriers pay the highest tax of any surface transportation mode in the nation.

In a recent OP/ED in *MarineNews* magazine, WCI's President pointed out that the President's FY2019 budget request to Congress proposes to cut more than 22% of the U.S. Army Corps of Engineers' Civil Works funding to $4.78 billion, down from the FY2018 Senate Appropriations Committee's funding level of $6.16 billion. Among other things, the FY2019 budget also proposes a New User Fee on Inland Waterways. The proposal would establish a vessel user fee to supplement existing revenue from the $0.29 per-gallon diesel fuel tax to help finance the users' share of anticipated capital investment projects, as well as 10% percent of the cost of Operations and Maintenance (O&M) – historically a Federal responsibility – activities on the inland waterways. This proposal would seek to raise approximately $1.7 billion over a 10-year window. If accepted, said Toohey, "This budget, like the infrastructure proposal, hamstrings America's ability to compete in the world, and could virtually eliminate the cost-competitive advantage the waterways provide to shippers." He wound up his talk, before taking questions, by saying that WCI looks forward to working with the Trump Administration and with Congress to develop an equitable and meaningful infrastructure plan, and to see full and efficient funding provided for the U.S. Army Corps of Engineers. "We can and must do better," insists Toohey. I agree. What about you? ***– MLPro***

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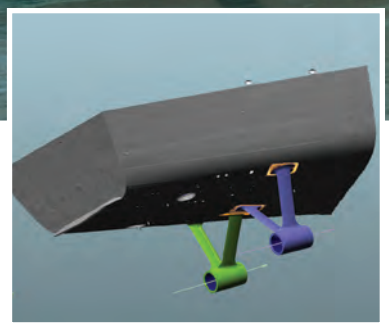

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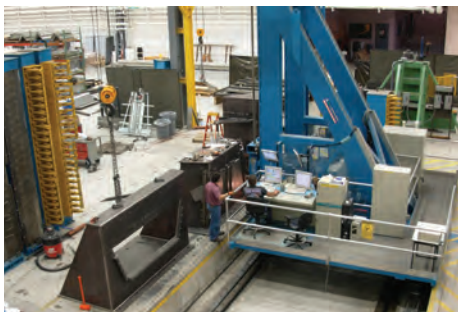

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The U.S. Government must Fund Icebreakers Now

Congress last funded the purchase of polar icebreakers for the U.S. Coast Guard in the early 1970s

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Congress last funded the purchase of polar icebreakers for the US Coast Guard in the early 1970s. The USCCG Polar Star (WAGB-10) was commissioned in 1976, followed by the USCGC Polar Sea (WAGB-11) in 1977. Polar Sea has been out of service since 2010 due to a major engine failure. Polar Star was 'in commission, special' status from 2008 through 2012 while undergoing a service life extension. It is currently the only active heavy polar icebreaker in the US fleet. The less capable USCGC Healy (WAGB-20) is a medium icebreaker and is equipped to support research missions in polar waters.

Polar Star is now 42 years of age. That is old for any ship, even one that has gone through a service life extension. Polar icebreakers operate in extreme conditions. Polar Star regularly uses its three 25,000 horsepower gas turbine engines to drive its 13,000 ton hull into pack ice. If the ice is thick and hard, and if there is little open water nearby, as is often the case, the icebreaker is brought to a halt in less than a ship-length. The officer of the deck reverses thrust before the icebreaker is fully halted, goes astern several hundred yards, and rams the ice again at full power. This process continues until the ice is broken and the ship can proceed. Even when the ice is thinner and the cutter can run continuously, the stresses on the hull, propellers, shafts, and engines are intense. This activity has been repeated over and over again for all but the four years of the service life extension.

On Polar Star's current deployment to the Antarctic in support of Operation

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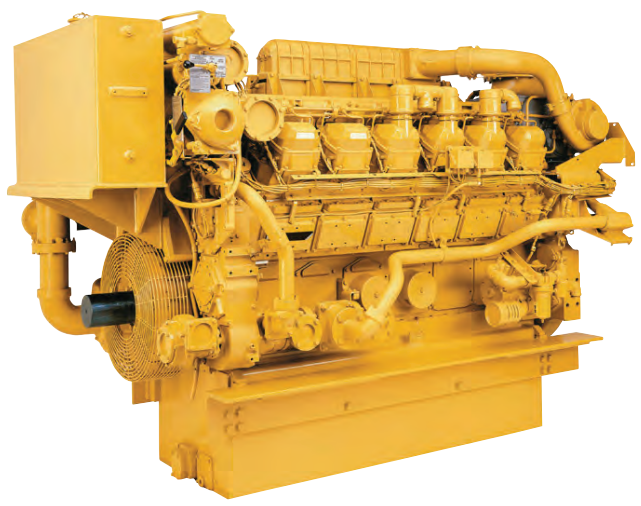

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On Polar Star's current deployment *to the Antarctic in support of Operation Deep Freeze, a seal on one of its three shafts failed, causing* ***flooding in the cutter's engine room*** *at the rate of approximately 20 gallons per minute. An emergency shaft seal was installed and the engineering space was dewatered. Separately,* ***one of the three gas turbine engines failed****. The crew was able to troubleshoot the turbine finding a programming issue between the engine and* ***the cutter's 1970s era electrical system.***

Deep Freeze, a seal on one of its three shafts failed, causing flooding in the cutter's engine room at the rate of approximately 20 gallons per minute. An emergency shaft seal was installed and the engineering space was dewatered. Separately, one of the three gas turbine engines failed. The crew was able to troubleshoot the turbine finding a programming issue between the engine and the cutter's 1970s era electrical system. This year's US Antarctic Program resupply mission is now complete and Polar Star is enroute its homeport of Seattle.

Ideally, Congress would have commenced planning to fund new polar icebreakers soon after Polar Star and Polar Sea were commissioned. But that is no realistic. The US Coast Guard, though, has sought such funding for many years now. It has prepared plans and drafted rough requirements for consideration by its Service Secretaries, the Office of Management and Budget (OMB), and its authorizing and appropriations committees in the House and Senate.

The 1984 United States Polar Icebreaker Requirements Study, prepared jointly by the Coast Guard, Department of Transportation, Maritime Administration, Department of Defense, National Science Foundation, National Oceanic and Atmospheric Administration, and Office of Management and Budget, recommended that four polar icebreakers would be required to meet national and program requirements through the year 2000.

In 1990, an updated report to the President on polar icebreaker requirements reiterated that: "As instruments of national policy and presence, icebreakers are necessary to meet the legitimate needs of national defense and security, to demonstrate the full range of national sovereignty, and to protect economic interests and to fulfill scientific research requirements." While data showed that at least four heavy icebreakers would be required, the report recommended funding for only two, based on budgetary forecasts.

The USCG Arctic Strategy (May 2013) noted that climatic conditions in the Arctic are changing rapidly, with a 40% reduction in the polar ice cap since 1970. Concomitantly, human activity in the Arctic is increasing rapidly. Merchant vessels, fishing vessels, passenger vessels, and oil and gas drilling rigs are becoming common sights in waters previously the almost exclusive domain of polar bears, walrus, and seals. This human activity will continue to increase regardless of whether the US government (and particularly the US Coast Guard) has a meaningful presence in the Arctic, but that human activity will be safer and more orderly if the Coast Guard is there to support maritime safety, security, and environmental protection.

In December 2016, the Department of Homeland Security (DHS) submitted a report to Congress entitled 'Arctic Icebreaking Capabilities'. The report addressed the current ability of the Coast Guard to provide the Navy with adequate icebreaking capabilities to operate a surface combatant ship in the Arctic year round. It concludes that the Coast Guard is planning to acquire at least two new heavy icebreakers to recapitalize the existing fleet.

In July 2017, the National Academies of Sciences, Engineering, and Medicine recommended construction of four new polar icebreakers of the same design as the lowest cost strategy for protecting US interests in the Arctic and Antarctic. At an estimated cost of $791 million each, four heavy icebreakers of common design would reduce operating and maintenance costs over the life of the vessels, improve continuity of service, increase the USCG's icebreaking capability, and improve operational effectiveness.

A September 2017 report of the Government Accountability Office (GAO) noted that the Coast Guard has taken various actions to advance its heavy polar icebreaker acquisition program since establishing it in 2013, such as partnering with the Navy and engaging the shipbuilding industry, but faces risks in implementing its accelerated acquisition schedule. In particular, in October 2016, the Coast Guard released a notional schedule for the heavy polar acquisition program showing delivery of the first of three heavy polar icebreakers in fiscal year 2023—three years sooner than initially planned. However, Coast Guard officials reported that should acquisition planning documents, including acquisition and lifecycle cost estimates, not be completed and approved by the end of fiscal year 2017, the program may not be able to meet its schedule for releasing the request for proposals for detail design and construction—a key step in the acquisition process—in mid-fiscal year 2018. This may then delay the contract award scheduled for fiscal year 2019 and extend the proposed delivery date.

Various responsibilities drive the Coast Guard's determination of its polar icebreaking mission requirements, and the Coast Guard has been unable to address all polar icebreaking requests since 2010. In accordance with statute and presidential and national security directives, the Coast Guard has an obligation to maintain the capability to conduct polar ice operations. Coast Guard polar icebreakers do so by providing a scientific research platform for National Science Foundation (NSF) and other federal agencies and enforcing U.S. laws and international treaty obligations in the Polar Regions. For example, to support the U.S. Antarctic program and NSF for national science missions, the Coast Guard provides reimbursable icebreaking services for the annual resupply of McMurdo Research Station. However, the Coast Guard reports that it has been unable to address all agency requests for its polar icebreaking services. For example, the Coast Guard is often requested to provide polar icebreaking services for other US government agency operations, and tracks its performance in meeting these requests. Specifically, the Coast Guard reported fulfilling 78 percent (25 of 32) of agency requests for polar icebreaking services during fiscal years 2010 through 2016.

In February 2017, the Coast Guard awarded five firm fixed-price contracts for heavy polar icebreaker design studies and analysis. The objective of the studies is to identify design and systems approaches to reduce acquisition cost and production timelines. In April 2017, the Coast Guard released its draft heavy polar icebreaker system specifications in a request for information (RFI). The RFI seeks questions, comments, and feedback related to heavy polar icebreaker technology risks, sustainability, productivity, and affordability.

The Administration has now requested that Congress appropriate $750 million in fiscal year 2018 for detail work, design, and construction of a new heavy polar icebreaker. There is still work to be done before steel can be cut, but it is time for Congress to step forward and commit itself to acquisition of the needed heavy polar icebreakers. It is recommended that Congress appropriate the necessary funds now. Reasonable conditions can and should be placed on expenditure of those funds to minimize financial risks. But, without adequate money on the table, US ship builders will not exert best efforts to bring this urgent need to fruition.

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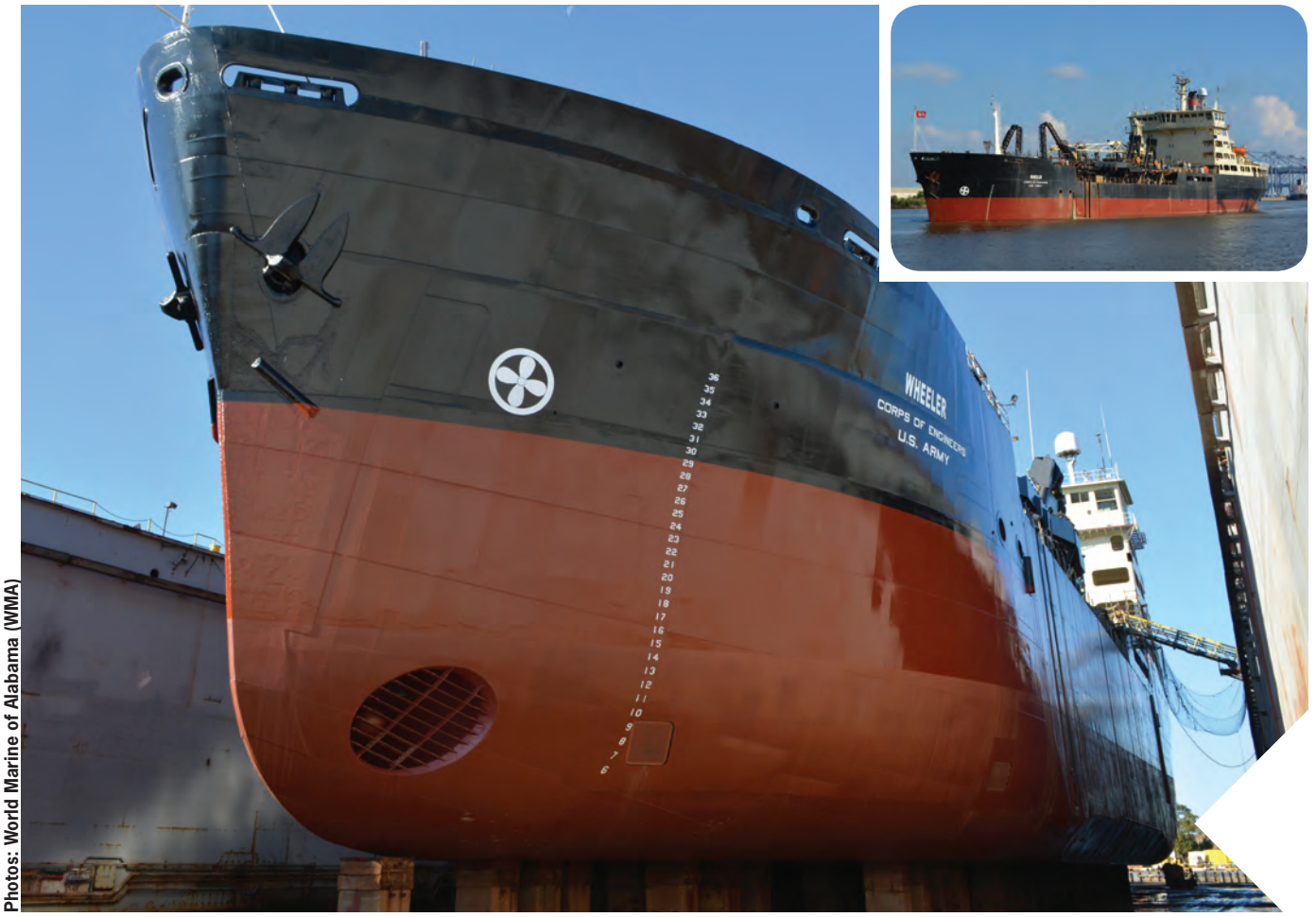

Photos: World Marine of Alabama (WMA)

American Pride

Working hard in the U.S. dredging industry

About the Author

William P. Doyle, CEO & Executive Director, Dredging Contractors of America. Doyle was nominated and appointed twice as a Commissioner to the U.S. Federal Maritime Commission (FMC).

World Marine of Alabama (WMA) completed work on a contract valued at over $14m to drydock and repair the Dredge Wheeler, a hopper dredge owned and operated by the USACE. The package included hopper and hopper door steel renewals, two new hydraulically-actuated weirs, and a new emergency generator. Machinist crews assisted with rebuilding the vessel's bow thruster, replacing one of the vessel's tail shafts and overhauling the vessel's CPP system. Pipe crews worked to renew piping throughout the vessel. Electrical crews had many assignments, including the installation of VFDs on the vessel's large seawater cooling pumps.

We have had a great first couple of months at the Dredging Contractors of America. As the new CEO and Executive Director, I have begun to visit the companies, their facilities and associated dredging projects. So far, I have surveyed the beach re-nourishment project in Ocean City, Maryland undertaken by **Great Lakes Dredge and Dock**. I've canvassed **Weeks Marine's** repair and yard facility in Jersey City, New Jersey. In the last week of February, I visited **Mike Hooks Inc.'s** corporate headquarters and boatbuilding and repair yard in West Lake, Louisiana. These companies and their employees are hardworking and dedicated, striving to protect the shores of the U.S.; they deepen our channels, harbors and inland waterways; and they restore our coastal wetlands and beaches. They are all filled with American pride. I look forward to continuing the visits to dredging facilities and job sites throughout this coming year and beyond.

I value the shipping sector of the United States, beginning with my mother working as a clerk in the Quincy, Massachusetts Beth Steel shipyard. I worked in that same shipyard as a cadet while attending Mass Maritime Academy breaking out ships for the first Gulf War (1989-1991). Upon graduation, I served as an engineering Officer with the U.S. Merchant Marine for 11 years. Then, I served in appointed positions under two U.S. Presidents.

Beware of False Prophets

One claim I have heard recently is the "dredging industry is not part of Jones Act," an assertion pushed by certain people with their own agenda, claims we heard following visits with officials from the Ports of New Orleans, South Louisiana, Houston and Galveston. Claims have been made that the U.S.-Flag dredging industry is not included within the purview of the coastwise laws of the United States. Claims have been made that U.S. dredgers do not have the adequate capacity to start projects.

These claims are wrong on all counts, and The Dredging Contractors of America will correct these false and misleading claims. After visiting Mike Hooks Inc. in the Lake Charles region of Louisiana, I headed to New Orleans and led a diverse group of companies and organizations at the New Orleans World Trade Center to discuss the U.S.-Flag dredging industry. This delegation consisted of relevant U.S. business leaders, including executives from dredging companies, repair yards, boat builders, vessel operators and riverboat pilots. Here is what we addressed:

Dredging Industry and the Jones Act

The Dredging Act was enacted in 1906, some 14 years before the enactment of the Jones Act. The Dredging Act established that all dredges engaged in dredging shall be constructed in U.S. shipyards. The term "Jones Act" today is a clear reference to our nation's body of coastwise laws which are set forth in a single chapter of the U.S. Code (46 U.S.C. Chapter 551), entitled "Coastwise Trade." This chapter reflects the 2006 codification of the maritime laws generally and incorporates the three fundamental cornerstones of our coastwise laws: that vessels engaged in domestic trade be U.S. built, U.S. owned, and U.S. crewed. Among the specific coastwise provisions included in Chapter 551 are Section 55102, which incorporates the original 1920 Merchant Marine Act governing the transportation of merchandise, and Sections 55109 and 55110, which incorporate the original Dredging Act of 1906 including the "transportation of valueless material or dredged material." Thus, the Dredging Act is an integral part of Coastwise Trade.

In 1988, Senator John Breaux of Louisiana, concerned with misinterpretations of the Jones Act, championed a Bill clarifying the transportation of merchandise. The Congressional intent to embrace dredging activities is clear by the express language in the law which codifies "merchandise" to include "valueless material" and clearly includes the term "dredged material" as merchandise covered by the Jones Act. Since then, numerous courts, including the U.S. Supreme Court, have held that dredges are Jones Act vessels and dredging activities are governed by the full suite of Coastwise trade laws and regulations.

U.S.-Flag Dredging Fleet Capacity

The U.S. Flag dredging industry has had the capacity to safely, economically and timely complete every dredging project in the United States. We have successfully deepened every port in the country as called for by our customers and will continue to do so. Moreover, the deepening projects have largely been completed well below the government estimates for the work. Most recently, major port deepening projects in Charleston, Jacksonville, Delaware River, Boston and New York were all bid well below the U.S. Army Corps of Engineers cost estimates for the work.

The U.S.-flagged dredging fleet, both private- and state-owned, totals more than 400 dredges. In 2017, the U.S.-flagged hopper dredging fleet capacity increased by 34% with the addition of two large new-build vessels built in U.S shipyards by U.S. workers. In fact, the U.S. dredging industry is amid a $1 billion-plus capital construction program. New investments include four large cutter suction dredges, two large hopper dredges, and approximately 50 barges built in shipyards across the U.S.

Jobs

When it comes to the Jones Act—Louisiana is all that. Louisiana is the top State in the nation for jobs, economic output, labor compensation, and value added related to the domestic maritime industry according to a study prepared by PricewaterhouseCoopers (PwC) for the Transportation Institute.

- The State of Louisiana is the top domestic maritime states in the U.S. It ranks first among all states for domestic maritime jobs with 61,956.
- Domestic maritime-related labor compensation exceeds $3.4 billion annually.
- The total gross economic output in the State is over $14.25 billion annually. Gross output is the "sum of receipts (or sales) and other gross income generated" in the domestic maritime sector, according to PwC.
- The total value added for goods and services moving by domestic waterborne transportation in Louisiana is over $5.3 billion annually. Value added represents, essentially, the gross domestic product for the domestic maritime sector in Louisiana.
- Four of Louisiana's Congressional Districts are in the top 10 of all districts in terms of economic impact, accounting for over 54,000 jobs and nearly $13 billion in economic output annually.
- In fact, Louisiana's 3rd Congressional Districts ranks first among all other districts in terms of domestic maritime jobs and economic impact.
- Nationally, the domestic maritime industry accounts for 499,676 jobs, $29.1 billion in labor compensation, $100.3 billion in economic output, $45.9 billion in value added and $11.4 billion in taxes. There are more than 40,000 vessels in America's domestic fleet, one of the largest in the world.

Competitiveness and Costs

The U.S. dredging industry is highly competitive with more than 50 different companies awarded federal work each year and 80 different companies bidding on that work each year. U.S. industry regularly works with the U.S. Army Corps of Engineers, ports, and the environmental community, to make project execution in the U.S. safer, more efficient, more productive, while minimizing project impacts. Here are some recent quotes by experts.

"The completion of entrance channel dredging is perhaps the most significant milestone to date for the Savannah Harbor Expansion Project," Col. Marvin Griffin, Commander of the Savannah District, said. "As of today, approximately half of the Savannah harbor's 40-mile channel is deepened and better equipped to handle post-Panamax vessels. The SHEP has broad national impacts, and with this achievement, we are now halfway to realizing more than $280 million in net annual benefits for the nation."

"Completion of the entrance channel is possible because of great partnerships: Georgia Ports Authority, Georgia Department of Transportation, Great Lakes Dredge and Docks Company, resource agencies, and Congress."

Next, the original U.S. government estimate for the current phase of the Jacksonville deepening project is $43,170,000. The winning bid by **Dutra Dredging Company** came in at $22,826,400 nearly 50% less than the government's estimate.

In June 2018, Jacksonville Deepening Contract #2 is scheduled to bid. Multiple dredging contractors have responded to the Corps' Sources Sought inquiry, submitting dredge availability lists for this deepening project. Multiple U.S Industry large cutter suction and mechanical dredges are available to perform this work. On January 29, 2018, the U.S. Army Corps released its estimate for the Boston Harbor deepening project and it was $166.37 million. The apparent winning bid for this project is $122.22 million by a joint venture of the Dutra Group and **Jay Cashman, Inc.**

Voices

William Harber, President, Americas Region, Hurtigruten

Five Minutes with

William Harber

President of the Americas Region, Hurtigruten

As the luxury yacht/adventure sector of the global cruise market continues to gain strength, *Maritime Reporter & Engineering News* recently received insights from Hurtigruten, a clear leader in the sector. William Harber, President of the Americas Region, Hurtigruten, explains the path forward.

BY GREG TRAUTHWEIN

Voices William Harber, President, Americas Region, Hurtigruten

Photo courtesy Hurtigruten

Please discuss Hurtigruten's plans to ramp up its North American presence?

We are indeed ramping up our presence in the Americas. From a distribution perspective, Hurtigruten is developing stronger, deeper and more strategic partnerships to drive our expedition cruise products. We're identifying new partners to grow our Antarctica business as well as to Arctic destinations. We're differentiating ourselves to better target today's cruise enthusiasts who want to touch all seven continents and to adventure travelers seeking a base camp at sea. Hurtigruten is changing the conversation about cruising to better define what's different about us and our guests. We're strengthening the Hurtigruten team in the Americas and enabling them to do great things for travel agents every day.

It looks like you are getting ready to more aggressively target the cruise market customers here in the U.S. For those considering a cruise on a bigger, more traditional ship, what would you tell them about the Hurtigruten experience?

Hurtigruten is the world leader in exploration travel and a global advocate for a green shift at sea. We're at the forefront of an energy-revolution in the shipping and cruise industry; imagining a future that's soundless and emission-free. We know the care we take with the destinations along our route is a deciding factor for conscious travelers.

The Hurtigruten experience is one of a kind and we're about exploring, not about cruising. It's important to provide our guests with memorable, high-impact, and even other-worldly experiences. The destinations and excursions we offer are based on 125 years of know-how in polar waters combined with innovative technology and design, and a passionate commitment to sustainability. Our ships allow for intimate experiences that bring travelers up close to wildlife and provide opportunities to visit some of the world's most remote destinations.

The Hurtigruten fleet consists of 14 expedition ships, custom built for adventure travel. Talk about the customs features of those vessels. What makes them special and what value-added perks do passengers get for their 'premium' dollars?

Our hybrid electric-powered ships that will debut later this year feature onboard high-tech activity centers that come at no additional cost. A highly-skilled expedition team provides small group workshops, on-land excursions, and hands-on training with advanced science tools and virtual reality goggles to truly connect travelers with the destinations they are exploring and allow them to learn in an interactive way.

Two new groundbreaking expedition

The MS Roald Amundsen and the MS Fridtjof Nansen are the world's first-ever adventure tourism expedition ***ships to sail fully electric with sustainable hybrid technology.*** *Being able to sail employing solely electric propulsion is a technical revolution and of great benefit for the environment*

Photo courtesy Hurtigruten/Rolls-Royce

Voices William Harber, President, Americas Region, Hurtigruten

Photos courtesy Hurtigruten

ships, MS Roald Amundsen and MS Fridtjof Nansen, are to be delivered in 2018 and 2019. Where will you deploy these vessels at first?

The new Hurtigruten hybrid-powered expedition ships offer one-of-a-kind sailings to pristine Arctic and Antarctic waters, including new adventurous itineraries to the Northwest Passage, Aleutian Islands, and to Svalbard.

Will the hulls have any special built-in Arctic-capable features to the vessels?

The MS Roald Amundsen and the MS Fridtjof Nansen are the world's first-ever adventure tourism expedition ships to sail fully electric with sustainable hybrid technology.

Being able to sail employing solely electric propulsion is a technical revolution and of great benefit for the environment; it also enhances the impact of experiencing nature for our guests through less noise emitted. Imagine sailing perfectly silently along the ice edge in the Arctic or Antarctica. The ships' design features an ice-strengthened hulls, wave piercing bulbous bows, and a Rolls-Royce Unified Bridge for safe and efficient performance.

How much fuel economy versus a traditional propulsion arrangement will the hybrid system bring?

On a technical level focusing on ship technology, the main elements are: Hybrid technology making periods of (soundless) sailing by electric propulsion only, a reality; energy saving low resistance hull construction; onboard energy conservation measures; and "peak shaving" i.e. batteries charging and recharging under varying power demand to allow the main generators to operate efficiently at near constant load.

Batteries are also being used as a "spinning reserve" (to eliminate the need for having a diesel generator running as a backup in order to have instant redundant power when navigating in narrow waters, harbor operations and under dynamic positioning). Other fuel-saving technologies include L-drive azipull thruster propellers with permanent magnet motors, and latest generation low fuel consumption diesel generators with low NOx emissions.

Where will they be built?

The newest additions to the brand are currently being built in Norway's Kleven Yards.

What else should readers know about Hurtigruten's long and short-term plans – especially in the North American theater?

As the world leader in exploration travel, Hurtigruten is the best-kept secret in the cruise industry – but not for long! Following the history of the Vikings and Norway's polar pioneers, Hurtigruten

combines an exceptional tradition and know-how with innovation, the highest maritime reputation, and a strong commitment to sustainability. With that said, our short-term plans include increasing the brand's reputation for offering a highly-attractive premium product for the modern adventure traveler, building stronger and more strategic partnerships to compete, and finding new channels to grow our Antarctica business. Our long-term goals include changing the conversation about cruising to better resonate with agents and consumers.

How many passengers and crew will the vessels carry?

The MS Roald Amundsen and the MS Fridtjof Nansen will both carry up to 530 passengers, including crew. We limit our guest count to 500 when sailing in Antarctica.

They will be the world's first hybrid battery powered cruise ships. Will they be USA EPA Tier 4 compliant?

The engines are equipped with an SCR (Selective Catalytic Reduction) system to meet IMO Tier III NOx emissions limit.

Tell us more about the exact nature of that battery hybrid arrangement. What OEM engine will you use? whose batteries? Which naval architect?

Designed by Hurtigruten in cooperation with Kleven Yards, Rolls Royce Marine and Norwegian yacht designer Espen Øino, MS Roald Amundsen will be powered by four "Bergen B33:45L" diesel engines by Rolls-Royce plus batteries. MS Roald Amundsen will manage 15-30 minutes at high speed and with a full passenger manifest without its diesel engines running. We expect to increase the reliance of hybrid electric power over time.

Hurtigruten offers a premium product for the modern adventure traveler. What's your largest vessel and what's the smallest (passenger count / LOA)? And, what's the average age of your current 14-ship fleet?

Our largest vessel is MS Trollfjord which can accommodate 640 guests and MS Nordstjernen with 149 guests is our smallest. The average age of our current 14-ship fleet is about to get much younger with the new ships coming on and older ones expected to leave the fleet. The average age of our purpose-built expedition ships sailing to worldwide destinations is 11.

Hurtigruten bills itself as 'the world leader in exploration travel.' Are you planning new routes in the New Year? If so, tell us about these new destinations? Why did you choose these over any other?

In addition to our new east coast itineraries in North America and Canada, we are also offering new expeditions along the west coast of South America and Central America. Most of our expansion is in the polar waters we call home. We offer more flexibility than any operator in polar regions with a total of 67 itineraries.

Our captains, crew and expedition teams have the most experience in polar waters where we can offer authentic and immersive expedition experiences for our guests.

Angus Frew

Secretary General, BIMCO

BIMCO's Secretary General & CEO Angus Frew spent some time with *Maritime Reporter & Engineering News* to discuss the burning topics of the day in maritime ... **environmental** regulation, **digitalization** & **cyber** security, and **reducing the administrative burden** on the ship's master. We left no stone unturned for the man who recently had his contract extended to the end of 2022 to remain at the helm of the world's largest international shipping association.

BY GREG TRAUTHWEIN

Many of our readers surely know BIMCO, but to kick things off, can you give me a 'by-the-numbers' overview of BIMCO today?

•BIMCO is a not-for-profit organization. We are a very well-capitalized organization, and we aim to reinvest our funds in products of value to our members. We have a staff of around 55 members in four locations – two in Asia, Singapore and Shanghai – we are a global organization. We have around 2,000 members in 120 countries, (reinforcing the point that) we are global. Of the 2,000 members, 800 are ship owners, 700 are brokers, and the rest are made up of agents and other associates. We have more than a billion deadweight tons in membership, representing around 56% of global tonnage at the end of 2016. (Note, that is a growth from 2014 to 2016 of 54 to 56 percent on a tonnage basis).

Our membership covers the three major sectors: containers, tankers and bulkers, and as you'd expect, we work very closely with other associations, in particular the International Chamber of Shipping, Intertanko and Intercargo.

Perhaps this is obvious, but why would I want to join BIMCO?

•We offer a wide range of practical tools and services to our members. We are a very practical organization. Clearly, we are well-known as leaders in developing contracts, standard contracts and clauses for the shipping industry.

Given the practical nature of BIMCO's services, as shipowners are increasingly stressed to keep on top of new regulations, do you see a growing importance of your practical services to your members?

•Absolutely. It is something that we've always offered, but since I've been onboard it has been a point of focus. If you are negotiating a contract and you are not sure if you should give in on something, our support and advice team is just a phone call or an e-mail away. *This is free to the members.* Another simple one is if you've got an undisputed debt, we can help you recover that. In 2017 we helped recover 3.2 million dollars on behalf of our members, and that is *another free service* to our members.

We also have "Shipping KPIs" which allows a ship owner to benchmark operations against others with a similar size and type of ship. That is also *free of charge*. Members must commit to enter data, but in return you can get some really important benchmarking data to help you see if you are as efficient as you would think.

Have there been any new service offering introductions of late?

•We have just launched – three weeks ago in Singapore – our new contract editor system called SmartCon, which uses the latest standard industry software. In fact, Microsoft (are) happy because we are using their latest products.

From what I've read, environmental regulation, promoting digitalization, and reducing administrative burden on the ship's master are three areas of focus for BIMCO, is that correct?

•Yes, that's absolutely right.

Photo courtesy BIMCO

BIMCO by the Numbers

Staff	55
Members	abt. 2,000
Countries of Members	120
Ship Owner Members	800
Ship Broker Members	700
DWT of Membership	1 billion +

Lets talk for a moment about the market, which has obviously been challenged in recent years, to put it mildly. When you look at the market, what do you see today?

•It is difficult across all sectors, but it differs sector by sector. We see (some hope) in dry bulk – if we can encourage people not to buy new ships, and keep the supply side under control, and preferably scrap some ships. We're seeing growth in terms of trade, so it continues to be a supply-side issue.

So we have a tough market, and at the same time an increasing number of environmental regulations which can be capital intensive.

•The environmental agenda is the most important issue to shipping right now and, of course, it's on top of our agenda, too. First there is the (IMO marine fuel) sulfur cap, and 2020 is not a long way away. This is interesting because it is probably the first piece of regulation where there is a substantial financial benefit for not complying. So we really focus on the compliance side on that issue.

We also have some concern about fuel availability. We funded a study alongside the IMO study, and it highlighted a lack of de-sulphurization capacity in the refining industry. And even if there is enough fuel worldwide, there will be places – regions – where at least initially, we believe, where fuel availability will be an issue.

Digging further into the environment, a topic that could fill our pages 100 times over, where are we, and where are we heading?

•We honestly believe that carbon emissions from ships peaked in 2008. So we are probably the only sector in the world that has actually peaked its emissions. I think that's incredibly positive.

Second, we really want to see a doubling of efficiency on a ton/kilometer basis by 2050. And we believe that we are making good headway towards that. We see much more efficient ships on the sea today than were around in 2008.

And the last one is the really tough one. The industry has to aim to completely de-carbonize, something that realistically will not be until the second half of this century. We are not in a position to even start at this moment. We need to spend research & development on new zero-carbon fuel types and new propulsion units.

So lets turn talk to another big topic, digitalization. It sounds as if this plays into all that you're doing with your membership.

•Digitalization is one of the three themes, specifically promoting digitalization across our industry to drive efficiency, safety and security. We are an organization focused on how we can – from our contracts work to a lot of our technical work –improve the standards and create standards for the industry which generate efficiency. So digitalization is just an extension of that. And we are involved in some exciting projects on that theme. We've been involved in the EU funded project called Efficiency 2, which will wrap-up shortly, which is focused on the port-ship interface and how we

can drive standardization in reporting across the world. A huge amount of the bridge team's time is spent reporting to different ports.

That would seem to be a natural link to your third objective, which is lightening the load of the ship's crew.

•Our third theme is linked to that: the reduction of the administrative burden on the ship's master. There is a lot of work in standardization and we're trying to find out how we can help reduce that.

So digitalization, the software, the cyber, the autonomy and lightening the load on the ship's master ... it all goes hand-in-hand.

•It does.

Drilling down a bit more into the digitalization trends, from where you sit, what is the reality on the ships, in the ports?

•It depends on the conversation. For example the work that's been happening in the industry on cyber security onboard ships is strong. I think there are a lot of industries that wish that cyber was on the tip of all their executives' tongues like it is in maritime. That doesn't mean we've solved the problem, but awareness is the beginning of being able to protect yourself against cyber attacks. BIMCO is a leading light in this area, and we have guidelines and standards on software maintenance.

Looking at the digitalization in whole, what is the key to moving it forward, faster?

•We are a conservative industry. But I think (once we get) the bit between the teeth – we actually get on with things. There are a host of projects that we're working on where digitalization doesn't happen without standardization. So we are really focused on standardization. You talk about autonomous ships; there is no autonomy without standardization.

Our time is running short, and I'd like to turn the conversation back to the market and achieving balance in the marketplace. Are there recommendation from BIMCO on trying to maintain balance and stability?

•We wrote a piece called "The Road to Recovery," about 18 months ago. I think the keys to the changes are, as the industry consolidates, and as we have fewer, bigger players, that we'll make more rational decisions based on the market requirements, rather than only individual requirements. I think a lot of people buy and sell ships for the capital gain, and one more ship from their companies makes little difference to the industry. But I think when it becomes the much bigger organizations that are really focused on servicing the industry, and they will be in a better position to make more rational decisions because there will be fewer players.

When I read the news of of your recent contract extension was struck by one of your goals going forward: having this industry speak in a clear and unified voice. Why is it important, and what's your strategy to do it?

•The industry has a lot of associations, all with a viewpoint. By not speaking in an aligned manner, it simply makes it too easy for them to either do nothing or to pick holes. What is very clear is that when we do speak together, the countries in IMO actually listen. So there is the roundtable – the roundtable of international shipping associations – and that is BIMCO, the International Chamber of Shipping, Intertanko and Intercargo, and on the big issues we spent a lot of time working together to get a common agreement among our organizations and our members. We are directly linked to our members and they participate in all of our work. If we can get the political and the practical to work together, it's a very strong partnership.

The industry has to aim to completely de-carbonize, *something that realistically will not be until the second half of this century. We are not in a position to even start at this moment. We need to spend research & development on* ***new zero-carbon fuel types and new propulsion units.***

Angus Frew,
Secretary General, BIMCO

Corrosion Control & the *Autonomous* Ship

BY BUDDY REAMS

Photo Source: ThinkStock

The remarkable success of autonomous and remotely-controlled vehicles on land and in the air and the interest in this technology being shown within maritime circles suggests that it is only a matter of time before autonomous ships are deployed at sea.

Although the fuel costs represent, by far, the majority of shipping costs compared to onboard crews, there are yet substantial benefits to be reaped from autonomous ships. The potential economic benefits are too great to ignore this emerging technology.

The success of autonomous shipping will require a complete change in the attitude of those working in the marine environment, starting with shipyards, which are typically focused only on lowering the cost of new ships.

While it is understandable that the current design model strives to minimize the cost of building and operating ships, this often causes less-than-optimal corrosion protection systems to be utilized. This decision-making model focuses on the initial capital expenditure without understanding and considering the significant safety and long term reliability of more advanced system. As a result, we encounter situations where a ship's crew will apply an additional coat of paint soon after delivery, or shipyards limit warranty coverage, all to compensate for the less-than-optimal corrosion protection systems.

For autonomous shipping to truly work, attitudes and infrastructure must change, beginning with a redesign the world's shipyards—which is no small task. The success of autonomous shipping will depend upon the concurrent development of many core technologies as well as a commensurate change in behavior and approach to design, construction and operation. Each of the challenges normally faced by mariners on board ships will need to be embodied in the computing systems for autonomous shipping or remotely controlled shipping.

Challenges of Autonomous Shipping

Navigation and communication at sea are challenging. For example, cell phone connectivity breaks down just three miles from shore and communication costs rise dramatically further out at sea.

Autonomous control of a ship's machinery based on real-time data relating to wind and ocean currents is just one challenge. Additional risks at sea include the unpredictability of the weather and hazardous objects. Safeguarding against piracy, cyber-piracy and terrorism also presents difficult problems as does the reliability of the electronic and mechanical systems of the ship. And lastly, an awareness of the state of corrosion of the ships structures and components is vital.

Autonomous shipping could apply to many types of ships, from tug boats maneuvering in a port to large cargo ships crossing oceans. An autonomous ship must be "aware" of its external surroundings as well as its internal condition. External surroundings include the weather conditions as well as objects at sea that could pose hazards. Internal conditions include the proper functioning of structural elements, engines and machinery as well as the digital computers, along with associated communications and electronics control systems. In this sense, an autonomous ship must be "self-aware."

Challenges of Maritime Corrosion

The history of maritime industries includes many long chapters on corrosion. The development of seaworthy alloys and coatings was long and arduous, and continues to progress to this day. Today, a large body of knowledge already exists to slow corrosion processes and minimize risks due to corrosion. The failure

of critical components at sea can result in the loss of life or the sinking of a vessel; or necessitate costly rescue operations.

The challenge now is to include corrosion prevention in the design and construction of autonomous ships and their onboard sensors and computing systems. This will not be a subtle change and could necessitate a holistic look at how ships are constructed. An autonomous ship cannot depend upon crew members to monitor coating performance and address its maintenance at sea. A ship that has not been maintained, coating-wise, for six months will deteriorate dramatically. Ships must be built to a higher standard of corrosion resistance at every level before they are commissioned. Once in the water, they must be regularly inspected and monitored and held to a higher standard than a manned vessel. Otherwise the failure of a relatively minor part that normally would be repaired at sea could result in a costly rescue operation to recover a vessel stranded at sea.

We are now learning the downstream effects of Tier II engine modifications, including increased cold corrosion in long stroke and more efficient engines. New issues may come into play with Tier III engines, which could include complex additions such as Exhaust Gas Recirculation (EGR), Selective Catalytic Reduction (SCR) and even scrubbers. The Ballast Water Treatment Systems (BWTS) imposed on shipping, as developed in the past decade, are proving to be quite maintenance intensive and would require people onboard.

The fuel situation through 2020 is already uncertain, and beyond 2020 it is even more so. The one certainty is that each major change will have downstream consequences.

Fortunately, corrosion is better understood today compared to the past. Unfortunately, such knowledge is generally not employed; at best, corrosion control is not applied as effectively as it could be, considering the excess focus on construction costs rather than long-term viability and corrosion protection.

Many superior products and solutions on the market today are not used because they are not easily adjusted into the cost-focused construction process. The financial cost of the vessel is the second most important cost in shipping behind fuel costs. Sophisticated corrosion prevention solutions drive up costs, and these added costs could become higher than the cost of crew members.

New alloys and coatings now exist that greatly extend the useful life of components, particularly at sea. Improved methods for monitoring corrosion can be employed. While corrosion cannot be eliminated completely, it can be managed to such a degree that catastrophic failures decrease.

The need to further minimize maritime corrosion on autonomous ships can be taken as an opportunity to improve systems for monitoring and controlling maritime corrosion. This article briefly reviews a few of the ways that current knowledge of maritime corrosion can be adopted in the development of autonomous shipping.

Corrosion of Structural Elements

The trend towards autonomous vessels will have consequences for the management of corrosion. Maritime corrosion is a subject that requires aggressive, proactive measures. Special alloys, coatings and sacrificial anodes have been developed to slow down the inevitable deterioration of materials that occurs in salt water environments. It is rarely a question of "if" but more often a question of "when." Furthermore, corrosion can be unpredictable and catastrophic. Risk can be controlled but it is not easily eliminated.

Photo Source: ThinkStock

The challenge now is to include corrosion prevention in the design and construction of autonomous ships and their onboard sensors and computing systems. ***This will not be a subtle change and could necessitate a holistic look at how ships are constructed.*** *An autonomous ship cannot depend upon crew members to monitor coating performance.*

Ships are operated in a brutally corrosive environment, with ship hulls especially prone to corrosion. The biofouling of the hulls can contribute to drag and add to fuel costs. Ships carrying freight on long voyages need reliable, long lasting coatings.

The days when ships were free to overlook the issue of corrosion are gone. Ballast and cargo tanks need to be coated. This is a class requirement. If these coatings are not "good" according to the class, the ship cannot trade.

There are several approaches to managing corrosion of a ship's hull. Most of these involve predicting the time to failure. The ship's hull itself can be made of special materials selected for their corrosion resistance, although, practically speaking, no material is completely safe from marine corrosion. That said, composites – such as glass flake epoxy – provide excellent corrosion resistance. This underutilized technology – suitable for use in hand rails, ladders, pipe supports and cable trays – has been available for more than 20 years, but resistance to change is strong in the ship building community.

For autonomous shipping, monitoring the condition of the hull is especially important, as daily monitoring by the crew and the potential for early intervention will be nonexistent. The use of unmanned aerial systems for surveys may not be practical when launched from the autonomous vessel itself with no crew aboard. Autonomous underwater vehicles and remotely operated vehicles possess unique capabilities that could be developed for inspecting ship hulls at sea. The key here is the prediction of the time to failure or the detection of a potentially catastrophic condition that would require bringing the ship into a port for emergency repair.

Another solution is to embed sensors within the hull, such as stress sensors or ultrasonic measuring instruments. The processing of such signals can indicate a condition of biofouling or rusting; or even a combination of both.

As is usually the case, there are tradeoffs between the costs for monitoring and maintaining the hull. Risk management will require a corrosion expert to evaluate the data. This knowledge could be built into the autonomous ship's knowledge base, or judgment calls can be made by a corrosion expert who is remotely monitoring the ship's condition.

Risk management could affect the size of the vessel; it may be more practical to carry cargo on many small ships and so distribute the risk.

Monitoring and Repair Capability

Typically, it will be necessary to remotely monitor the corrosion of critical control systems on autonomous vessels. Such systems include the propulsion equipment, as well as vital flooding and fire protection systems. These can be monitored in the manner of equivalent systems on an airliner. The main difference is that autonomous ships are at sea and hence they are subject to highly corrosive environments for long periods of time.

Depending upon the type of vessel and length of time at sea, it may be necessary to monitor these components remotely. This can be accomplished by various methods. Sensors can be installed on critical components to monitor their condition at sea and this data can be captured and made available to the computing system used for autonomous control of the ship. This situation is not much different from that of an airliner which may be required to make unscheduled landings when an engine or other critical component fails.

The main difference between an airline and an ocean vessel is that a ship may be at sea for weeks. If a critical component is susceptible to suddenly accelerated levels of corrosion then monitoring of that component may be warranted and the ship must be prepared to change its course for needed repairs. The inability to make repairs on an autonomous ship while it's underway could induce lengthier in-port periods.

Conclusion

As technologies in support of autonomous shipping mature, the systems for monitoring corrosion will have to become more sophisticated. The removal of the human element from corrosion control can be seen as an opportunity to advance the science of corrosion. Rather than viewing corrosion as a barrier to autonomous shipping, the development of autonomous shipping and on-board data collection could be seen as a means to advance the science of maritime corrosion.

About the Author

Buddy Reams serves as NACE International's first Chief Maritime Officer, a position he started in April 2016 after retiring from nearly three decades of service to the United States Coast Guard (USCG). In his current role, he leads the development of corrosion control programs and services to meet increasing demand from all maritime industries including notably the shipbuilding, shipping, and offshore sectors. Reams is also the principal head for all NACE initiatives within the International Maritime Organization and with global industry peers such as INTERTANKO, INTERCARGO, BIMCO, International Chamber of Shipping, Active Shipbuilding Experts Federation, and other leading maritime-related organizations.

(U.S. Navy photo by Mass Communication Specialist 3rd Class Morgan K. Nall/Released)

U.S. Navy

355-Ship Fleet is the Mandate, Funding it is Fuzzy

BY EDWARD LUNDQUIST

As Congress wrestles with the budget, there is at least a bi-partisan consensus that defense spending should grow, and that includes growing the Navy's fleet. The current goal is 355 ships, an admirable goal, but an objective that faces many cost hurdles.

The surface fleet (which excludes submarines and aircraft carriers) needs to grow in capability and capacity. The numbers of ships being procured or envisions would increase as the total n umber of ships increases, but the number in this story represents current program status.

Surface Combatants

DDG 1000 is a multi-mission surface combatant built from the keel up as a quiet and stealthy platform with active and passive signature reduction.

The first in the class, USS Zumwalt (DDG 1000) arrived in her homeport of San Diego at the end of 2016 and is now nearing completion of installation work in prior to activating her combat system. The plan in to conduct the testing and evaluation of her systems in 2018 and proceed and achieve initial operational capability (IOC) in 2020. USS Michael Monsoor (DDG 1001) has completed acceptance trials. USS Lyndon Johnson (DDG 1002) was 70 percent complete as of 1 December 2017 and continues construction at Bath Iron Works in Maine.

The Zumwalt class was originally planned for 32 ships. That number was cut to 24, then 12, then seven, then three, then two, then zero, and finally Congress stepped in and said the Navy would build three. Among the many unique features of this ship was a new 155 mm gun with new rocket-assisted precision ammunition. The Advanced Gun System was designed to fire the long range land attack projectile (LRLAP), and had an automatic handling system. Purchased in quantity the rounds might eventually have a reasonable price tag, but the Navy said that the cost of buying 2,000 rounds for each of the Zumwalt class ships would equal a new Arleigh Burke class destroyer.

The U.S. Navy hasn't had 155 mm ammunition for many years, and while the AGS barrel was specifically designed for the LRLAP round, Raytheon and BAE-Systems Bofors are offering a less capable 155 mm GPS-guided round called Excalibur with a significantly lower price tag and is already in production for

Pictured above: The guided-missile destroyer USS Preble (DDG 88) fires a Mark 45 5-inch gun during a live-fire exercise.

"No matter what ships we bring online, how we maintain them, how many people we have, ***at the end of the day we have to make sure they are properly trained. We will not waiver from that.*** *We're doing a lot of thinking in terms of how we can improve training across the Navy, but particularly the surface Navy, to make sure we're getting the training we need so we can get out there to sea."*

Adm. John Richardson, Chief of Naval Operations (CNO)

the Army. This ship generates 78 MW of power, enough to power a small-to-medium size town – and even though it's one and a half times the size of a DDG 51– it has 1/50th the radar cross section of an Arleigh Burke.

Aegis Cruisers

The Navy still has 22 of the 27 Ticonderoga-class guided missile cruisers commissioned between 1983 and 1994. The remaining 22 ships (CGs 52 through 73) have or will undergo a modernization, but there are limitations to how many ships can be taken from service to undergo costly modernization process. One of the most important missions for Aegis CGs and DDGs today is to provide ballistic missile defense (BMD). With the accidents taking two BMD-capable Aegis guided missile destroyers out of service last year, the need to keep BMD-capable ships available for operational commitments has become even more critical.

Aegis Guided Missile Destroyers

With 65 ships delivered to the fleet, the DDG 51 Arleigh Burke-class program is one of the largest and most successful post World War II naval ship programs. With the DDG 1000 programming being limited to just three ships, the Navy has restarted the DDG 51 production line to produce Flight IIA ships at both BIW and HII, and is preparing to build a new version called Flight III. Both yards have delivered "restart" ships and are in serial production with 12 ships under contract. Initial Flight III ships have been contracted to both shipyards.

Littoral Combat Ship

The Littoral Combat Ship (LCS) program continues at a steady pace at two production yards, each building a unique design. Lockheed Martin is building the monohull Freedom-variant at Fincantieri Marinette Marine in Wisconsin, while Austal USA is building trimaran Independence variants at Mobile, Ala.

Concurrently the Navy is developing mission packages that can configure LCS for one of three focused missions: ASW. ASUW or MIW. The first was commissioning in 2008, and the second in 2010. Currently 11 LCSs have been delivered with 18 more on contract. Yet not one LCS is deployed today.

Future Frigate

While the Navy sees LCS as the best ship for those three asymmetric missions in the littoral, it also needs a multi-mission combatant that's smaller than a DDG. In other words, it needs a frigate. And that frigate will be a full and open competition, not just an up-gunned variant of one of the two LCS seaframes. The Navy is referring to the program as the FFG(X) with the mission of conducting anti-submarine warfare, surface warfare, electromagnetic maneuver warfare and air warfare. FFG(X) will fit in the "high / low" mix of surface combatant capabilities between LCS and the Aegis cruisers and destroyers. FFG(X) will operate independently or as an integral part of a task force to conduct offensive and defensive operations in the littoral and blue water environments.

The new frigate will feature the AN/SLQ-61 Light Weight Tow (LWT); AN/SQS-62 Variable Depth Sonar (VDS); AN/SQQ-89F Undersea Warfare / ASW Combat System, as well as the significant ASW capability of the MH-60R helicopter. FFG(X) will have the 57mm

5-Step Guide to The Fleet of the Future

Chief of Naval operations Adm. John Richardson, speaking at the Heritage Foundation on Feb. 1, set forth five dimensions to increase America's naval power.

1. "One way to increase naval power is just to **build a bigger fleet**. A bigger Navy is a more powerful Navy," he said.

2. "A second dimension of naval power would be to **build a better fleet**," Richardson said. A more capable fleet might incorporate directed energy, high power microwave, lasers, electromagnetic maneuver warfare, unmanned and autonomous systems.

3. The third component is **a networked fleet**, and taking those platforms with their inherent and enhanced capability, and network them together. "If you're able to share data more across the force, you're able to respond to that awareness with more agility, and you can be a more powerful fleet," said Richardson.

4. The fourth dimension is **a more talented fleet**. "If you think about growing these other dimensions, growing naval power, at some point we're going to have to man that fleet with sailors," Richardson said. "There's a 'number of sailors,' dimension, but also the skill sets those sailors are going to need are different than the ones we have right now." "So once we have built this fleet, we've modernized it, we've networked it, we've manned it with appropriately trained sailors, with the assistance they need, we've got to figure out how we're going to operate it," Richardson said.

5. The final dimension, Richardson said, is the potential of a "fleet in being. Turning that potential energy into kinetic energy requires readiness, and that means **you've got to go out, you've got to steam, you've got to fly. You've got to have your magazines full**. You've got to have your logistics element in place. You've got to have your parts. You've got to do the maintenance. All of those things creates actual fleet capability."

gun and a variety of defensive missiles, as well as offensive anti-ship missiles. The Navy is planning for a 20-ship class. In addition to the LCS designs, a number of foreign frigate designs will be considered.

Amphibs

The Navy's expeditionary ships are equipped with flight decks and aviation facilities for helicopters and vertical take-off and landing (VTOL) fixed-wing aircraft; and well decks for storing and launching their landing craft to deliver Marines and their equipment and supplies to distant operating areas to conduct expeditionary operations from the sea to the shore. These ships can deliver Marines with their vehicles, equipment and supplies in opposed landings as well as in permissive environments, such as theater security cooperation and humanitarian assistance and disaster response operations.

The come in three different sizes—big, bigger and really big.

The largest are 40,000-plus ton "big deck" amphibious assault ships – LHAs and LHA(R)s -- that can carry V-22 tilt-rotors; a variety of helicopters, and the AV-8 Harrier and F-35B Joint Strike Fighter; as well as Landing Craft, Air Cushion (LCAC) and other watercraft. The ships have steam or gas turbine propulsion making 70,000 hp. Currently LHDs 1-8 and LHA 6 are in service. The Navy awarded a contract for detail design and construction for LHA 7 to HII on May 31, 2012. The ship started fabrication on July 15, 2013. LHA 8 starts fabrication in the fall of 2018.

The San Antonio-class of landing platform docks (LPDs) continues building at HII in Pascagoula, Miss., with Portland (LPD 27) now delivered and awaiting an April commissioning in Portland, Ore. Two more are being built to the LPD specifications, but will also serve to transition the program to the LX(R) replacement for the 12 existing LSDs of the Whidbey Island (LSD 41) and Harpers Ferry (LSD-49) classes. The first of these 12 ships will reach age 40 in 2025.

Instead of designing an entirely new class to replace the LSDs, the Navy will create a less capable and less expensive variant of the LPD design. The next LPD, USS Fort Lauderdale (LPD-28), will be a transitional ship to incorporate some design features that will be found on future LX(R) ships.

Small Boys

The Navy has 11 mine countermeasures ships currently located in Bahrain, San Diego and Sasebo, Japan. Small coastal patrol boats (PCs) are forward deployed in Bahrain in support of the U.S. Fifth Fleet, as well as Mayport, Fla., supporting the U.S. Fourth Fleet.

Expeditionary

In addition to the amphibious ships, there are a number of other platforms that have a great deal of utility to conducting expeditionary operations.

The U.S. Navy's Military Sealift Command first two 764-foot Expeditionary Transfer Dock (ESDSs, formerly Mobile Landing Platforms (MLPs)), Montford Point (T-ESD-1)

A Landing Craft Air Cushion vehicle (LCAC) embarks the Whidbey Island-class dock landing ship USS Rushmore (LSD 47) during Iron Fist 2018.

and John Glenn (T-ESD-2), are built on a commercial tanker design, and provide the ability to transfer material from large prepositioning ships to connectors such as LCAC for further movement to the beach. USS Lewis B. Puller (ESB-3) and sister ship Hershel "Woody" Williams (T-ESB-4) are expeditionary mobile bases (ESBs, formerly afloat forward staging bases (AFSBs)), based on the ESD but at 87,000 tons fully loaded are heavier, that can support mine countermeasures operations and Special Forces units. Both the ESD and ESB are built by General Dynamics NASSCO in San Diego.

The Expeditionary Fast Transport (EPF) was originally conceived as a joint Army and Navy program to provide intra-theater lift, but today EPF is demonstrating its value for highly specialized operational support assignments from ISR, support of unmanned systems and theater security cooperation. Built by Austal USA in Mobile, Ala., the diesel-powered 2,400-ton EPF is 338 ft. long with a beam of 95 ft., and can carry the load equivalent to 10 C-130 aircraft.

(U.S. Navy photo by Mass Communication Specialist 3rd Class Reymundo A. Villegas III)

Direct Fleet Support

MSC operates combat logistics force (CLF ships to deliver fuel, ammunition and supplies directly to the fleet at sea. Multi-product fast combatant support ships (T-AOEs) can sustain a carrier strike group at sea, and keep up with them. Other CLF ships include fleet replenishment oilers (T-AOs) and the 14, 689-foot dry cargo/ammunition ships (T-AKEs). The 15 The Henry J. Kaiser-class T-AOs can carry 180,000 bbls of fuel. The 12 41,000-ton Lewis and Clark T-AKEs carry ammunition, food, 23,450 bbls of fuel, repair parts and ship store items (two of the T-AKEs are assigned to Maritime Prepositioning Ship squadrons). The Navy is planning a new class of 17 fleet oilers. The John Lewis (TAO-205) class oiler, previously known as the TAO(X) program, is a program to build a new class of 17 fleet oilers for the Navy. The TAO-205 class ship was procured in FY2016.

Maritime to get Biggest Bang for **VW Settlement Bucks**

With $2.9 billion available, Tug & Ferry engine upgrades are best bet for NOx Reductions

Marine engine overhauls at 40% to 75% cost savings? When it comes to financing engine upgrades and replacements using other people's money – this is as good as it will ever get. You're going to want to apply early and probably in more than one state.

BY PATRICIA KEEFE

Imagine a settlement over falsifying emission levels in another transportation sector dropping money onto your deck. Who knew? But it's true. The $2.9 billion settlement fund Volkswagen agreed to capitalize for distribution across all 50 states, tribal lands, and Puerto Rico, as a result of "dieselgate," its criminal dodging of required auto emission levels, presents an unparalleled opportunity to maritime companies that want to move their noxious diesel engines up a couple of EPA notches, and stick someone else with close to half the bill or more.

The settlement is "unprecedented in its sheer scope of funds, geographic reach and market-moving potential," according to Joe Annotti, senior program manager with transportation consultants Gladstein, Neandross & Ass. (GNA). "This type of thing just doesn't happen," he says, comparing it to the Energy Department's $300 million Clean Cities Program expressly for alternative energy vehicle projects. "That's 900 percent smaller than the VW settlement."

From the state's perspective, there is no better use of the funds than to clean up marine diesel engines, adds Annotti, calculating that in terms of tonnage of NOx reduction for dollars spent, the cleaning up of marine diesel engines is the most cost-effective by virtue of the number of hours they operate, the amount of fuel consumed and the emissions profile of the engines currently in use.

Annotti heads up GNA's Funding 360 program, which has a free VW Funding Project Competitiveness Calculator, and a subscription Portal, that provides access to information about state-specific VW Funding programs.

Under the rules of the Volkswagen Mitigation Trust Fund (see related story Dieselgate 101.txt), tug, tow and ferry owners with qualifying NOx emissions reduction projects can get the job done at a significantly reduced cost, the extent to which will depend on the engine upgrade option they choose, and whether the patient is privately or publically owned.

In the latter case, projects, whatever they may be, are 100% funded. That's why, and how, Washington State is hoping to build, and pay for, three new all-electric state-run ferries. Officials there estimate that a single such ferry could cut carbon dioxide emissions by 620 metric tons a year, the equivalent of taking about 132 cars off the road. It also cuts fuel consumption 100 percent.

In the former case, owners of commercial vessels running on pre-Tier 3 diesel engines can get back 40% of the cost of installing a new Tier 3 or Tier 4 diesel or alternate fuel engine, or by installing an EPA-certified remanufactured system or verified engine upgrade, in this case

Show me the $

The top 10 recipients of Volkswagen mitigation trust funds Where the water is, conveniently for marine projects, is where most of the VW settlement dollars can be found:

$423 Million ..... California
$191.9 Million ..... Texas
$152.3 Million ..... Florida
$117.4 Million ..... New York
$110.7 Million ..... Pennsylvania
$103.9 Million ..... Washington
$97.7 Million ..... Illinois
$87.6 Million ..... Virginia
$87.2 Million ..... North Carolina
$71.4 Million ..... Ohio

The Funding Clock is Ticking

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"These grants really help people get technological advances for their fleet in an affordable manner."

– Buckley McAllister, President, McAllister Towing & Transportation

moving pre-tier or Tier 1 engines to T2. According to the EPA, Tier 4 rules cut NOx by 80 percent and particulate matter (PM) by 91 percent.

Go all-electric and you can get 75% of the cost covered, plus additional monies to install charging stations and related equipment.

Apply under the Diesel Emissions Reduction Act (DERA) option, which is allowed under the trust rules, and states can use trust funds to match the DERA grant, and in doing so, reap an additional DERA bonus equal to 50% of the base sum. It's manna from heaven, basically, to do work that needs to be done.

It just can't be mandated or already scheduled work. "There is a requirement to show funds will be used in a situation to reduce emissions where it might otherwise not happen," says George Lin, Technical Manager, Global Regulatory Affairs, Global Marine, Caterpillar, Inc.

But it could be used think bigger, and greener, notes Buckley McAllister, president of McAllister Towing and Transportation Co., Inc., and a veteran of several incentive grant projects. "A major overhaul can exceed a half million dollars, and if you factor that into the concept of installing a new engine, and that gets you a subsidy and a main engine that will require less maintenance than a 30-year-old engine, it's a great thing."

There are other incentive programs targeting environmental improvements, but the types of projects allowed and the competition for those dollars is much broader. By comparison, the Volkswagen MTF is narrowly focused on cutting PM and nitrogen oxide (NOx) emissions, which contribute to smog, and in the case of the maritime sector, only available to two specific classes of vessels – which must operate solely in U.S. waters – tugs, tow boats and ferries.

"The marine sector still has the dirtiest engines out there. It should have a great shot at mitigation funds," says Elena Craft, a public health scientist focused on air pollution for the Environmental Defense Fund. "If you want to prioritize NOx reductions, more so than any other projects, they have not been touched!" The VW settlement is a "game changer for maritime," which she says is starting to come around to the need to improve air quality. "These kinds of funds don't come around very often. If you have the means and ability to take advantage of this opportunity, you definitely should."

Everyone's a Winner

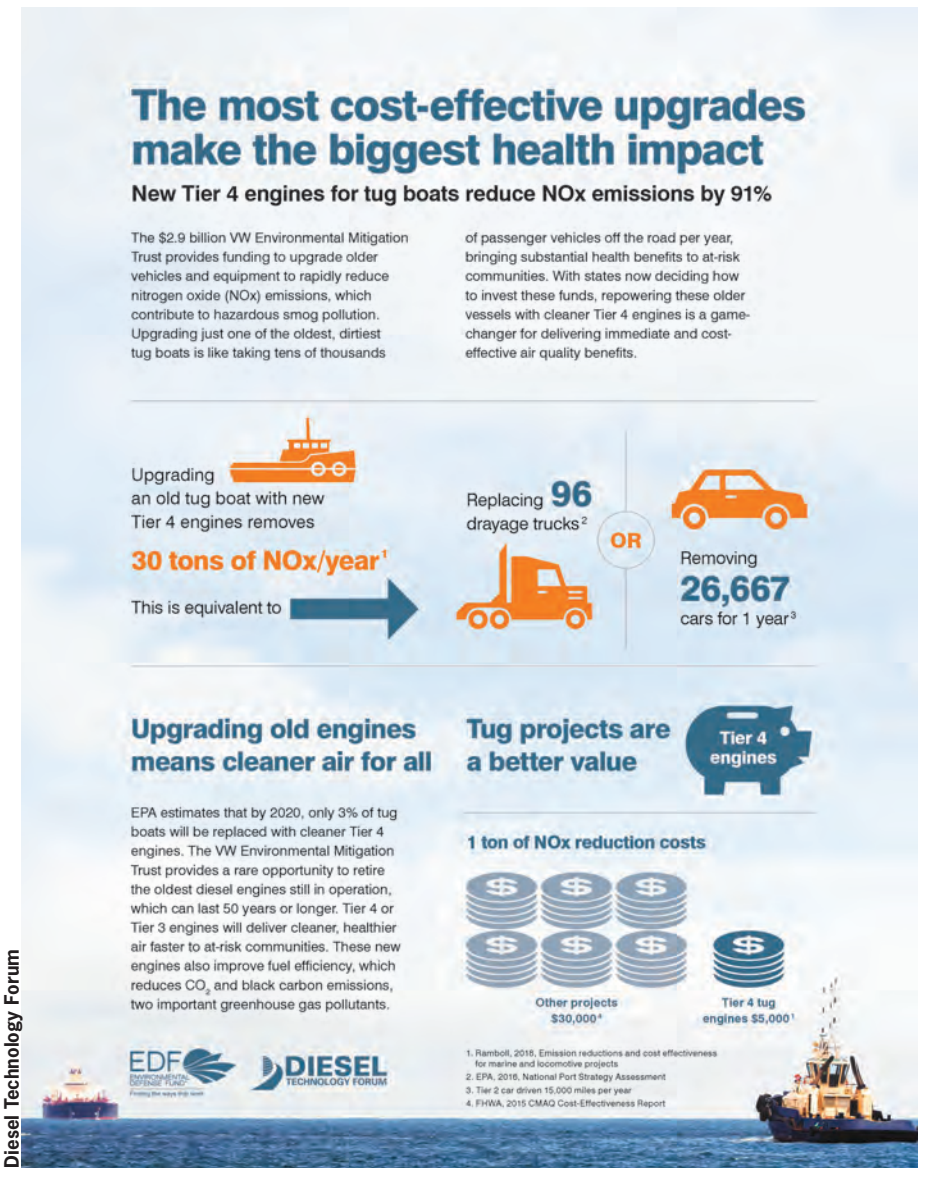
The Volkswagen settlement is also an incredible boon to states desperate to green transportation, but lacking the funds or control to do more than a bit at a time. While the amount each state receives will vary, depending on the number of illegal VW vehicles registered inside its borders, the money puts each in a position to map out a 10-year emissions reduction plan and to dedicate specific monies toward specific goals. And for those coastal and brown-water states looking for the fastest, cheapest and biggest reduction bang for the buck – the marine sector can't be beat.

"If you take one of these pre-EPA Tier engines and upgrade to one of the newer engines, the emission reduction is dramatic," says McAllister, who has installed some of the first Tier 4 engines (Caterpillar 3516) found on tugboats.

As one example, according to the Diesel Technology Forum (DTF), of the roughly 47 marine workboats in New York Harbor, 28 are powered by pre-emission standard engines. Swapping out an older "uncontrolled" engine for a Tier 4 engine in just one old tugboat removes an estimated 96,000 lbs of NOx per year, equivalent to replacing 76 older trucks or removing 74,000 cars for one year, according to a new report on "emission reductions and cost-effectiveness for marine and locomotive projects," from the DTF, a diesel industry organization, and the Environmental Defense Fund.

By comparison, marine transportation consultant Paul J. Moynihan, vice president, technical services, M.J. Bradley & Ass. LLC, estimates that a rough approximation of the total tons reduced and equivalent trucks replaced and cars removed from the road by going to Tier 3 instead of Tier 4, might be somewhere in the neighborhood of 76,000 pounds NOx reduced annually, 60 old trucks replaced and 58,500 cars removed for one year.

In other words, upgrading the engines in a few vessels is far more cost-effective for states than upgrading a fleet of city busses, especially since, by some estimates, the lifetime mileage-weighted average NOx emission factors for diesel school buses has already been slashed by roughly 92 percent. Which means



Diesel Technology Forum

"You get a fully electronic, computerized engine with incredible control over the vessel. It's like moving from a 1980s car to 2017."
– David L. Holt, Energy & Transportation Industry consultant for Caterpillar Global Aftermarket Solutions.

the achievable emission reductions from upgrading buses won't come anywhere close to what's achievable with a marine project, while also taking longer and being more work to manage, since each bus would be a separate project. With so many states eying this option, the fact that there is only so much bus manufacturing capacity in the U.S. per year, would make even a 25-bus fleet overhaul a multi-year project, adding even more time onto the wait for a lesser overall emission reduction, notes Moynihan.

So why wait?

Hands down – harbor craft and river vessels are the oldest and dirtiest spewers of NOx pollutants out there (see charts for ferries and tugs). Many pre-EPA tier engines are still cranking away like a diesel version of the Energizer Bunny. Diesel engines, like the craft they power, were built to last for decades.

There are fully functional 50-year-old tugs capable of doing a great job, and new engines are expensive. In an industry hidebound with environmental regulation, there isn't a one forcing upgrades. (Emission levels aren't really regulated beyond the highest EPA Tier in effect the year an engine was installed.)

So what we have is an unparalleled opportunity to upgrade or replace engines at a significant cost reduction versus no legal or regulatory incentive to do so.

In its absence, by 2020, the EPA has been estimating that only three percent of tugboats, and five percent of ferries, will be running on the cleanest available tier engines, i.e. Tier 4, which produces "near zero" emissions.

The hope is that trust fund will motivate vessel owners to more quickly lower the industry's emissions output.

"These grants really help people get technological advances for their fleet in an affordable manner," says McAllister.

Still Up in the Air

As the states work their way through their own approval process, collecting public input and writing mitigation plans for allocating their share of the trust, potential applicants are waiting to see which states are committing how much to marine initiatives, what the application process involves, and how the settlement money will be dispersed.

So far, California's Air Resource Board says it expects to split much of that state's $423 million on electrification projects and existing emissions reduction programs targeting areas near

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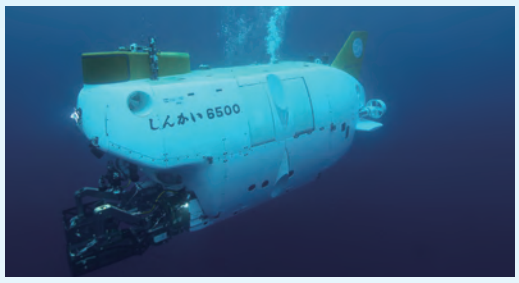
Japan Pavilion introduces cutting-edge technology, products and service of of Japanese Maritime Cluster and JSMEA members.

NEW EVENT! Research Vessel will be Opened to the Public!

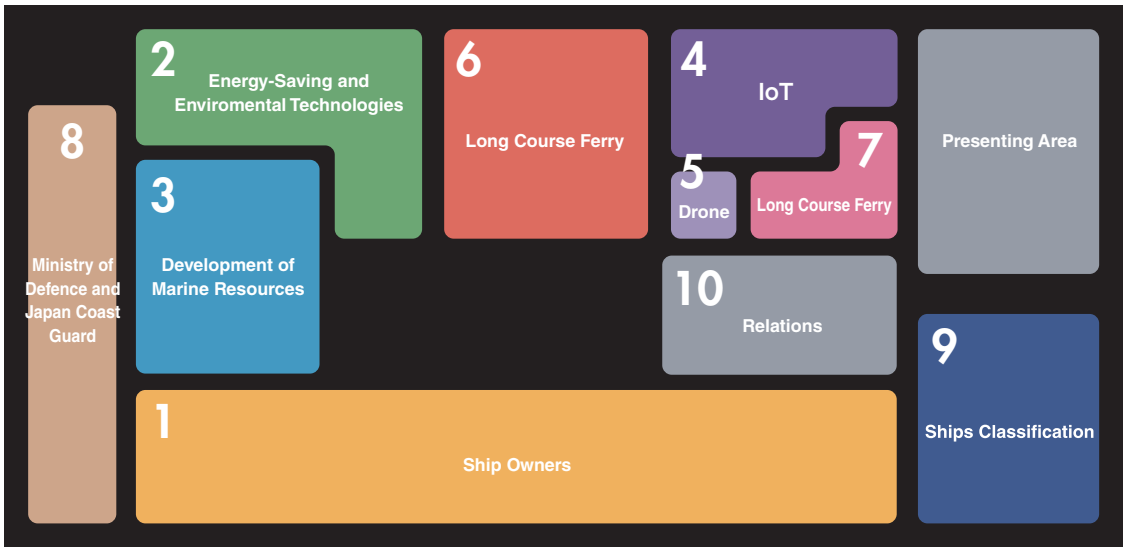
13(Fri) April JAMSTEC (Japan Agency for Marine-Earth Science and Technology) will open their ocean research vessel "YOKOSUKA" and "SHINKAI 6500" to the public! This will be the very unique opportunity to explore the inside of research vessel at Sea Japan.



Japan Pavilion Layout

JPN-17	JPN-20		JPN-41	JPN-42		JPN-49	JPN-52		JPN-57		JPN-65		JPN-71		JPN-87	
NYK TRADING	The China & Japan Marine Industries		SEKIGAHARA SEISAKUSHO	NIPPON HAKUYO ELECTRONICS		Tokyo Nisshin Jabara	TECHNO KASIWA		NISHISHIBA ELECTRIC		DAIHATSU DIESEL MFG.		TOKYO KEIKI		AZBIL	
				JPN-40			JPN-46								JPN-83	
				Daido Steel			SHONAN		JPN-53		JPN-61		JPN-69		Japan Engine	
JPN-15	JPN-16		JPN-35	JPN-38		JPN-45			TAIKO KIKAI INDUSTRIES		TERASAKI ELECTRIC		IBUKI KOGYO			
Mitsui Engineering & Shipbuilding Co.,ltd.	KOKOSHA		MATSUI	TEIKOKU MACHINERY WORKS		TANABE PNEUMATIC MACHINERY										
JPN-13	JPN-14			JPN-36												
UTSUKI KEIKI	TAIKO SANGYO			Maritime Report												

Thematic Zone



JPN-11	JPN-10		JPN-31																
SATAKE	USHIO REINETSU		MUSASINO	MINISTRY OF DEFENSE															
JPN-09																			
YAMASHINA SEIKI																			
JPN-07																			
Kyokuyo Electric																			
JPN-05	JPN-06		JPN-27																
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JPN-03	JPN-04		JPN-23																
MURAYAMA DENKI	SUCTION GAS ENGINE MFG.		SHIMADA	Japan Coast Guard															
JPN-01	JPN-02																		
MANABE ZOKI	Japan Weather Association																		

Sea Japan Seminars

International Maritime Seminar

Wednesday 11 April

S-1

9:30▶ **Opening Ceremony**

Session 1 : Keynote Speech

10:00▶10:10 **Opening Address**
Ministry of Land, Infrastructure, Transport and Tourism

10:10▶10:35 **Keynote Speech**
Mr. Mitsuyuki Unno, Executive Director, The Nippon Foundation

10:35▶11:00 **Keynote Speech**
Norwegian Ministry of Trade, Industry and Fisheries

Session 2 : Southeast Asia Maritime Summit

11:00▶11:10 **Opening Remarks for Session 2**
Moderator: Mr. Hiroaki Sakashita, Advisor, Nippon Hakuyohin Kentei Kyokai

11:10▶11:15 **Japanese Maritime Industry and Southeast Asian Market**
Dr. Shinichiro Otsubo, Senior Deputy Director-General, Maritime Bureau Ministry of Land, Infrastructure, Transport and Tourism

11:15▶11:40 **Current State and Future Prospects of Marine Industries in Southeast Asia**
- Indonesia: Mr. Johnson W. Sutjipto, Chairman, Indonesian National Shipowners' Association (DPP INSA)
- Malaysia: Mr. Abdul Hak Md Amin, Chairman, Malaysia Shipowners' Association
- Philippines: Mr. Roy R. Alampay, Chairman/President, Filipino Shipowners' Association
- Thailand: Mr. Bhumindr Harinsuit, Chairman, Thai Shipowners' Association
- Singapore: Singapore Shipping Association(TBC)

11:40▶11:45 **Future of Japanese Ship Machinery and Equipment Industry**
Mr. Masaharu Ono, Vice chairman, Japan Ship Machinery and Equipment Association

11:45▶12:25 **Panel Discussion**

12:25▶12:30 **Closing Remarks**

Sea Japan 2016

Ships and Marine Technology Seminar

Friday 13 April

10:30▶10:50 **The Opening Address and Introduction of Maritime Policies (i-Shipping)**
Mr. Takemasa Minemoto, Director, Boat Affairs Office, Shipbuilding and Ship Machinery Division Maritime Bureau

10:30▶10:50 **R&D on Structural Health Monitoring for Large Container Carriers**
Mr. Yasushi Yamamoto, Deputy General Manager, Technical Group, NYK Line

11:40▶12:10 **Enhancement of SPEEDS (Smart Platform of Enhanced Engineering Data for Shipping and Shipbuilding) -Information Platform for Maritime Industries to Realize the Innovative Use of Ship 3D Data-**
Professor Kunihiro Hamada, Dr. Eng. Chairman of the Project Research Committee P-55, Japan Society of Naval Architects and Ocean Engineers (Professor, HIROSHIMA UNIVERSITY)

13:10▶13:40 **Maritime Innovation using Digital Technologies - From a Standpoint of Classification Society-**
Mr. Toshiyuki Matsumoto, Director of Research Institute, ClassNK

Introduction of SSAP2 Project

13:50▶14:35 **(1) The Role of Open Platform in the Coming Era of Ship Digitalization**
Dr. Hideyuki Ando, Senior General Manager, MTI (Chairman of Smart Ship Application Platform 2 (SSAP2) Project)

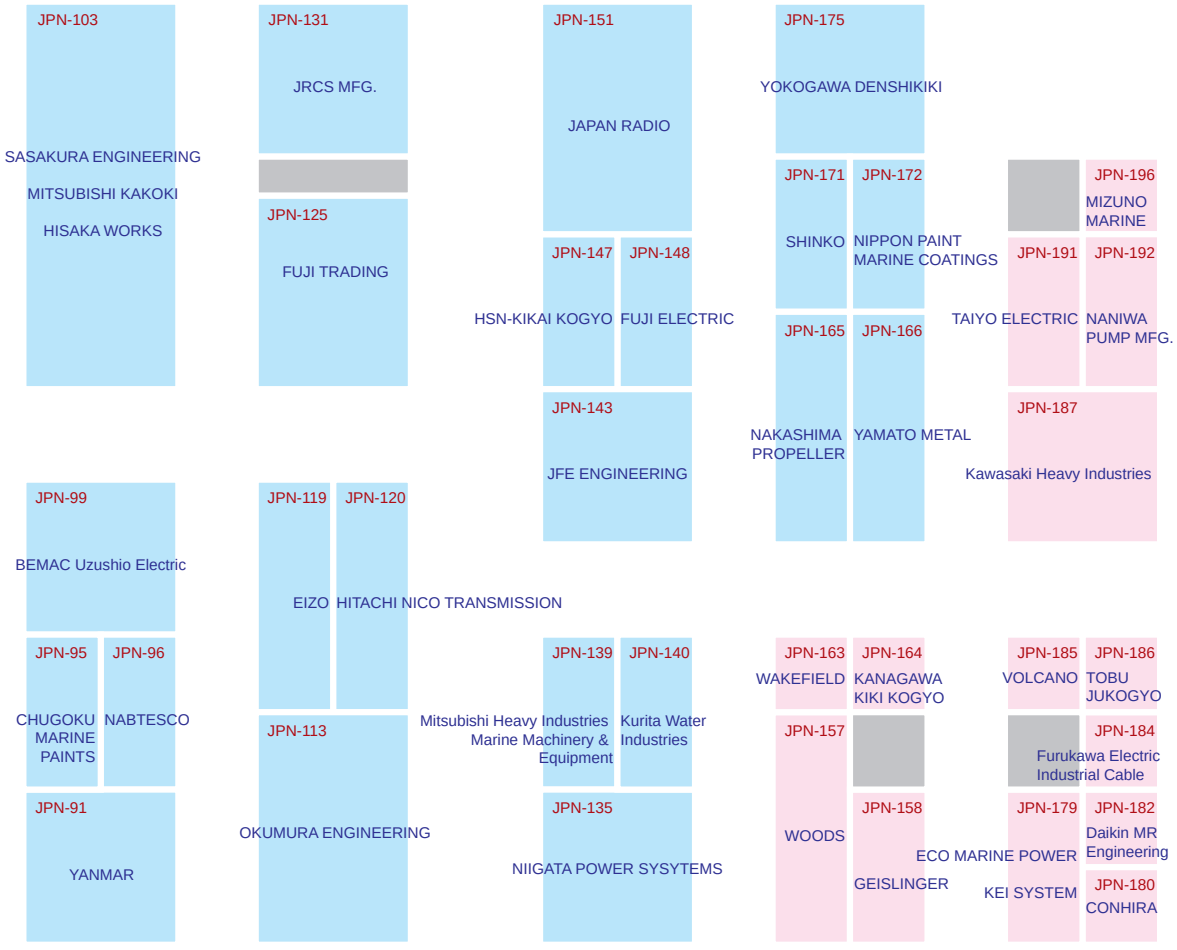
(2) International Standardization Efforts from Japan to Promote the Use of Ship IoT Data (ISO/FDIS 19847,19848)

14:35▶14:55 **①Introduction of ISO/FDIS 19847 (Shipboard data server to share field data at sea)**
Mr. Takashi Yamada, Expert IT Innovation Management Group, UZUSHIO ELECTRIC CO,. LTD.

14:55▶15:15 **②Introduction of ISO/FDIS 19848 (Standard data for shipboard machinery and equipment)**
Mr. Mineyuki Morimoto, Assistant Manager Development and Design Section Development and Design Department System Division, TERASAKI ELECTRIC CO., LTD.

15:15▶15:50 **(3) Activities of ShipDC, the Foundation for a 'Productivity Revolution' in Maritime Affairs, and Cooperation with the SSAP Project**
Mr. Takashi Nagatome, Representative Director and President Ship Data Center Co., Ltd.

16:00▶16:30 **Opportunities to Use Engine-plant Simulators and Introduce the IoT in Maritime Affairs Education**
Mr. Takashi Miwa, Chairman, Research Committee for Engine-Plant Simulators, The Japan Institute of Marine Engineering (Kobe University, Graduate school of Maritime Sciences, Lecturer)



THE THEMATIC ZONE EXHIBITORS

Theme	Company Name
Ship Owners	Kawasaki Kisen Kaisha, Ltd. ("K" LINE)
	Mitsui O.S.K Lines, Ltd. (MOL)
	Nippon Yusen Kabushiki Kaisha (NYK Line)
	OCEAN NETWORK EXPRESS (JAPAN) LTD.
Energy-Saving and Enviromental Technologies	USHIO REINETSU CO., LTD.
	Kamome Propeller Co., Ltd.
	KOBE STEEL, LTD.
	Japan Marine United Corporation
	TAIKO SANGYO CO., LTD.
	DAIHATSU DIESEL MFG. CO., LTD.
	TAIYO ELECTRIC CO., LTD.
	Chugoku Marine Paints, Ltd.
	NANIWA PUMP MFG. CO., LTD.
	Nabtesco Corporation
	NIIGATA POWER SYSYTEMS CO., LTD.
	NGK INSULATORS LTD.
	The Hanshin Diesel Works, Ltd.
	Volcano Co., Ltd.
	Mitsui Engineering & Shipbuilding Co.,ltd.
	Musasino Co., Ltd.
	Meiyo Electric Co., Ltd.
	Yanmar Co., Ltd.
Development of Marine Resources	INPEX Corporation
	Japn Drilling Co., Ltd. (JDC)
	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
	Japan Oil, Gas and Metals National Corporation (JOGMEC)
	National Maritime Research Institute (NMRI)
	BEMAC Uzushio Electric Co., Ltd.
	Kawasaki Heavy Industries, Ltd.
	KOBE STEEL, LTD.
	Teikoku Machinery Works, Ltd.
	Nippon Paint Marine Coatings Co., Ltd.
	NIHON MARUKO Co., LTD.
	MANABE ZOKI CO., LTD.
IoT	Imabari Shipbuilding Co., LTd.
	Japan Marine United Corporation
	Suzuki Shipyard Co., Ltd.
	TSUNEISHI SHIPBUILDING Co., Ltd.
	FUKUOKA SHIPBUILDING CO., LTD.
	Mitsui Engineering & Shipbuilding Co.,ltd.
	Mitsubishi Shipbuilding Co., Ltd.
	MITSUBISHI HEAVY INDUSTRIES MARINE STRUCTURE
	The University of Tokyo
	The Japan Society of Naval Architects and Ocean Engineers
	KOBE STEEL, LTD.
	Nippon Paint Marine Coatings Co., Ltd.
	MANABE ZOKI CO., LTD.
	Smart Ship Application Platform 2 Project (SSAP2)
Drone	NIPPON KAIJI KYOKAI (ClassNK)
	Tsuneishi Holdings Corporati / V-cube Robotics, Inc.
	Sony Business Solutions Corporation
	NEC Corporation
Long CouLong Course Ferryrse Ferry	Ocean Trans Co., Ltd.
	MOL Ferry Co., Ltd.
	Shinnihonkaiferry Co., Ltd.
	Taiheiyo Ferry Co., Ltd.
	Hankyu Ferry Co., Ltd.
	Ferry Sunflower Limited
	Miyazaki Car Ferry Co., Ltd.
	Meimon Taiyo Ferry Co., Ltd
	The Japan Railway Construction, Transport and Technology Agency (JRTT)
Research	The University of Tokyo
	Tokyo University of Marine Sciane and Technology
	Yokohama National University
	Japan Ship Technology Research Association
	Shipbuilding Research Centre of Japan
Ministry of Defence and Japan Coast Guard	Japan Coast Guard (JCG)
	MINISTRY OF DEFENSE
	Acquisition, Technology & Logistics Agency (ATLA)
Ships Classification	NIPPON KAIJI KYOKAI (ClassNK)
Relations	Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
	The Shipbuilders' Association of Japan (SAJ)
	The Cooperative Association of Japan Shipbuilders (CAJS)
	Japan Ship Machinery and Equiopment Association (JSMEA)

"These kinds of funds don't come around very often. If you have the means and ability to take advantage of this opportunity, you definitely should."

– Elena Craft, a public health scientist, Environmental Defense Fund

warehouses, industries and seaports. Pennsylvania is reserving 55% of its $110.7 million share for rail and tug engine replacement projects. Maine is committing 40% of its $21 million to improvements in ports and rail yards. And notes CAT's Holt, Missouri has a lot of barge traffic while all the waterways meet in Paducah, KY.

Also unclear are answers to several questions that would impact the ability of some harbor craft, workboats and ferries to garner a share of these settlement dollars:

* What about vessels that traverse a regular route that takes their emissions through several states - which, if any state, do they apply to? "For inland waterway folks, go up and down the Mississippi and hit eight states – which state gets to pay for it?," says Moynihan.

* Would states be willing to collaborate, to split the cost of funding a qualifying application involving a vessel that runs between both states? By splitting the bill, each state could win some emissions credit at half the cost of a NOx reduction project, notes MJB's Moynihan.

* Will a company based in one state with a vessel that spends most of its time working the waters of another state, be able to submit proposals in both states? Some transportation consultants think the answer is yes. States, like the EPA's DERA program before it, will focus primarily on the history of where each vessel operates.

Brace For Impact

Additionally, there are business impacts to consider with a diesel repower or replacement. For one, it won't necessarily lower fuel consumption, and it might raise it, which increases carbon output. Switching to biofuels reportedly can reduce engine performance. "The efficiency of engines will decrease the more emissions reduction is applied," according to McAllister, adding that while the older engines tend not to be super fuel-efficient or have the greatest emissions, they "have a lot of raw power."

Some vessels have limited space in their engine room, and you can't necessarily rearrange the chairs under the deck, so to speak, on an older vessel. Some paths to cleaner diesel, such as selective catalytic reduction, require more room for additional components, such as pipes and an air-cooled tank to hold urea. The new engine block might not be the same size as the old, exhaust systems might need to be increased, the entire gear box may have to be changed and installation may require cutting through decks, piping and steel.

A new engine can change the weight and balance of the vessel. "It's not like a car engine," says David L. Holt, Energy & Transportation Industry consultant for Caterpillar Global Aftermarket Solutions. "A lot of engineering goes into a

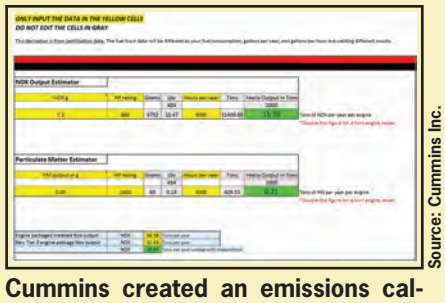
Need Help Estimating NOx Reduction?

Need help figuring out the eligibility of your project? Vessel owners can avail themselves of a variety of tools designed to calculate the likely emissions savings, cost and competitiveness, of their engine updates. Here are a few options: **The Global Marine division of Cummins Inc., has developed an emissions estimator (see screen shot)** that it says can help calculate the emissions produced by previous Cummins products and emissions produced by EPA Tier 3 Cummins products. "These estimations are derived from test cell and emissions certification data and may vary depending on engine life, duty cycle and fuel quality," says Global Marine's Andy Kelly, Marketing Communications Manager.

Gladstein, Neandross & Associates (GNA), consultants specializing in low-emission and alternative fuel projects, has a free VW Funding Project Competitiveness Calculator on its site. Fleet owners can input their fleet size, current fuel, and planned fuel to receive a recommendation on their possible funding eligibility, according to GNA's 360 Funding team, which helps companies track, evaluate, and apply for funding programs throughout the U.S. and Canada.

The **U.S. Environmental Protection Agency's Diesel Emissions Quantifier (DEQ)**, which it says "specializes in estimating emissions from medium-duty and heavy-duty diesel engines. DEQ is frequently used to estimate diesel emissions reduction from the repower or replacement of diesel engines with newer diesel engines and the use of emissions control devices, for DERA projects. Fortunately, GNA's Funding 360 team has researched, read and distilled down all of the important details so fleet managers, technology providers, and fuel suppliers can identify the best incentives for their projects.

www.gladstein.org/volkswagen-settlement-funding-project-competitiveness-calculator/



Source: Cummins Inc.

Cummins created an emissions calculator for customers to use to see how much an engine upgrade can reduce NOx emissions.

"These estimations are derived from test cell and emissions certification data and may vary depending on engine life, duty cycle and fuel quality,"

– Andy Kelly, Cummins, Inc.

The settlement is "unprecedented in its sheer scope of funds, geographic reach and market-moving potential. This type of thing just doesn't happen."

Joe Annotti, senior program manager with consultants Gladstein, Neandross & Assoc.

vessel, and it may not be possible to replace the existing engine with a current tier engine." Manufacturers like Cat and Cummins, Inc., sell alternatives to a new engine for these instances – kits or systems that upgrade to T2 or T3 that can be done inside the engine room.

The maintenance needs of modern engines are still unclear. This isn't your father's power plant. Tier 4 engines, says McAllister are "delicate and complicated." New engines, even upgrades, tend to involve more electronics and software, which McAllister says can't be repaired by a traditional mechanic. "Repairs can end up being much more involved than readjusting some mechanical aspect of the engine. So engineers on our tugs have to be half IT people." Adds port engineer Mario Dezelic, a 31-year veteran of the Port Jefferson ferry, "The days of the 'shade tree mechanic' are gone. Now people go onboard with a laptop."

That nice new dashboard feeding off new sensors means more information about the status of the engine and its myriad related equipment, leading to more engine checks. Problems may require more vendor assistance in order to diagnose and correct the malfunction, says McAllister.

And the state paying for reduced emissions will want to make sure it gets those benefits. Be aware that some incentive programs come with geographic restrictions, cautions McAllister. That won't work for every vessel, he notes, pointing out such requirements would have prevented his vessels going to Puerto Rico for FEMA to assist with sealift after the September 2017 hurricane.

Why do it?

Because the pros far outweigh the cons, says just about everyone tracking emissions. It's better for the environment, it's better for the health of your employees, and it's better for your business. "You can get a new engine for what it costs to rebuild an old engine, and you get a better operating vessel," says port engineer Mario Dezelic, a 31-year veteran of the Port Jefferson ferry.

Besides the desire or pressure to run a green operation, an upgrade alone can add 23 years to the life of an engine, says CAT's Holt, who explained that CAT's certified upgrade kits that can take a "dirty, noisy, smoking" 1996 pre-T1 mechanically-based engine, keep the same engine block, change out the major components and make it conform to a much cleaner 2006 T2 engine standard, and operate at that standard for the next 23 years. Keep the rest of the vessel shipshape, and your workhorse is good for another generation of dependable performance.

"You get a fully electronic, computerized engine with incredible control over the vessel from a handling, acceleration performance and engine fault codes perspective," Holt says adding, "It's like moving from a 1980s car to 2017."

Cleaner engines that run more smoothly and generate less noise are a plus for your crew and passengers. It's a plus for the riverways and oceanic highways, and surrounding communities on land and in the water. Fewer emissions of all kinds, leads to less smog and acid rain, fewer health problems, and less eutrophication. - the excessive depositing of nutrients into waterways. "The EPA estimates that every dollar in any diesel cleanup generates up to $13 in public health benefits," says GNA's Annotti.

Mitigation projects can earn environmental credits that owners can use or sell. And are required in California, which has laid down a timetable by which vessels have to upgrade through the various EPA Tiers in order to do business in its waters. The only state to enact its own emissions regulations, they are unlikely to be the last. Other states are building Tier requirements into bids. Andy Kelly, marketing communications manager, Global Marine, Cummins, Inc., says a requirement in a New York state RFP that engines had to be Tier 3 or T4 lead Norfolk Tug Co. to repower four to five vessels.

Carpe Diem!

There seems to be near-universal agreement that along with locomotives, replacing the engines of tugs and ferries old enough to have carried your parents, if not your grandparents, is urgently needed. These old workhorses can generate as much as 40 times the emissions of a Tier 4 engine, which coincidently, is exactly the problem wrought by VW's deception.

The newer diesel engines radically reduce a vessel's NOx emission (see charts) even more so than projects involving many more trucks, busses or even multitudes of more cars. To recap. a handful of marine projects is cheaper to fund, easier to manage and track. There is simply no comparison in terms of the cost-effectiveness, speed and NOx reduction impact of upgrading diesel clunkers on ferries and tugs. Marine engine upgrades and the states' settlement mandate are a match made in heaven: States should be lining up to give free money to tug and ferry operators.

Fish or Cut Bait

Operators that don't try to take advantage of this unique, once-in-a-lifetime opportunity may down the road find themselves forced to cut emissions.

Manufacturers have already pushed diesel engine emissions down to near zero with Tier 4 technology. As the movement toward all-electric and zero-emission vehicles grows, and that technology and capacity starts to catch up with demand, it's going to become harder for tug, tow and ferry operators to ignore the fact they are rapidly sailing alone in the haze. The expectation among transportation consultants, industry organiza-

Table 5-36. Typical Emission Impact per Tug per Year – NOx (lbs)

Old Equipment	New/Improved Equipment: Tier 1	Tier 2	Tier 3	Tier 4	DOC	DPF	B20	Hybrid	LNG
Pre-Control	-17,970	-49,917	-61,798	-96,840	0	0	439	-100,733	-100,084
Tier 1		-31,947	-43,828	-78,870	0	0	367	-82,763	-82,114
Tier 2			-11,880	-46,922	0	0	240	-50,816	-50,167
Tier 3				-35,042	0	0	192	-38,936	-38,287
Tier 4					0	0	52	-3,894	-3,245

Source: EPA

tions and environmental concerns is that if business and health gains from greener operations don't force a change, eventually, regulators will. And by that point, the cost of doing so will have grown exponentially while the settlement funds will have been spent.

It's a heck of a worm the early birds are going to catch here. Technically, operators have 10 years to apply for the money, but the funds are expected to run out in the first three years in most states. The first projects will probably kick off in early summer.

None of this is lost on engine makers like Cummins, Inc., and Global Marine Caterpillar, which are said to own 85 percent of the marine engine market. Both are working hard to promote the benefits to funding marine initiatives. Cummins for example, put together a strategy team to lobby states for inclusion of a maritime category, while CAT is developing a program to prepare dealers to assist customers with their trust fund applications. CAT is targeting the more than 1,000 3500 series engines it sold between 1993 and 2004, which it believes would qualify for trust fund monies using CAT Emissions Upgrade Kits.

Both companies maintain that the market for all-electric isn't quite here. The infrastructure needs to be put into place, and power and size limits of batteries need to be addressed.

"The technology has not developed to the point where it can really change the segment," says Chad Hoey, director of sales for marine engines, Cummins, Inc. Annotti is a little more positive. He says electrification can work for "captive fleets' the work out of a port and or within small, confined operating territories where vessels come back to the same locations repeatedly.

Meanwhile, clean diesel is here today, and upgrade kits are being positioned as a more affordable alternative to installing new engines. "Not only are customers getting an emission upgrade, they are also getting new-like engine condition and up-to-date technology, adding decades of reliable operation," says Holt. Total cost of ownership is cut by the reduction in needed major overhauls over the life of the engine, he adds.

The potential windfall here is also a boon to engine manufacturers. Given the target audience, most are focusing their efforts on selling upgrade kits. And while they do not have the benefit of a government mandate, the companies say they don't need it. The ROI on cleaner engines speaks for itself.

In case it doesn't, Cummins has created an emissions calculator for customers to use to see how much their engine upgrade or swap out project can reduce their NOx emissions (See graph and sidebar Tools.x)

The EPA's grim expectation for a slow steam toward emission improvements among tugs and ferries doesn't have to be that way.

While the states seek the most bang for their emission reduction dollars, smart operators will seek out the most bucks for their engine upgrade bill, Now is the time to is work with your engine dealer or state's designated VW Trust agency, figure out and check your emission reduction strategy, plot your states, and get in line for lots of green to help reverse the damage done and ensure clean sailing ahead.

"This is a unique opportunity, there aren't many [programs] of this magnitude. There aren't any other Mitigation Trust Funds or consent decrees being set up," reminds CAT's Lin. "If you miss this opportunity, there won't be another as significant in the future." Agrees Holt, "The sooner people apply the better, once these funds are gone – they are gone."

Dieselgate 101: Opening the Door To Cleaner Engines

By Patricia Keefe

Don't do the crime if you can't do the time – or at least pay the staggering fine. And pay it forward, Volkwagen will.

The auto manufacturer got caught using software to trick emissions control software during testing on some cars - nearly 500,000 2.0 liter and 83,000 3.0 liter diesel vehicles - in order to get a passing grade, after which the cars operated in violation of the Clean Air Act. The years of cheating on vehicles from model years 2009 to 2016 sold and leased in the U.S., resulted in emissions of up to 40 times the permitted level of nitrogen oxides (NOx) and particulate matter.

As part of a series of three settlements with the U.S. Environmental Protection Agency (EPA) totaling close to $14.7 billion, Volkswagen was required to fund two mitigation trusts to the tune of $2.925 billion, which will be used to clean up diesel emissions – one for the states, Washington D.C. and Puerto Rico; and one for the Indian Tribes. Both trusts will be administered by an independent trustee, the Wilmington Trust.

The money is to be used specifically to fund projects with "eligible mitigation actions," such as upgrading tugboat or ferry engines, to reduce the excess emissions that were produced by the illegal cars. Engines change outs can only be repowered to EPA levels Tier 3 or Tier 4. However, operators can use Verified Emissions Upgrade Kits to move their existing engines from any EPA level to a Tier 1 or Tier, says David Holt, E&T Industry Consultant, Caterpillar Global Aftermarket Solutions. Other eligible options include hybrid engine solutions or all-electric.

How much money each state receives depends on how many of these "illegal" vehicles were sold or leased per state. As it happens, the top 10 recipients of trust funds are also the states with the largest marine sectors (see box on page 37).

The states and tribes can take up to 15% of their funding to cover administrative costs. They have to select a board or agency to oversee the process and distribute the funds; pick up to 10 categories – of which tugs and ferries are one - in which to spend the money; create a public-facing web site and post a draft mitigation; collect public comments; revise the plan; submit it to the Wilmington Trust for approval. One that happens, the trust beneficiaries will post the plan and application forms, process and information, including the all-important, "when do you get your money?" Some states might opt for upfront grants; others may prefer to reimburse post implementation.

The beneficiaries have 10 years to request their funding and implement approved mitigation actions. Any monies not spent after 10 years will be redistributed to the states that did use up their allocations. Applications must include projected NOx reductions and impact on air and community health. Project priority will be based on the emissions reduction or offset per dollar spent, as well as factors such as health benefits and impact on wild areas. There are free online calculators for modeling numbers (see Tools box).

Applicants can work through the process themselves, which one analyst likened to doing your taxes; work with their dealer or supplier; or, depending on how complicated or big the project, hire a firm that helps clients write and defend winning applications, such as advanced transportation specialists at Gladstein, Neandross & Ass., or M.J. Bradley & Ass.

Only a couple of states have made it to the final approval stage, one of them being Maine, which has committed a major part of its funding to reducing marine diesel emissions.

States are expected to start getting their funds in June, accepting applications in late summer through the fall, with projects kicking off anywhere between the fall and the spring of 2019.

The beneficiaries, or states, are encouraged to be as cost-effective as possible and to, where possible, look for way to serve Environmental Justice areas, areas that have been overly burden with pollutants and wastes – typically area around ports and industrial areas.

Practical Contributions to the Development of

Autonomous Sailing

A great deal of debate and speculation surrounds autonomous sailing. While MARIN does not pretend to know all the answers, it is taking practical steps to assist in its development.

The introduction of further autonomy in shipping first aims to facilitate much higher safety standards, but at the same time, a reduction in manning. MARIN is focusing on three main areas in relation to autonomous sailing. We believe it is important to study the ship in relation to traffic control, to understand nautical safety issues and the definition of new manning roles, including those onshore.

Additionally, in an effort to further research into autonomous sailing, MARIN, together with the Dutch maritime industry, has already started a new Joint Industry Project. Within 'Autonomous Sailing' we will look together into the available technology required. Here we outline the various roles control and vessel modelling play in the development of autonomous sailing.

Control

Without heading, position and track control, sea keeping and maneuvering model tests would not be possible. Conclusions and predictions about the performance of the whole system inevitably include the performance of the controlled system. The best control possible is therefore essential for MARIN. The performance of the control system should not be dominating the outcome of simulations and model tests unless it was supposed to. A control system is used to keep a vessel in position, or on track in varying conditions, and should make optimal use of all its available resources, such as the installed generator power, thruster characteristics and others. If this is not done correctly it will result in a vessel design with a (much) lower operational capability than predicted.

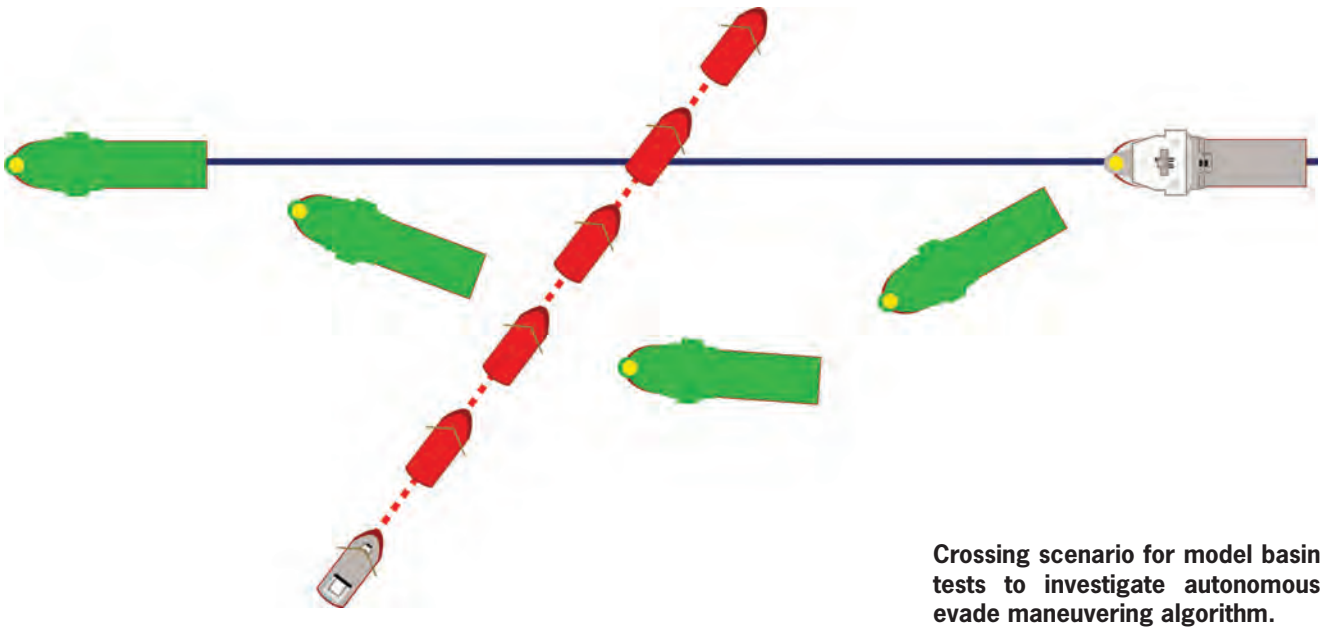
There is a parallel hierarchy between autonomy and control. Control is an inevitable basis for the higher levels of autonomy: no control, no autonomy. The lowest level of autonomy corresponds to manual control by a human operator. A system complying with the highest autonomy level will make its own plan, take its own decisions and execute it using its control systems.

When performing docking simulations to study the safety of harbour approaches, the simulation model needs to include a decision algorithm that realistically allocates and controls the harbour tugs that assist the vessel as it enters the harbour and docks along the quayside. Similar challenges apply when simulating marine traffic when evaluating traffic separation scheme designs. These should incorporate some sort of 'operator in the loop' model to be able to include the long-term mission planning and to avoid high-risk collision situations.

Models

MARIN's time simulation models will be used to predict dangerous situations well in advance. This gives the opera-

(Image: MARIN)



(Image: MARIN)

Crossing scenario for model basin tests to investigate autonomous evade maneuvering algorithm.

About the Author

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tor – either onboard or onshore - the opportunity to assess the situation in plenty of time and it provides him with alternative solutions. The better these simulation models reflect the actual behavior of the ships and the better they incorporate actual environmental conditions, the better the operator will be able to identify risky situations and select the lowest risk scenario for execution.

Nautical Safety Issues

In addition to adequate modeling of the maneuvering and route/track prediction capabilities, the 'detect and avoid' algorithms also require knowledge about traffic conflict solutions. The latter will have to cope with multiple vessel and other complex scenarios. The conflict solutions of these scenarios will need to take into account various perspectives. They have to obey the Collision Regulations (COLREGS), local regulations and the pure physical limitations imposed by the environment on the vessels' capabilities.

In addition good seamanship and predictability are other very important factors. These reflect the many 'unwritten rules' about traffic situations that are often only confirmed by direct contact through the VHF. The unwritten rules refer for instance to the distances kept during close range encounters and/or the more strategic, long-term 'well clear' behavior. Both traffic (conflict) solutions have their own safety and economy driven parameters.

New Manning Roles

Each level of autonomy will introduce its own challenges concerning the interfacing with the nautical data representations like route planning, weather assessment and the ship's condition. Both the onboard and on-shore parts of these representations will require new equipment capabilities and new operator competences. Again, the detect and avoid models are used to produce the appropriate, and safety critical situational awareness representations, pointing (well in) time and space to the emerging and potentially conflicting or even violating traffic situations.

Complete removal of the ship's crew will require full autonomy for all onboard functions, including maintenance and repair. It will require simpler systems and the redundancy of critical systems. The "All-Electric Ship" will be a very appealing design solution for autonomous ships. In addition, an all-electric ship has the benefit of reducing emissions drastically provided renewable energy is used to charge its batteries. Here we have outlined some of the first practical steps that are being taken. As mentioned, the Autonomous Sailing Joint Industry Project is already underway. Furthermore, a model test programme will investigate the present status/capabilities of our autonomous evade maneuvering algorithms ('crossing' and 'passing').

A real-life traffic situation (AIS) with the no-go conflict areas as seen from the black vessel's perspective (arrow). The vessels are shown with their trail and ship domain.

Floating Liquefaction and Regasification

IMA/WER has launched a new report series and online database that tracks and evaluates floating liquefaction and regasification projects in the planning stage. We track all known planned projects and apply success factors to rate the potential of each to pass the investment hurdle. Some highlights from the new report and database are provided below.

Future LNG Demand

Global demand for natural gas is expected to grow at an annual rate of 1.5 to 2% over the next 25 years – driven by the economic and environmental advantages of natural gas as feed for heat and power production.

Much of future gas demand growth will be in locations where gas delivery by pipeline is either uneconomic or impracticable. These locations, primarily in Asia and Europe, will produce a growing requirement for natural gas in refrigerated liquid form – which will generate demand for additional LNG production capacity and need for new import/regasification terminals.

Floating vs. Land Facilities

LNG liquefaction and regasification has historically been done in land-based plants and terminals. But floating facilities are now recognized as having advantages over land-based alternatives in many situations.

Despite the growing number of floating LNG Plants and regasification terminals, they still represent a small portion of installed capacity. FLNGs in service and on order account for 4% of LNG plant capacity scheduled to be operational in 2021/22. FSRUs account for 20% of global regasification capacity scheduled to be operational by 2021.

Outlook for New LNG Facilities

Investment appetite for LNG projects has been dampened by the near term imbalance of LNG supply and demand. LNG plant construction has outpaced demand growth and additional capacity scheduled to come on line over the next several years will add capacity to a market already saturated. This has caused many planned LNG projects – land and floating – to be placed on hold.

But the excess supply of LNG is soon to be wiped out by increasing demand – and willingness to invest in new LNG liquefaction capacity will strengthen from 2021 onwards as global LNG demand catches up to LNG supply. By the early-2020s we expect many of the shelved LNG projects to come back to life.

Some of the LNG projects over the next decade will be land-based facilities with multiple trains capable of 8+ mtpa output. Some, perhaps many, will be smaller LNG projects utilizing floating plants with 1 to 4 mtpa production capability.

Even in the current saturated market, FLNG projects continue to attract investment funding. The investment decision in June 2017 by ENI and partners to proceed with the $8.4 billion Coral South FLNG project testifies to the strength of the FLNG sector.

FSRU demand has remained very strong. Since the beginning of 2013 an average of six new FSRU projects have been funded annually. During 2017 there were nine FSRU orders.

Looking forward we expect an uptick in orders for both FLNGs and FSRUs. The question is which projects now in the planning stage are most likely to successfully move to a final investment decision.

Likely vs. Unlikely Projects

There are numerous FLNG and FSRU projects in the planning stage. Not all will move to development. To sort the likely from the unlikely we developed a methodology to rate projects based on specific "success drivers".

Success drivers for FLNG projects include project cost (gas processing requirement, gas quality, upstream location, FLNG site conditions, FLNG size, etc) and whether floating liquefaction represents the only practical method of commercializing the gas reserves to which it is linked. Then there are key stakeholder criteria – promoter strength, government support and buyer strength.

We assign a positive, neutral or negative rating to the success drivers in each project. Together these ratings indicate the probability that a project will make the investment hurdle and move to development. The ratings are continuously updated in the database as conditions change.

For example, in our evaluation of the Greater Tortue project in Senegal/Mauritania, where several FLNGs are planned to be employed, we have given a positive rating to most of the project attributes. The upstream site is in deep water, which is a negative. But this is offset by the lack of alternative commercialization options apart from LNG, support of the two governments and a determined BP as development operator and offtaker. Overall we rate the chances of success of this project proceeding as high.

In contrast, the success potential of the planned Fortuna FLNG project is negatively impacted by its deep water location and lack of liquid leg – coupled with a lack of developer financial strength. While there are some important positives, including strong government support and lack of alternative gas monetization paths, we rate this project as having less chance of moving forward to development. This rating will be upgraded if and when the project developer arranges the financing package.

A similar analysis is made for each FSRU terminal in the planning stage. Here we evaluate the project demand drivers, strength of the project promoter, gas offtaker strength, whether there is an alternative source of gas and project do-ability. The latter includes the investment needed in downstream infrastructure, access to project finance, difficulty in obtaining permits and licenses, need to involve multiple offtakers to achieve critical offtake mass, government support of the terminal project, etc. As with FLNG projects, we assign a positive, neutral and negative rating to the drivers in each planned terminal project.

The Big Picture

Overall, we expect a growing number of FLNG and FSRU projects to reach the investment decision over the next five to ten years. This is a very robust market sector that has lots of room to grow.

But the competition for investment funding will be strong – and only some of the projects in the planning stage will make the investment hurdle.

The IMA/WER monthly FLNG/FSRU report and online database provides an analytical tool for professionals in the LNG business. We track the status of all floating liquefaction and regasification projects – and provide a continuously updated evaluation of which projects will make the funding hurdle, which will have difficulty doing so.

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Floating Liquefaction Plants

FLNGs can be positioned over a shallow or deepwater offshore gas reservoir, eliminating the need for a subsea pipeline to a shore-based land plant. LNG produced on the FLNG is stored in special cryogenic tanks and directly transferred to an LNG carrier for global delivery. FLNGs can be relocated when the reservoir is no longer economical to produce. Four FLNGs have been completed. One is in service, two are being commissioned and one is available. Two more are under construction. Looking forward, 31 floating liquefaction projects are at various stages of planning and design. All have the potential of becoming FLNG contracts. Ten of the planned projects are in Africa, six in Australia, fifteen in other areas of the world.

Floating Regasification Terminals – FSRUs can be positioned in a port or moored offshore to receive, store and regasify LNG. An FSRU-based import terminal is generally quicker to build and easier to finance than a land-based terminal. Like FLNGs, an FSRU can be relocated when the import requirement changes.

Twenty four FSRU terminals are in operation and 4 FSRUs are available for terminal contracts. Another 18 FSRU terminals are under construction. In the planning stage are 43 FSRU terminal projects. Thirteen of these planned terminals are in SW Asia, 7 are in SE Asia, 6 in Africa, 6 in So America and 11 elsewhere.

What Projects Are Planned, Which Are Likely to Proceed to Development?

Jim McCaul – IMA/World Energy Reports

Floating LNG Liquefaction and Regasification
(Number of Projects as of March 2018)

Status	FLNG	FSRU
In Service	1	24
Commissioning	2	
Available	1	4
On Order	2	18
Planned	31	43

Source: IMA/WER Floating LNG Database

Location of Floating Liquefaction and Regasification Projects in the Planning Stage

FLNGs		FSRUs	
Region	Number Projects	Region	Number Projects
Africa	10	SW Asia	13
Australia	6	SE Asia	7
SE Asia	3	Africa	6
Mediterranean	3	So America	6
Canada	2	Mediterranean	5
Gulf of Mexico	2	No Europe	2
Other	5	Other	4
All Regions	31	All Regions	43

Mitsui O.S.K. Lines, Ltd.

Production Floaters Orders Are on the Rebound

Jim McCaul – IMA/World Energy Reports

Fifteen production floaters were contracted in 2017 – 11 FPSOs, 2 production semis, a wellhead TLP and an FLNG – and the number of deep water projects in the near-term planning queue indicates production floater orders are set to accelerate.

This is a big change from 2016 when orders for new units totally dried up and the deepwater future looked pretty bleak.

Recent Orders – Here's a round-up of contracts awarded last year and in January 2018.

Tempera FPSO - Keppel in Jan 2017 received a contract from Dixstone Holdings, an affiliate of Perenco, to convert a tanker to an FPSO for use on the Yombo field offshore the Congo. The 2002-built Aframax-size tanker Tempera is being used as the conversion hull. When completed, it will replace the Conkouati, which has served as the FPSO on the field since 1991.

Carioca MV30 FPSO - In Oct 2017 Modec was awarded an EPCI contract + 21 year lease to supply an FPSO to Petrobras for use on the Sepia field in Santos Basin. The FPSO, named Carioca MV30, will be VLCC-size (1.4 million bbls storage) and have capability to produce 180,000 b/d oil, 212 mmcf/d gas (which will be re-injected) and 240,000 b/d water injection.

Ca Rong Do FPSO - In Apr 2017 Yinson Production finalized a contract to supply an FPSO to Repsol for use on the Ca Rong Do oil/gas discovery offshore Vietnam. The unit will be leased on a time charter basis for a firm 10 yrs with 5 extension options of one year each. The estimated aggregate value of the bareboat charter is $1 billion for the entire 15-year period.

Guanabara MV31 FPSO - Petrobras in Dec 2017 signed an EPC contract + 22 yr lease with Modec to supply an FPSO as the pilot production unit on the Mero (ex-Libra) field. The FPSO will be a VLCC-size unit with capability for 180,000 b/d oil, 420 mmcf/d gas, 225,000 b/d water injection and 1.4 million bbls storage. Start of the production is planned for 2021.

Liza #1 FPSO - SBM in June 2017 was awarded the EPC contract and lease for an FPSO to initiate development of the Liza oil/gas discovery offshore Guyana. The lease is for a firm 10 years with up to 10 one year extensions. The FPSO will have production capacity for 120,000 b/d oil, 170 mmcf/d gas and water injection capacity of 200,000 b/d. The conversion is being done at Keppel.

Adolo FPSO – BW Offshore in mid-2017 began modifying the Azurite FPSO for use as a production unit offshore Gabon. Keppel is doing the modification. Azurite had been available for redeployment since 2014. The FPSO currently has production capacity for 40,000 b/d oil, 18 mmcf/d gas and 60,000 b/d water. It is single hull with spread mooring able to store 1.35 million bbls oil.

Aoka Mizu FPSO - In July 2017 Bluewater was contracted by Hurricane Energy to modify and redeploy the Aoka Mizu for use as an early production system offshore the UK. The 605,000 bbl FPSO has production capability for 30,000 b/d oil and 20,000 b/d water production. It will be connected via a manifold to two production wells on the Lancaster reservoir. Dubai Drydocks World is doing the modifications/upgrades.

Johan Castberg FPSO - Statoil in December 2017 awarded an EPC contract to Sembcorp Marine to fabricate the FPSO hull and living quarters for the Johan Castberg FPSO. In February 2018 an NOK 3.8 bil contract for topsides fabrication and hull/topsides integration was awarded to Kvaerner. SBM is supplying the turret mooring system. The FPSO will have 1.1 million bbls storage and production capacity of 190,000 b/d oil, 290 mmcf/d gas.

Fast4Ward Spec FPSO - SBM in June 2017 contracted with CSTC and SWS, both in China, to build a speculative VLCC-size FPSO hull that can be used

Summary of Recent Production Floater Orders 2017 through January 2018

(excludes FSRUs and FSOs)

Unit	Field Location	Field Operator	Lease or Own	New/ Conv/ Redeploy	EPC Contractor	Order Date
Floating Production Storage Offloading Units						
Tempera FPSO	Congo	Perenco	Lease	Conv	Keppel	2017 Jun
Carioca MV30 FPSO	Brazil	Petrobras	Lease	Conv	Modec	2017 Oct
Mero Pilot (ex-Libra Pilot) FPSO	Brazil	Petrobras	Lease	Conv	Modec	2017 Nov
Fast4Ward Spec FPSO	TBD	TBD	Lease	New	SBM	2017 June
Liza #1 FPSO	Guyana	ExxonMobil	Lease	Conv	SBM	2017 June
Adolo (ex Azurite) FPSO	Gabon	BW Offshore	Own	Redeploy	BW Offshore	2017 July
Aoka Mizu FPSO	UK	Hurricane	Lease	Redeploy	Bluewater	2017 July
Sururu FPSO	Brazil	Petrobras	Own	New	CIMC Raffles (hull)	2017 Dec
Johan Castberg FPSO	Norway	Statoil	Own	New	Sembcorp Marine (hull)	2017 Dec
Ca Rong Do (OSX 1) FPSO	Vietnam	Repsol	Lease	Redeploy	Yinson	2017 Apr
MTC Ledang FPSO	Malaysia	Octanex	Lease	Conv	MTC Engineering	2017 Feb
Penguins FPSO	UK	Shell	Own	New	Fluor	2018 Jan
Floating Oil/Gas Production Units						
Ca Rong Do TWLP	Vietnam	Repsol	Own	New	PTSC	2017 Apr
Mad Dog 2 SEMI	USA	BP	Own	New	Samsung	2017 Jan
Vito SEMI	USA	Shell	Own	New	Sembcorp Marine	2017 Dec
Floating LNG Production Units						
Coral South FLNG	Mozambique	ENI	Own	New	Technip/Samsung/JGC	2017 June

Source: WER Floating Production Database

on a future FPSO contract with short execution requirement. According to SBM, Fast4Ward can accelerate delivery of an FPSO by up to 12 months.

Mad Dog 2 Production Semi - In January 2017 Samsung was awarded a $1.27 billion contract to build the production semi for BP's Mad Dog Phase 2 project The unit will have capability to produce 110,000 b/d oil and 25 mmcf/d gas from up to 14 production wells. Mad Dog 2 will be used to develop further oil discoveries near the original Mad Dog Spar in the GOM. Production is expected to begin in late 2021.

Vito Production Semi - In December 2017 Sembcorp Marine received an LOI from Shell for a turnkey contract to construct the production semi for the Vito field in the GOM. The production unit will comprise a single topside module supported on a 4-column semisubmersible hull. It will be moored in water depth of 1160 meters and have production capacity of 100,000 b/d oil + 100 mmcf/d gas.

Ca Rong Do TWLP – In April 2107 PTSC received an EPCI contract to fabricate an 18 slot dry tree TWLP to use with an FPSO on the Ca Rong Do oil/gas field offshore Vietnam. PTSC is fabricating the unit in its Vung Tan facility. This is the first TWLP fabrication contract to be executed by PTSC. FloaTEC has a $40 mil contract to provide engineering and support services to PTSC during the construction period.

Coral South FLNG - ENI in June 2017 proceeded with its project to develop LNG exports offshore Mozambique using an FLNG with 3 mtpa LNG + 0.5 mtpa condensate production capacity. Technip/Samsung/JGC JV was selected for the $ 2.5 billion FLNG EPC contract. The FLNG will be 439 m long, 65 m wide – and displace 210,000 tons. Production start is scheduled in mid-2022.

Penguins FPSO - Shell in January 2018 contracted with Fluor to supply an FPSO for use on the Penguins cluster in the UK sector of the northern North Sea. The production unit will be based on a Sevan Marine 400 cylindrical design FPSO. It will have peak production capability of 45,000 boe/d – including 35,000 b/d oil – and storage for 400,000 bbls.

MTC Ledang FPSO - Puteri Bangsa, a 350,000 barrel 1992-built tanker formerly used as an FSO, was modified into a small 15,000 b/d FPSO for use on the Ophir field offshore Malaysia. MTC Engineering had the EPC contract + lease to supply the unit. Keppel had the conversion contract.

Sururu FPSO - In Dec 2017 Petrobras contracted with CIMC Raffles to build the FPSO hull for the Sururu/Atapu Norte fields in Santos Basin. The hull will be VLCC size, designed to support a 100/120,000 b/d + 200 mmcf/d topside plant. Delivery of the hull is scheduled in mid-2019. This was earlier to be the P 71, the sixth FPSO in the serial hull project.

Planned Projects

Looking forward, we are currently tracking 227 floating production projects in various stages of planning.

Geographically, 35% of the projects in the planning queue are located in South America, 26% in Africa, 11% in SE Asia, 8% in Northern Europe and 7% in the GOM. The remaining 13% are spread over a half dozen other regions.

Of the total projects, 53% involve an FPSO, 10% another type oil/gas production floater, 33% liquefaction/regasification floater and 4% storage/offloading floater.

As for timing, 64% of the projects in the planning queue are likely to lead to a production system contract within the next five years. The remaining 36% consists of longer term projects where the production system order is likely after 2022. In the very near term are 24 FPSO projects, several FPU projects and 20+ FLNG/FSRU projects likely to reach an investment decision within 2018/19.

Details for all known planned projects are provided in the online WER Floating Production Database.

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Bulker

Statistics & Analysis Courtesy of VesselsValue.com

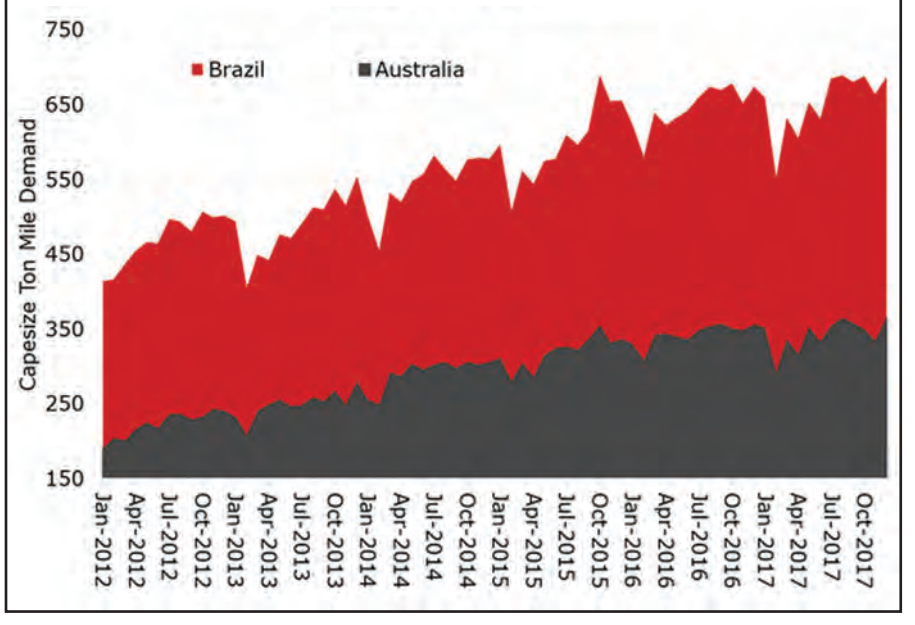
The dry bulk markets have been off to a promising start for owners in 2018 after seeing stronger year in 2017. Rate strength is determined by the major bulk cargoes of iron ore, coal, and grain, all of which have contributed to rising demand for dry bulk carriers. The demand for minor bulk cargoes, which can be very important to short term rate volatility, appears to be edging upwards over a strong global economic situation.

In the Capesize Market orders remained depressed during the down cycle in rates over the past two years. Interest in newbuilds has risen during the periods of strength in TCE returns, but monthly totals have remained below the peak levels in 2013. Despite the lower cargo volumes normally seen in February, we are seeing counter seasonal peaks and returns are pushing new five-year highs. This could drive rates in 2018 substantially higher.

The demand generated by the Chinese economy remains critical to the dry bulk market, and any substantial shift could cause a surprise swing to the upside or downwards. Forecasts of Chinese growth are inherently unreliable due to the ability of the government to exercise command authority over key infrastructure and energy decisions.

Asset values across all dry bulk segments have increased over the past year and should continue to appreciate throughout the year. Prices are just now approaching their median value since 1992, indicating that upside potential remains.

Ton Mile Demand



Tanker

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Statistics & Analysis Courtesy of VesselsValue.com

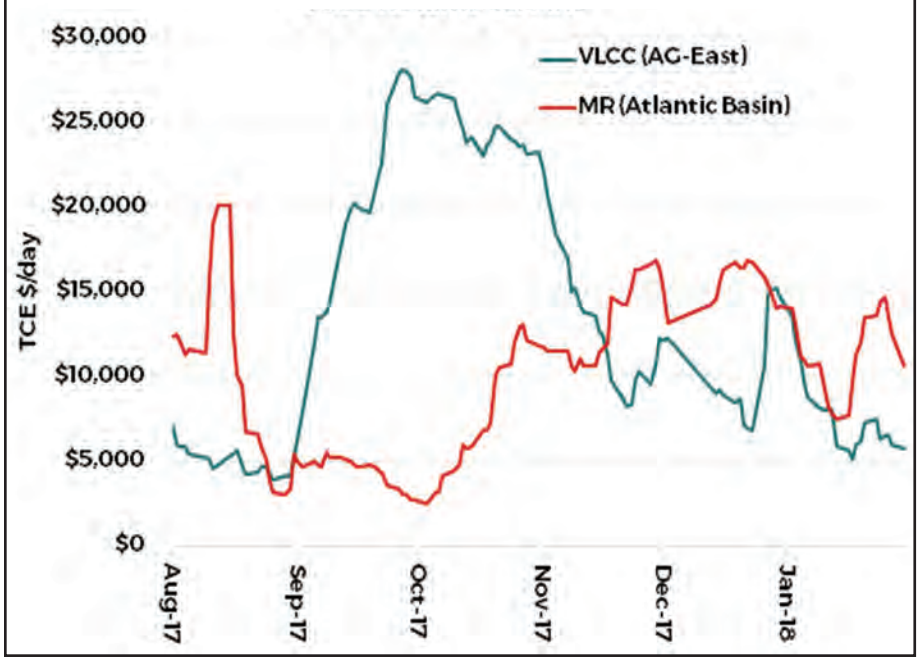
The crude tanker markets remain depressed due to the oversupply of tonnage in the VLCC and Suezmax segments. The low hire rates for these ships filters down to smaller crude tankers, who are unable to push market rates too high during sensitive rate windows. Charterers can simply book the larger ships for the same amount of money, which caps gains. The shifts in global crude production due to shore-based production (i.e. shale or other novel production techniques) is benefitting smaller crude tankers. Many of these volumes can be shipped opportunistically from ports that have not traditionally serviced VLCCs or Suezmaxes. The demand for distillates to blend low sulfur bunker oils will create new trade flows to service key global refueling points.

Clean tankers are subject to the same sentiment that faces crude tankers despite wildly different fundamentals in the markets. The market weakness, while not as pronounced as in the crude markets is due to the lingering effect of new build additions to the fleet over the past several years. Arbitrage trades for clean products have an outsized impact on the rate strength seen. Upcoming additions to global refining capacity and the steady rise in product demand should boost the cargo volumes available to all clean tanker segments.

Tanker valuations are a mixed bag. Ships from zero to five years in age have rebounded in value as market participants have snapped up younger units at bargain prices in the Sale and Purchase market. Older ships have not fared as well, particularly for large crude tankers. VLCC values for ships between 10 and 15 years of age saw a significant drop from a year ago.

The reduced trading options for these vessels in todays low rate environment combined with the limited trading life over the next several years leaves fewer buyers willing to take a speculative position in ownership.

VLCC Returns vs. MRs



Container Shipping

Statistics & Analysis Courtesy of VesselsValue.com

Rates for large containerships remain well below the desired levels of carriers, but market participants are acting. The consolidation of commercial control by alliances should encourage a stronger market despite the ongoing overcapacity in the market on the primary trades. Newbuild orders for ULCVs continue to be placed as owners vie for larger market share, which could disrupt the efforts at rate stabilization.

China retains its position as the top owner by value in the containership markets. The lack of interest in shipping seen from traditional sources of finance is unlikely to change in the short run. It remains to be seen if there is a significant change in rate structures because of the ongoing shift in control of ships to Asian ownerships.

Protectionism remains a concern for the container ship industry. There have been few substantive barriers thrown up to trade because of waves of populism sweeping certain economies. However, trade wars can escalate quickly and tariffs on bulk commodities have started already. This could filter down into manufactured goods as well, where it would negatively impact the efficiencies of a global supply chain, and in turn containerized volumes.

Smaller ships have seen a modest recovery after a spate of scrapping in 2017, but it is certainly not a windfall environment for cash strapped owners. Sub-panamax will continue to see a baseline of employment due to port restrictions limiting the size of ships which can call at certain terminals.

End of 2015	
Owner's Country	**Total Value**
Germany	$26,677
China	$22,592
Japan	$13,196
Denmark	$12,971
Greece	$11,901
Singapore	$6,321

End of 2016	
Owner's Country	**Total Value**
China	$18,570
Germany	$15,197
Japan	$10,117
Denmark	$8,384
Greece	$7,871
Singapore	$4,879

Start of 2018	
Owner's Country	**Total Value**
China	$20,384
Germany	$18,203
Japan	$10,688
Denmark	$8,975
Greece	$8,400
Switzerland	$6,102

Gas

There is a tale of two markets for gas carriers. LNG rates have surprised to the upside as global demand for natural gas has increased. China's shift away from coal is heavily polluted regions has led to hunger for natural gas imports, leading to higher spot market levels for LNG carriers. The market has softened in the past several weeks but remains much stronger than would have been expected a year ago.

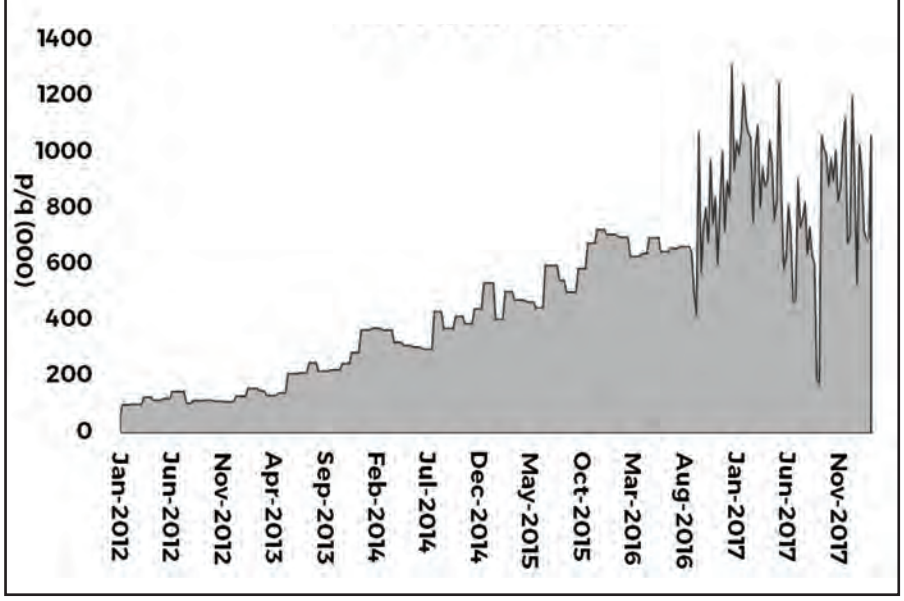
LPG carriers haven't seen the same boost as the oversupply of large gas carriers has weighed on the market. Much of the incremental global demand for LPG is coming from petrochemical plants in Asia for plastics, and the growth has been lower than expected. The ability to substitute certain naphtha grades being produced from condensate splitters has offset some demand for LPG. Domestic and transportation uses for LPG have been increasing at a far more gradual rate.

The combination of low freight rates and rising production/exports from the US again will encourage a market use for LPG, and in turn drive ton mile demand higher. There has been market chatter about using LPG as a bunkering fuel, an idea that has gained limited traction so far but could be a practical solution for some owners looking for 2020 bunker fuel compliance alternatives.

Asset values are mostly negative from a year ago, but older and smaller semi-refrigerated and pressurized ships have seen a modest rebound. Asset prices could be the bottom of the cycle as global trade patterns for these ships balance out.

Statistics & Analysis Courtesy of VesselsValue.com

US Propane Exports



offshore

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Statistics & Analysis Courtesy of VesselsValue.com

Offshore vessel orders have been severely depressed following the oil price collapse that began in in 2014, but rising oil prices could change this.

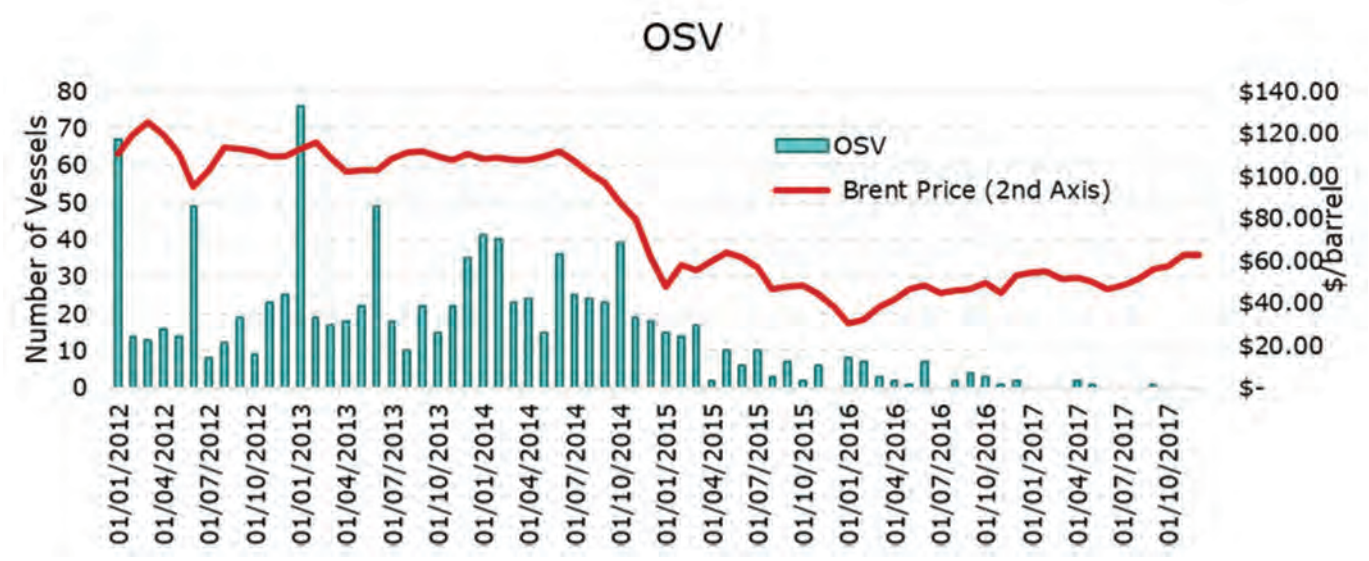
The OSV market is affected by the market for offshore exploration, which is driven by the price of oil. The growth in land-based shale oil production from the US and other areas has depressed demand for scouting for new traditional oil fields. Order interest is expected to remain on a replacement basis, but the market is unlikely to see a strong rebound in replacement orders until demand for offshore oil production increases. This could be sooner than some expect.

The recent run up in oil prices suggests that a light may be on the horizon for returns. The Brent benchmark is now at its highest level since December of 2014, at almost $70/b. There was an increase in OSV orders during the "dead cat bounce" in oil prices back in early 2015. Market participants have been gunning shy since then, but the tide may be turning. Once asset values begin to appreciate interest in new orders should materialize.

OCV activity has been slower as well, although the downwards trend in orders is not as pronounced as that seen in the OSV market. This is a much smaller market to begin with but includes a higher percentage of vessels not directly tied to oil field exploration.

The MODU segment has been the hardest hit by the oil price decline, with no new orders placed since 2015. Interest in drilling units will remain isolated to custom projects required for specific fields. There are multiple units warm and cold stacked around the world waiting to return to service should rates firm.

The age profile of the fleet is young, which will limit the incentive to send ships to the recyclers. Asset values for OSV remain depressed, although they appear to be at their floor level. If the rise in oil prices translates into increased demand for units, the asset values should appreciate.



Maritime Simulation

High Tech Meets Practical Skills

When talk turns to 'Maritime Simulation' visions of high-tech bridge simulators with seamless graphics and interwoven component simulators – engine room, DP systems, cargo loading – come to mind. But modern simulation is so much more, a wholistic visual, audio, tactile and cereberal experience that prepares mariners to deal with a bevy of real-world situations.

By Greg Trauthwein

Modern maritime simulation has evolved rapidly, driven by exponential leaps in computer and graphic display power, a critical and valuable tool in the maritime training tool belt which helps to develop a mariner who comes ready with not only knowledge and a certificate, but the practical hand-on experience that is otherwise gained only through sea time. But maritime simulation is not only centered on fast computers, seamless displays and modern maritime equipment. The maritime simulation experience today is a multi-layered, multi-faceted endeavor which combines complex maritime navigation skills with the more mundane yet equally critical skills of communication, situational awareness and the ability to multi-task in any situation.

Communication on the bridge and between the bridge and traffic controllers is often where problems can occur, said **Rosemary G. Mackay**, Modeling and Research Coordinator, Curriculum Development & Lead Engineering Instructor, Resolve Maritime Academy, Inc. So simulation at Resolve Maritime Academy is not just about the technical side of simulation, rather the practical side too. Resolve aspires to learn their trainee's strengths and weaknesses, overloading them with information to help test the boundaries of bridge performance, focus and response.

Offshore Energy

The energy slump has touched nearly every corner of the maritime market, and the simulation training sector is no exception, particularly painful as many had recently expanded to help fuel a fast-growing business.

When the energy crisis hit and the offshore market slowed, Resolve took a hard evaluation of its maritime simulation services and focused on efficiencies, said Mackay. "We do things in a very efficient scale. We had to, but at the same time we still have to deliver top quality."

A few blocks away in Fort Lauderdale is another top-tier and long-tenured training school, Maritime Professional Training (MPT).

"The oil and gas market slowdown has definitely been felt by the mariners, industry, and training providers alike," said **Captain Ted Morley**, Chief Operations Officer, Academic Principal, MPT. Tangibly MPT felt the pinch in student flow, with just more than 14,000 students coming through the facilities in 2017, "which is kind of an off-year for us" from MPT's peak of 16,000+ students. "Our focus as a training center is to keep the mariners working," said Captain Morley. "If they are in oil and gas and not working, they can get trained to work in another sector. It might not be in the industry that they want, it might not be at the

Capt. Ted Morley

Chief Operations Officer, Academic Principal, MPT, on

The future need for Maritime Simulation Training

"The IMO is forecasting a 148,000 shortfall in trained officers by 2025, *so there is ample opportunity for a manpower shift to other segments. Many DPOs are finding employment in wind farm development projects and, as always, recruiting and training veterans remains a vital mission."*

Photo: MPT

Photo: MPT

Maritime Professional Training (MPT) has just finished a $6m renovation and expansion project with new technology, upgrades in simulation, a new waterside lifeboat training facility, and a recently expanded Main Campus.

Photo: Resolve Trainng Academy

The Resolve Training Academy features a NT Pro 5000 Class A Full Mission Navigational Simulator with 220 degrees FOV on the main sim and 220 on the bridge wing, a bridge wing which can dock port or starboard.

Photo: Cal Maritime

Cal Maritime has upgraded its full mission bridge simulators and is also upgrading its iBest Lab. In addition, Cal Maritime instructors continue to hone their skills with training from its simulator manufacturer.

Photo: Resolve Trainng Academy

Rosemary G. Mackay

Modeling and Research Coordinator, Resolve Maritime Academy, Inc., on

Investment in Technology

"Resolve in investing in a visual upgrade for the main bridge, **a new 1920 x 1200 laser phosphor projection system** *which is scheduled to be delivered and online toward the end of March 2018."*

salary that they want, but there are jobs out there."

To illustrate his point, Captain Morley continued. "The IMO is forecasting a 148,000 shortfall in trained officers by 2025, so there is ample opportunity for a manpower shift to other segments. Many DPOs are finding employment in wind farm development projects and, as always, recruiting and training veterans remains a vital mission."

And while the discussion turns gloomy when the topic of offshore energy arises, Captain Morley has a different take on the situation. "Offshore oil and gas is flat, but it's not dead. There still is a fair amount of training going on, and the ships that are still working tend to be more technically advanced, and the crews have to be as well. You're seeing a lot of the second and third tier vessels sidelined, but the 265- and the 300s … the bigger supply vessels are all working."

Continued Investment

Regardless of the depth and breadth of any industry sector downturn, the elite maritime simulation training schools continue to invest in the latest gear to ensure that its facilities are in step with the evolution of technology on new ships and boat.

On the west coast at **Cal Maritime**, the university has upgraded its full mission bridge simulators and is also in the process of upgrading its iBest Lab, according to a school spokesperson. In addition, Cal Maritime instructors continue to hone their own skills with training from its simulator manufacturer. This continued investment has paid dividend, as Cal Mari-

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time is better positioned to deliver a full training package to their clients. “Our longstanding relationship with a shipping client has expanded over the years to include not only training for their employees, but also assessments of their mates and captains.

This includes bridge resource management, engine resource management, candidate assessments and evaluations; all of these programs use our campus simulators.

In addition, a multi-year contract included use of our simulators for development of a study for the Coos Bay area with multiple industry partners, agencies, and local pilots participating in the exercises.”

Investment is not limited to the universities, as explained by Captain Morley. “As you know, MPT has just finished a $6m renovation and expansion project with new technology, upgrades in simulation, a new waterside lifeboat training facility, and a recently expanded Main Campus,” said Captain Morley. “This investment will soon be followed by an additional project due to break ground in 2019.”

This investment support MPT’s broad client base, which includes offshore oil and gas, cruise ships, ferries, mega yachts, fishing vessels, commercial deep draft and commercial inland. “All of those (industry sectors) ebb and flow at different rates; for example the container and short sea shipping business is moving well right now.

Captain Morley said that MPT’s clients are looking at ways to not only satisfy the regulatory requirements, but also increase retention within their workforce. “One of our clients is a global leader in the fishing industry and has worked with MPT to develop a program in which their crews are trained and promoted to higher paying jobs within the fleet.

This has not only resulted in higher retention, but higher efficiency as these crews are already familiar with the vessels, the company, and the operations. Having the range of courses that MPT has allows them to single source all the training, and work to ensure it fulfills the non-regulatory company specific goals as well.”

The Resolve Training Academy counts its flexibility, particularly the flexibility of its main bridge to run multiple software platforms, as a key plank in its ability to serve a diverse and discerning client base. The Resolve’s Full Mission Ship Simulator can be re-configured in step with a specific company’s needs, and in fact Resolve aspires to incorporate the real equipment controls from the OEMs versus generic controls that come with a specific bridge.

To do this we partner with specific clients to get the equipment and maintenance upgrades, entering an exclusive loop which helps them and their clients, said Mackay.

In addition, we can work with clients to specifically model their past mistakes, allowing the people on the bridge to step into the simulator and live or re-live something that happened in real life.

The Resolve Training Academy features a NT Pro 5000 Class A Full Mission Navigational Simulator with 220 degrees FOV on the main sim and 220 on the bridge wing, a bridge wing which can dock port or starboard.

Resolve in investing in a visual upgrade for the main bridge, a new 1920 x 1200 laser phosphor projection system which is scheduled to be delivered and online toward the end of March 2018.

Photo: Kongsberg Digital

Kongsberg Digital & ‘Simulation as a Service’

At press time Kongsberg Digital signed the British Columbia Institute of Technology (BCIT) as a pilot-customer for the cloud-based application of the K-Sim simulation technology, making BCIT among the first to offer simulation as a service by integrating K-Sim with the new Kognifai digital platform, effectively enabling its students to train anytime and anywhere.

To start, Kongsberg Digital will focus on enabling students at BCIT’s School of Energy to use the K-Sim Engine Thermal Power Plant (TPP) simulator for industrial/utilities engineers, by giving access to the simulator on their own devices. However, the train anytime and anywhere strategy is already set to improve and extend the use of simulation in power engineering training.

“We have been providing distance learning services for many years so appreciate the benefits for both the market and our instructors,” said Brian Buckley, Associate Dean of Industrial and Mechanical Trades, School of Energy at the BCIT Burnaby Campus.

“The Kognifai-based K-Sim Engine Thermal Power Plant simulator represents a digital disruption that we see as benefiting BCIT and our customers, both within our mainstream power engineering programs and our industrial activity out in the field. While distance learning is not new, the ability to run a fully dynamic thermal power plant in real time from the cloud certainly is. In an instant, we now have the ability to extend our classroom beyond the confines of our Burnaby campus for power engineering without instructors needing to leave the premises.”

In addition to the K-Sim Engine TPP, the first maritime engine room simulators will soon be running in the Kognifai cloud environment, extending the K-Sim product offering from traditional classroom and full-mission simulators to include self-study training where students can use their own computers to access high quality, simulation-based courses. With cloud-based training, instructors can assign exercises to students who can complete them anytime and anywhere. The training provider can complement traditional simulator training in the center with training beyond physical confines and opening hours.

The new tool is intended to result in more cost-effective packages for Kongsberg customers while maximizing and creating new revenue streams. Kognifai enables portfolios of exercises to be downloaded and shared within the training organization. Ultimately, this ability to share content will make exercises of higher quality available to the students.

Marcus Högblom, Vice President of Global Sales, Passenger vessels and Azipod propulsion.

ABB

Simulate First

While rightfully much of the maritime simulation talk focuses on training and education matters, ABB's Marcus Högblom, Vice President of Global Sales, Passenger vessels and Azipod propulsion, said that increasingly his company is working with clients to 'build' an electronic version of a vessel in advance, allowing a company's personnel to give the mock ship a test run in a maritime simulator in advance of the start of construction.

Specifically when Viking Line was considering podded propulsion for its new ferry, ABB was able, in its own digital center, to build a digital model of the ship featuring podded propulsion, and subsequently run it in a simulator so that the company's captains could gauge fuel consumption, ship handling and stability characteristics.

"We were able to make a virtual ship and test it, which is pretty cool if you think about it," said Högblom. You can do much more today with digital solutions and simulations, so you don't have to build the whole ship they figure out what went wrong. "This is not the 'norm' today, but it's where we are heading. And it's the smart thing to do."

Transas CEO Frank Coles Holds Court in Vancouver

Photo: Eric Haun

In his keynote at the 2018 Transas Global Conference in Vancouver, B.C., Transas CEO Frank Coles laid out his vision for the maritime industry's future – from **smarter**, **greener** and **safer ships** to a world without freight forwarders.

As has come to be expected from the Transas CEO, Coles did not hesitate to offer a healthy dose of constructive criticism – particularly in the direction of those he identifies as obstructers of industry-wide progress, be it ship owners and operators, class or the IMO.

"Maritime operations and infrastructure thinking seems to change at a snail's pace. We seem to be content to have old-fashioned ships and an old-fashioned business infrastructure sitting alongside modern logistics," Coles said.

Coles acknowledged progress such as the growing use of connectivity and monitoring of data for analytics and performance, for example, but said the "lowest-cost, fragmented-purchase model is sure to result in a weak cyber structure ... **we need to build ships with integrated systems of systems**, **not a mishmash of standalone IoT applications."**

Attitudes need to change, Coles stressed: "Until we change the attitudes to the business and the current maritime culture, technology remains just a patch, not a solution."

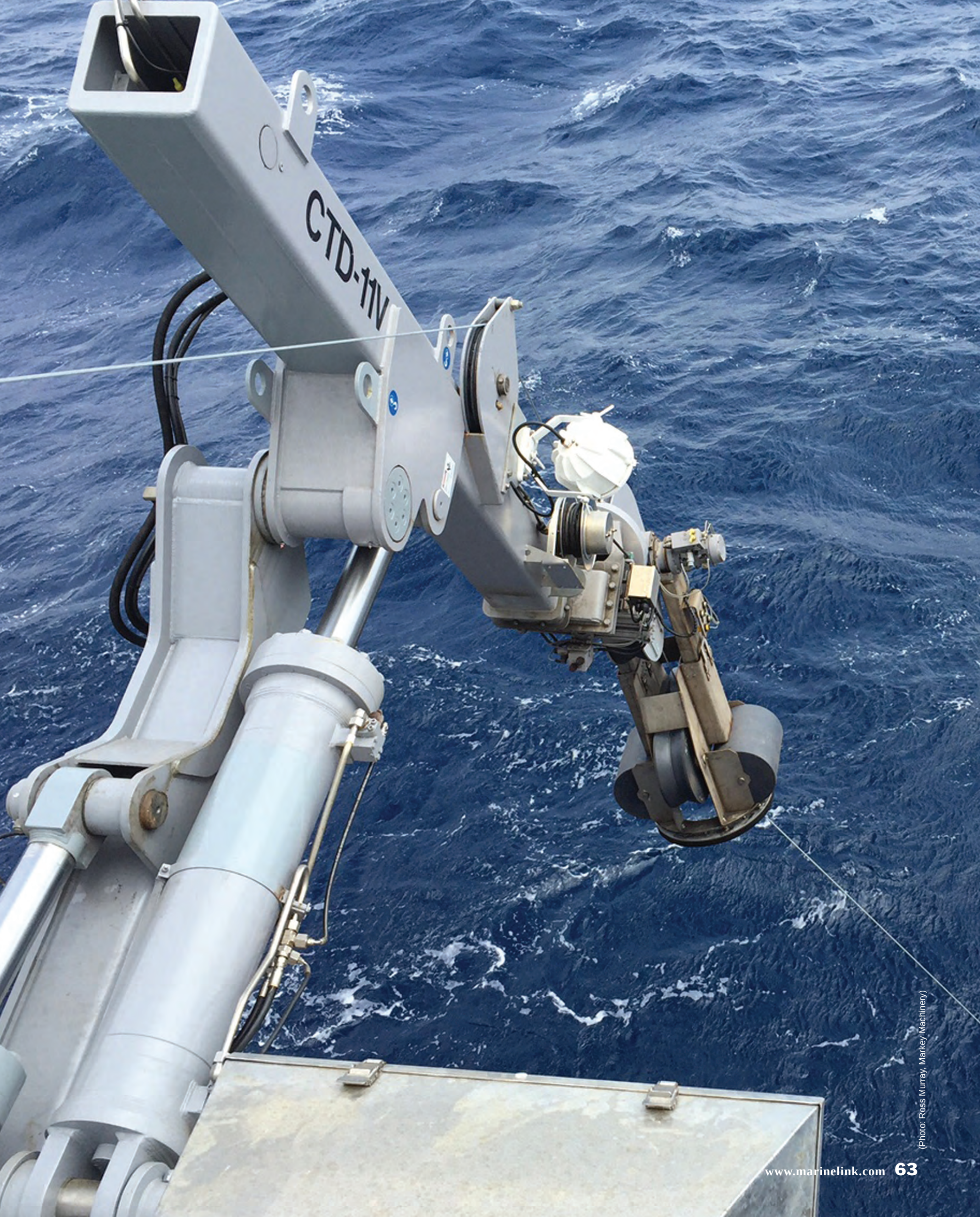
Heavy Duty Machinery

Orders pour in for marine lifting machinery; State-of-the-art equipment installed on vessels and in ports

Edited By Tom Mulligan

In the first of a series of marine industry sector reviews, MR&EN correspondent Tom Mulligan reports on the latest innovations in heavy lifting machinery technology with a selective overview of new product launches and recent equipment installations on board ships, ferries and workboats, as well as in ports, docks, harbors and shipping terminals worldwide.

Allied Marine Crane CTD-11V in action, as part of Markey's 'Oceanographic' offering, on the US Navy research vessel RV Sally Ride.



(Photo: Ross Murray, Markey Machinery)

(Photo courtesy CCCCSH)

The PBES/CCCC Shanghai RTG hybrid battery crane in Shanghai, reducing emissions from port operations.

Markey Machinery

Markey Machinery's Render/Recover and Asymmetric Render/Recover 'active heave' compensating winches have been recognized as a 'best available technology' for teaming with the powerful new tugs being built to serve the shipping industry worldwide. Designed to automatically maintain winch line tension between tug and tow, it allows line to be spooled off if line-pull exceeds a preset tension, with rapid retrieval automatically occurring if the tension drops below that setting. This eliminates sea-state induced 'snap loading' of the tether, a leading cause of line failure, and frees the operator to focus on the agile maneuvering required to guide rapidly transiting tankers, container ships and bulk carriers through restricted waterways.

This same technology is integrated into Markey's 'Oceanographic' offering. Deployed on board several U.S. research vessels, it interconnects handling cranes, docking heads and the research winch sensor network into the Render/Recover control system, thus enabling scientists to safely deploy equipment under a wide range of operating conditions. Designed and manufactured by Markey in collaboration with Systems Interface and Allied Marine, the combined Launch and Recovery System (LARS) and CTD Winch incorporates the Render/Recover system to deploy or land instruments automatically by pressing a single pushbutton, a feature that is unique to Markey systems. The system also automatically reduces winch speed to eliminate potential 'two-blocking' damage and, during deployment, compensates for wave-induced vessel motion to maintain package depth and position stability, reducing 'snap loading' of the wire induced by that motion. In addition, the'flagging fairlead' system reduces wire stresses found in multiple sheave arrangements. The system also eliminates the need to have line handlers leaning over the gunwales attempting to arrest a swinging instrument package, thus greatly reducing the potential for personnel injuries.

Further information: **www.markeymachinery.com**

PBES: Hybrid Battery RTG Crane

Norwegian energy storage specialist PBES has installed and commissioned China's newest hybrid battery rubber tire gantry (RTG) crane in Shanghai in collaboration with China Communications Construction Company (CCCC), the world's largest manufacturer of port container cranes. CCCC's subsidiary, CCCC Shanghai Equipment Engineering Co, Ltd (CCCCSH), carried out the work on behalf of its parent company.

Low-emissions container cranes are part of the global push to reduce the environmental impact of operations. RTG container cranes are particularly well suited to hybridization: however, 24-hour use and rapid cycling combined with very large capacity for producing regenerative power mean that highly robust batteries are required for their operation. Hybrid cranes reduce fuel consumption by hundreds of thousands of liters per year compared to traditional diesel-only versions and are very effective in reducing emissions while at the same time providing significant operational cost savings.

Further information: **www.pbes.com**

Elebia: Automatic Lifting Clamp

Barcelona, Spain-based automatic hook manufacturer Elebia has diversified its product range with the launch of the five-ton (11,023 lb, safety factor 4:1) capacity C5 Automatic Lifting Clamp designed to lift steel plates, beams and pipes in a safe and secure manner. The launch marks the completion of an extensive research and development program centered on developing a safer method for lifting steel plates, specifically at ports. the automatic release lifting clamps are designed to be used with a linear beam and chains, and a tagline can drag them to a desired point. This new product is designed to reduce the need to pick and carry the clamps, thereby making the lifting operation safer, faster and easier, and automation takes over once the clamps are fixed to the load. The C5 combines the safety and security of a clamp with the ease of use and

(Photo courtesy of Elebia Autohooks SUL)

The C5 Automatic Lifting Clamp from Elebia: safe and secure lifting of steel plates, beams and pipes.

The Tandemloc Emergency Gear adapter shoe and swivel: a versatile system for lifting damaged or 'stuck' containers.

(Photo courtesy of Tandemloc, Inc.)

productivity of a claw. Elebia said that the principle advantage of the clamp, as with its range of hooks, is the removal of the requirement for personnel to gain access to rig loads manually.

Further information: **www.elebia.com**

Heila Cranes: Outfilling Polar RV

Heila Cranes has been selected as the supplier of marine cranes for the UK Natural Environment Research Council's new polar research vessel, the Sir David Attenborough, to be operated by the British Antarctic Survery. The contract covers six cranes, all offshore-rated and to be used for various purposes. The Cammell Laird shipyard in Birkenhead, UK is building the polar research vessel, designed for operation in both Antarctica and the Arctic. Operation of the vessel is expected to commence next year. The delivery by Heila of the main crane, a HR 2050/35-2BJ model, is expected shortly. The crane is already positioned in the testing area and is ready for pre-commissioning and Heila will ship it to the Cammel Laird shipyard in separate sub-assemblies. In addition, two HLRM 170-4SL cranes are ready for final assembly, and delivery of the remaining cranes will follow during the first half of this year. An additional seventh landing craft crane was recently added to the original contract. Heila has delivered an HLM 10-2S crane for harbor use to UK firm Exeter Fabrication which is building a landing craft also intended for use on the Sir David Attenborough polar research vessel. Details of the supply contract are as follows (all offshore rated unless noted.

- One main crane, model HR 2050/35-2BJ
- Two research cranes, model HLRM 170-4SL
- One provisions crane, model HR 200/16-2BJ
- One port-side deck service crane, model HLRM 170-4SL
- One starboard-side deck service crane, model HR 300/21-2BJ
- One landing craft crane, model HLM 10-2S, for harbor use, not offshore-rated

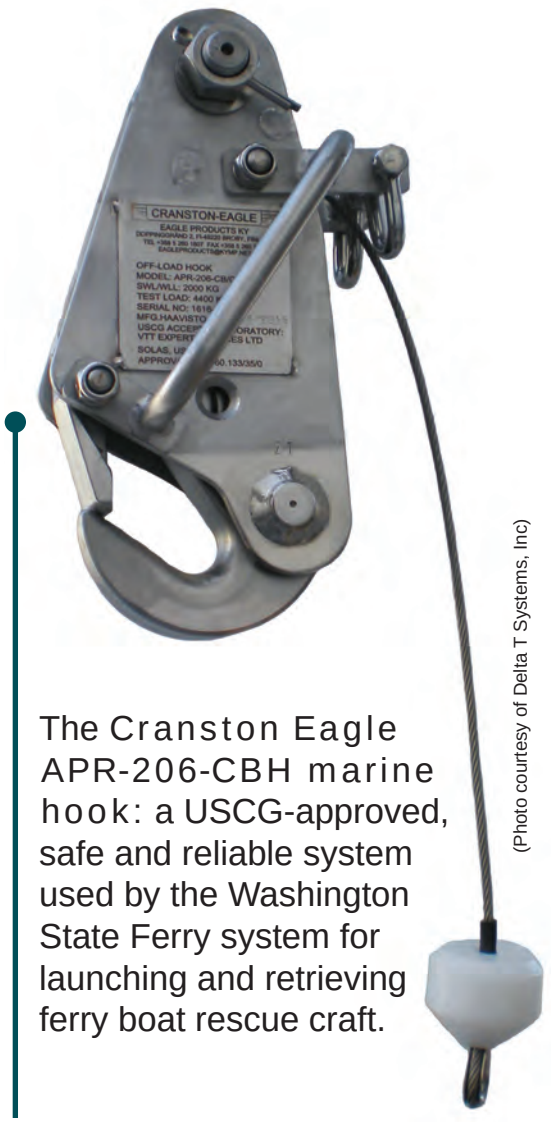
Further information: **www.heila.com**

Marine Hooks to WSF System

The Washington State Ferry system, the largest ferry system in the US and the fourth-largest in the world, runs 10 routes serving 20 terminals located in the San Juan Islands and around Puget Sound, currently operating a total of 23 ferries, all of which use Cranston Eagle APR-206-CBH marine off-load hooks to launch and retrieve rescue craft. These marine hooks are very robust and reliable and have been serving the Washington State Ferry fleet for more than a decade. The Cranston Eagle APR-206-CBH hook is USCG-approved and is rated to lift two tonnes with a safety factor of six times that load. The stainless steel construction features a simple and safe lock-pin design that will only open when there is no load on the hook and the rescue craft is fully at rest in the water. Cranston Eagle hooks are widely used throughout several maritime sectors including commercial marine, offshore oil and gas, and oceanographic vessels.

They are also used extensively by the United States Coast Guard and the United States Navy because of their reliability and readily-available product support. The Cranston Eagle line of cable- and boat-mounted hooks is distributed in the US by Delta T Systems, which provides sales, service, parts, load testing and recertification services for these products. Delta T Systems is an agent for Finland-based hook manufacturer Eagle Products Ky.

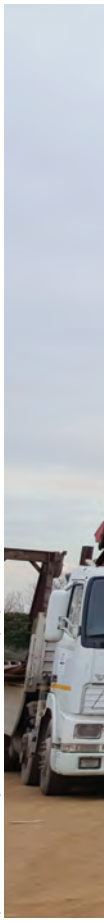
Further information: **www.deltatsystems.com**



The Cranston Eagle APR-206-CBH marine hook: a USCG-approved, safe and reliable system used by the Washington State Ferry system for launching and retrieving ferry boat rescue craft.

(Photo courtesy of Delta T Systems, Inc)

(Photo courtesy of Roll Group)



(Photo courtesy of Heila Cranes SpA)

RollDock Shipping: sophisticated loading/unloading systems for wind turbine component transportation.

ZPMC: Container cranes and RTGs

Dongbang Shipping and the company's subcontractor Engineered Heavy Services have delivered two ZPMC ship-to-shore container cranes weighing about 1,600 tons each, and of six rubber tired gantry cranes to the SSA terminal in Manzanillo, Mexico from Long Beach, California. Engineering, sea fastenings, loading and unloading equipment on board the Dongbang Shipping delivery vessel were provided by EHS and the operation was completed by the company's personnel. This international project involved specialist staff from the U.S., Panama, Korea, Singapore, Mexico and Malaysia. The sea fastenings, primarily provided by EHS, included an erector set of equipment from EHS's sister company Nordholm Rentals, much of this equipment being sourced from a recently completed project in Long Beach. Bracing, loading and sea-fastening of the STS machines was completed in a very short period of only 14 days and employed a crane-moving system that was developed specially to provide maximum flexibility and deal with all types of docks and cranes, including weak docks.

https://engineeredheavyservices.com

RollDock Shipping Tech

RollDock Shipping recently transported 66 transition pieces to be used in the construction of a large German wind farm from Aviles, Spain to Eemshaven, The Netherlands in a shipping project that represented a major challenge as the components are 'pushing the envelope' because of the cargo weight, the lifting capacity of one crane and the available dock space, all of which needed to be utilized to the maximum. The transition pieces serve as a connection between the wind turbine and the base that is anchored to the seabed. RollDock was employed by Coordinadora Internacional de Cargas, which was responsible for the logistical part of the project, to take care of the transportation by sea of the 66 transition pieces in a vertica manner, representing a logistical challenge due to their 330-ton weight and 27.9-meter height. The company owns five dock-type vessels, all of which have the choice of three loading modes: RoRo, float-in/float-out and LoLo.

Two on-board cranes of 350 tons each were used to load and discharge all of the transition pieces using specialized equipment and keeping the rigging height as short as possible. Conventional sea fastening methods were deemed unsuitable for the safe transportation of the cargo, so a custom-made grillage design was devised by Coordinadora Internacional de Cargas in collaboration with RollDock to enable rapid turnaround times in port.

To date, 34 transition pieces have been transported from Aviles to Eemshaven in five shipments. RollDock expects to transport the remaing 32 pieces in four more shipments over the next two months to support construction of the German wind farm which is expected to be operational by the end of 2019.

Further information: **www.roll-group.com**

Delivery of the HR 2050/35-2BJ main crane from Heila Cranes to be installed on the polar research vessel Sir David Attenborough is expected shortly.

(Photo supplied by HS.MARINE/Damen Shipyard)

The custom-designed renewable service vessel Voe Vanguard is capable of servicing not only wind farms but also a wide range of other activities with its HS.MARINE-supplied combined knuckle and telescopic boom cranes.

Tandemloc: Emergency Gear

Lifting equipment specialist Tandemloc's 'Emergency Gear' is a versatile lifting system that consists of an adapter shoe with swivel, a sling pendant and a top lift lug that can be used to lift damaged or 'stuck' containers. Despite the many precautions and advances made in the container cargo handling industry, accidents still happen and cargo containers shift or receive damage during their transportation which can make it very difficult for spreader lifting frames to safely remove the damaged or stuck container from the transportation vehicle.

Tandemloc's Emergency Gear is designed to assist the spreader frame when container removal becomes more complex than usual. Used as an accessory attachment to a spreader frame's bayonets, the Emergency Gear's shoe swivels and provides the end-user with a 22,000 lb capacity or 88,000 lb maximum when four shoes are used with a spreader rated for such a load. Simple-to-use top lift lugs are inserted into the top corner fitting's top aperture, the swivel eye allows for a variety of sling pendants to be attached, and the shoe is locked onto the spreader frame's bayonets, making what was once a difficult and potentially unsafe lift much easier and significantly safer.

Further information: **www.tandemloc.com**

Vestdavit: Delivering for NOAA

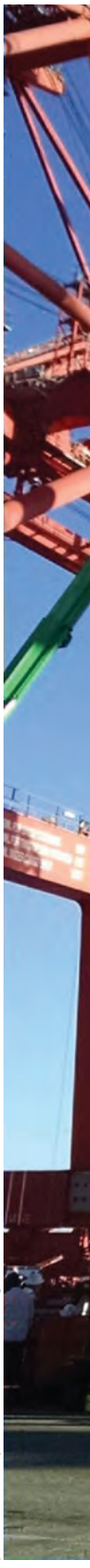
Vestdavit, Inc., the U.S. subsidiary of Norwegian davit manufacturer Vestdavit AS, delivered two of the company's HN-9000 davit systems to the U.S. National Oceanic and Atmospheric Administration ship Thomas Jefferson based out of Norfolk, Virginia. The HN-9000 is a hydraulically operated dual-point davit with a 9,000 kg SWL and the two davits are being used to launch and recover two 28' hydrographic survey launches. When out on a mission, the NOAA often needs to operate survey launches on a daily basis, which means that the davits are essential equipment that support the ship's mission.

The HN-9000 davits are designed to be able to launch and recover boats in very rough weather up to sea state 6. This is accomplished by a variety of safety features in the davit design, including dual independent winches with independent constant tension. Each davit arm is outfitted with a shock absorber, which eliminates up to 80 percent of peak loads from the davit, the deck and the survey launch, resulting in a much smoother ride in the davit. Two guiding arms on the davit act as anti-pendulum devices and stabilize the survey launch during the launch and recovery process. The davit is controlled by a PLC that enables it to be operated with pre-programmed sequences, allowing the davit operator to focus attention on the boat and its crew. The davit is operated by only one person.

Vestdavit delivered its first davit system to the NOAA in 1995 and now has 20 davits in operation with the agency spread out over several ships, the HN-9000 being the most advanced davit in use in the

(Photo courtesy of Roll Group)

The two new Liebherr mobile harbor cranes LHM 420 will be mainly used for tandem lifts at the port of Emden, Germany.



(Photo courtesy of Nordholm Rentals)

NOAA fleet.

Further information: **www.vestdavit.no**

H.S. Marine Meets Green Challenge

With the increasing demand of the marine market for deck cranes that operate in an environmentally acceptable manner, lifting equipment manufacturers need to supply a 'Green Passport' and an inventory of hazardous materials with each piece of machinery. However, nowadays these documents are not enough: the most challenging request in today's marine industry is for a crane that operates using environmentally acceptable lubricants (EALs). Unfortunately, many EALs, even those declared as equivalent to common mineral oils, are much more aggressive against various types of components such as hoses, seals, painted surfaces and brakes, as well as to many others sensitive to biodegradable oils.

With a focus on reliability, HS.MARINE has responded to this 'green challenge' with a scientific approach: after having identified the critical crane components, a company research team working in close cooperation with suppliers of components and lubricants has established acceptable criteria for deformation and corrosion that ensure an acceptable lifespan for each crane component. As a result, all of the company's standard crane designs have been revised by replacing those components that were found to be much too sensitive to the potentially damaging effects of biodegradable lubricants. This means that HS.MARINE is now able to supply standard cranes that operate using a range of EALs without there being any concerns about compatibility issues.

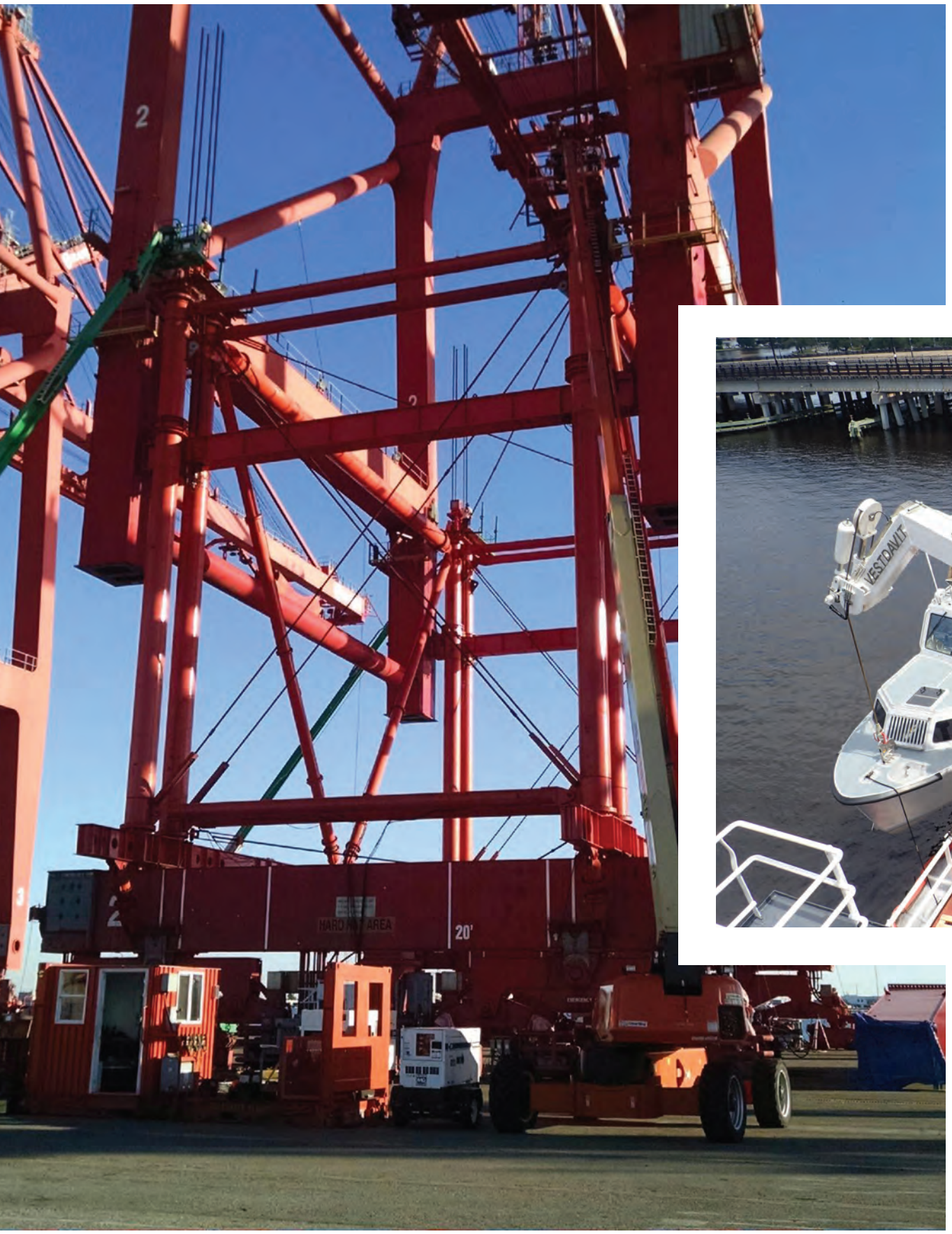
In 2017, UK shipowner Delta Marine took delivery of a new DP2 renewables service vessel, the custom-designed type RSV3315 Voe Vanguard to service not only wind farms but also a wide range of other activities, as HS.MARINE supplied the ship with two large combined knuckle and telescopic boom cranes capable of supporting a multitude of operations: a model AKC 550 HE3, with a lifting capacity of SWL 14950 kg on a working radius of 20 meters, and its smaller sister model, the AKC 370 HE3, which has a lifting capacity of SWL 9100 kg on a working radius of 21 meters.

Built to specifications with environmental considerations in mind, the vessel meets strict requirements in terms of environmental impact. Each crane was supplied with its Green Passport and a complete inventory of its hazardous materials and, in the most challenging part of the supply agreement, the cranes were constructed to satisfy operational requirements pertaining to the use of EALs, in particular the most common problem related to the use of biodegradable oils: a reduction in the lifespan of hydraulic components and seals.

Further information: **www.hsmarine.net**

Nordholm Rentals: New Cranes for Long Beach

Raising activities for six units of ZPMC STS container cranes were recently finished for US West Coast marine terminal and stevedore operator Total Terminals International (TTI) in Long Beach, California. The crane-raise system, constructed from Nordholm Rentals' 'erector set' equipment, is capable of lifting loads up to 2,000 tons and of withstanding 70 mph winds with the crane in its raised position without added bracing. This easy-erection system is capable of being moved from crane to crane without disassembly. Construction work for the project was managed



Six ZPMC STS container cranes have been raised for Total Terminals International at the company's Long Beach, California terminal using moving and lifting systems from Nordholm Rentals.

(Photo courtesy of Vestdavit)

The HN-9000 davit from Vestdavit: a hydraulically-operated dual-point davit with a 9,000 kg SWL.

by PCMC with system operation under the control of Nordholm Rentals personnel. The average raise time for the cranes was four hours.

The cranes were manufactured in China from modification steel supplied by another Chinese company: Liftech was responsible for modification engineering and Nordholm Rentals was in charge of the raise-and-move engineering aspect of the project.

The Long Beach terminal was jointly owned by Hanjin, which went bankrupt in mid-project. Funding, however, had already been set aside and the project was supported by the remaining owners, primarily Mediterranean Shipping Corporation.

https://nordholmrentals.com

Liebherr: High Performance Twins

German port handling company EPAS earlier this year received two new Liebherr mobile harbor cranes type LHM 420. Both cranes together can handle up to 248 tons in tandem lift operation. The two devices will further improve the logistic process at the Nordkai terminal in Emden, Germany.

To further increase the turnover capacity, the German port company invested in high-end mobile harbor crane technology from Liebherr. End of 2017 EPAS received two new Liebherr machines, type LHM 420, from the Liebherr maritime headquarter in Rostock, Germany. Each crane has a maximum lifting capacity of 124 tons at an outreach of up to 18 meters

This investment will significantly improve the logistic processes at the Nordkai terminal in Emden. The main driver in the decision process was the capability to do twin lift operation.

Liebherr convinced with its synchronized lifting assist system Sycratronic. The system makes it possible to operate two Liebherr cranes in tandem mode. A crane operator controls the movement of both machines that are electronically synchronized.

Further information: **www.liebherr.com**

Why we test for Drugs & Alcohol

Is chemical drug and alcohol testing of commercial vessel personnel effective?

By Walter J. Brudzinski

In 1988, the Coast Guard implemented chemical testing to discourage drug and alcohol use by commercial vessel personnel, reduce the potential for marine casualties related to drug and alcohol use, and enhance the safety of the maritime transportation industry.

While the Coast Guard has been collecting data on drug testing results for more than 20 years, there have not been any studies on the effectiveness of chemical testing in meeting stated goals.

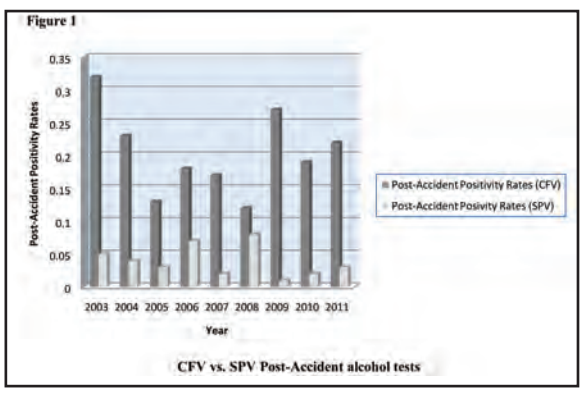
To determine the extent chemical testing achieves these goals, Post-Accident drug and alcohol test results of crewmembers from two vessel categories were compared. The first vessel category consists of minimally regulated commercial fishing vessels (CFVs) with no crewmember chemical testing requirements except for Post-Accident drugs and alcohol. The second category consists of highly regulated small passenger vessels (SPVs) of 100 tons or less with comprehensive crewmember chemical testing requirements. The drug test results that marine employers submit to the Coast Guard each year, 2003-2011, were also compared.

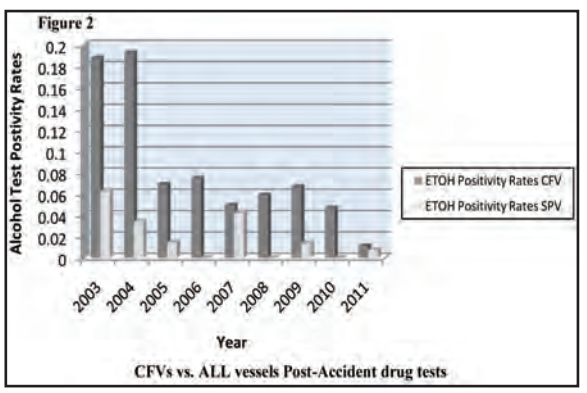
Comparing Post-Accident drug and alcohol positivity rates between crewmembers of the above vessel categories, Post-Accident drug and alcohol positive tests per serious marine incident (SMI) between crewmembers of each vessel category, and Random versus Post-Accident drug test positivity rates from all commercial vessel personnel subject to comprehensive chemical testing as reported by their employers, crewmembers on small passenger vessels were found to have had much lower Post-Accident drug and alcohol positive test results than crewmembers on commercial fishing vessels. Chemical drug and alcohol testing therefore appears to have achieved its goals at least to the extent of the data analyzed in this study.

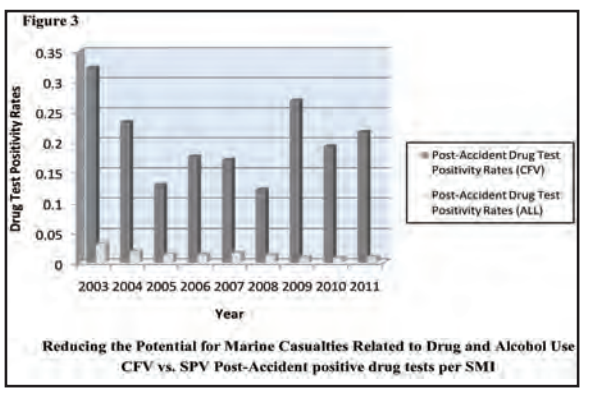
Methods

U.S. Documented small passenger vessel (SPV) crewmembers in safety sensitive positions are subject to chemical testing as well as credentialing or licensing requirements. SPVs are also subject to inspection and are the most regulated of all U.S. Documented vessels. Conversely, U.S. Documented commercial fishing vessels (CFVs) are subject to the least amount of Coast Guard regulation. For example, they are subject to safety inspections such as firefighting and lifesaving equipment, but are not subject to vessel inspection. CFV crewmembers are not subject to Coast Guard credentialing or licensing requirements; they have no limits on the time they are on duty; and, they are not required to pass a Pre-Employment chemical test or be subject to subsequent Random or Reasonable Cause testing. They are, however, subject to Post-Accident drug and alcohol testing so they present a perfect contrast to SPV crewmembers for comparison.

To determine if the test results between the two vessel types were statistically significant; the two-proportion z-test was used. Yearly and total, overall differences in positivity rates and positive tests per SMI between CFVs and SPVs were compared. The level of significance used for those tests was equal to or less than 0.05, giving less than 5% likelihood the results were due to chance. Linear regression and correlation were used to examine the relationship between Post-Accident drug test positivity rates and Random drug test positivity rates from all vessels with crewmembers subject to chemical testing.







CFV vs. SPV Post-Accident Positive drug tests

To determine the extent chemical testing has discouraged drug use by commercial vessel personnel, Figure 1 compares Post-Accident verified positives for one or more drugs between CFVs and SPVs from 2003-2011. Each year, the positivity rates of CFVs are higher than the positivity rates of SPVs by at least 32% and as much as 96%. SPV crewmembers averaged 77% fewer positive drug tests than CFV crewmembers. Overall, the probability that Post-Accident drug test positivity rates between CFV crewmembers and SPV crewmembers was due to chance is much less than five percent and thus statistically significant.

CFV vs. SPV Post-Accident alcohol tests

Figure 2 compares Post-Accident alcohol test positivity rates between CFV and SPV crewmembers. Despite some expected year to year variation, all of the Post-Accident alcohol test positivity rates of SPVs were lower than CFVs by at least 14% and as much as 100%. SPV crewmembers averaged 73% fewer positive alcohol tests than CFV crewmembers. Overall, the probability that Post-Accident alcohol test positivity rates between CFV crewmembers and SPV crewmembers was due to chance is less than 5 percent and thus statistically significant.

CFVs vs. ALL vessels Post-Accident drug tests

Figure 3 compares Post-Accident verified positives for one or more drugs between CFVs and ALL vessels with crewmembers subject to comprehensive chemical testing from 2003-2011. Recall from Figure 1 that Post-Accident drug test positivity rates of SPV crewmembers subject to chemical testing were much lower than drug test positivity rates of CFV crewmembers not otherwise subject to chemical testing. The differences were even greater when CFV crewmembers' positivity rates are compared to crewmembers of ALL vessels with crewmembers subject to comprehensive chemical testing. Post-Accident positivity rates of crewmembers subject to chemical testing from ALL vessels were at least 89% lower and as much as 97% lower than Post-Accident positivity rates of CFV crewmembers. Crewmembers from ALL vessels averaged 92% fewer Post-Accident positive drug tests than CFV crewmembers. Overall, the probability that Post-Accident drug test positivity rates between CFV crewmembers and ALL crewmembers was due to chance is much less than five percent and thus statistically significant.

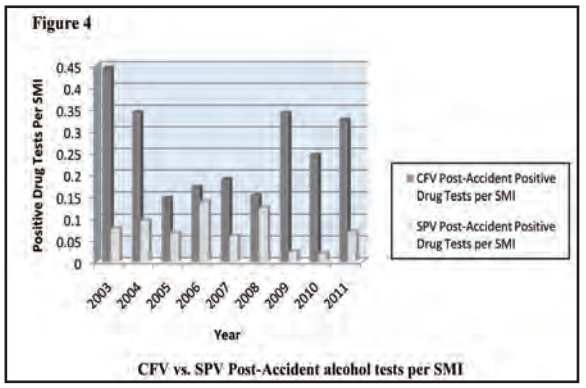
CFV vs. SPV Post-Accident positive drug tests per SMI

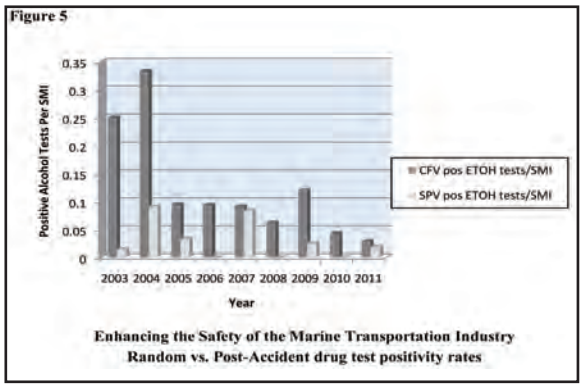
In response to whether chemical testing reduces the potential for marine casualties related to drug and alcohol use, Post-Accident positive drug tests were compared to the yearly 2003-2011 SMIs in which drug tests are reported. Comparisons were performed in the same manner as those presentedabove except they are per-incident instead of per-person and include only SMIs in which drug tests are reported. As shown in Figure 4, SPV Post-Accident positive drug tests per SMI are much lower than CFV Post-Accident positive drug tests per SMI by at least 17% and as much as93%. SPVs Post-Accident positive drug tests per SMI averaged 64% lower than CFV Post-Accident positive drug tests per SMI. Overall, the probability that the differences between SPV and CFV Post-Accident positive drug tests per SMI was due to chance is much less than five percent and thus statistically significant.

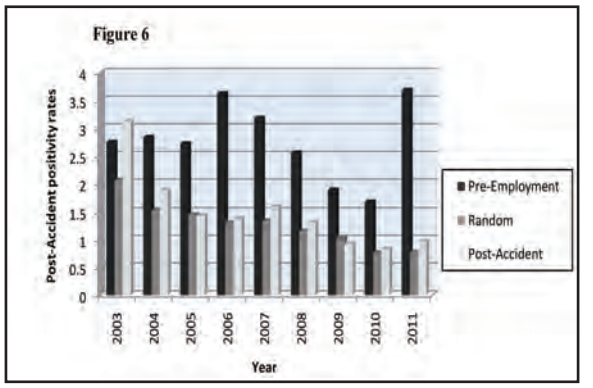
CFV vs. SPV Post-Accident alcohol tests per SMI

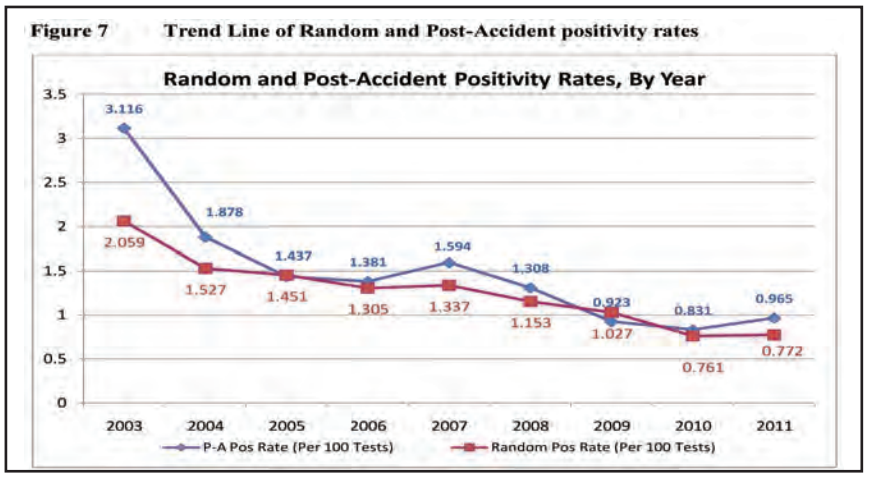
In further response to whether chemical testing reduces the potential for marine casualties related to drug and alcohol use, Post-Accident positive alcohol tests were compared to the yearly 2003-2011 SMIs in which alcohol tests were reported. As shown in Figure 5, SPV positive alcohol tests per SMI were much lower than CFV positive alcohol tests per SMI by at least 8% and as much as 100%. SPV Post-Accident positive alcohol tests per SMI averaged 73% lower than CFV Post-Accident positive alcohol tests per SMI.

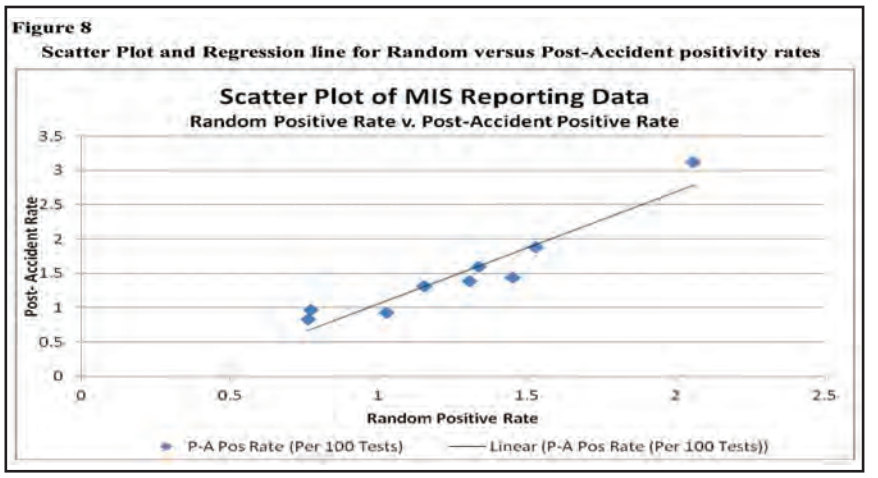
As with year to year variations in alcohol test results in previous comparisons, similar variations exist here. Two factors are known to contribute to these variations. The first factor is the two hour time period in which alcohol tests must be ordered. This time limitation will leave out many instances in which tests ought to have been ordered but were not due to the remoteness of the vessel's location, especially commercial fishing vessels that ordinarily operate farther offshore than small











passenger vessels. The second factor is the relatively small number of tests which could cause wide swings in the percentages of positive tests per serious marine incident. Even with these factors, the ratio of positive alcohol tests per serious marine incident consistently shows crewmembers of small passenger vessels test positive for alcohol less than crewmembers of commercial fishing vessels. Overall, the probability that the differences between SPV and CFV Post-Accident positive alcohol tests per SMI was due to chance is much less than five percent and thus statistically significant.

Random vs. Post-Accident drug test positivity rates

Figure 6 shows yearly 2003-2011Pre-Employment, Random, and Post-Accident Random drug test positivity rates from ALL vessels with crewmembers subject to chemical testing as reported by their employers.

Crewmembers not passing a Pre-Employment chemical test for dangerous drugs are not hired and thus not subject to further comprehensive chemical testing. Pre-Employment positivity rates therefore do not directly affect Random or Post-Accident positivity rates; however, the differences in positivity rates between Pre-Employment and Random as well as between Pre-Employment and Post-Accident are startling. The data appear to show the Pre-Employment drug test eliminates those persons whose drug use would appear to be so much a part of their lives that they are unable to suspend it sufficiently long enough to pass a drug test even with advance notice. Random and Post-Accident positivity rates also appear to have a gradually decreasing trend as shown graphically in Figure 7.

Examining annual drug test results marine employers submit to the Coast Guard, random drug test results represent at least 53% and as much as 63.6% of crewmembers eligible for testing. This represents more than a mere sampling of crewmembers subject to Random drug tests; therefore, the trend as shown in Figure 7 is fairly representative of the crewmember population. Figure 8 shows Random and Post-Accident positivity rates in a scatter plot with a regression line.

The scatter plot and regression line show that within the range of values for which there is data (2003-2011), there is a very straight linear relationship between Random and Post-Accident positivity rates.

Statistically, this linear relationship has a near perfect correlation coefficient of 0.9464. Beyond the shown data points, the line may no longer be linear and no predictions are made of Post-Accident positivity rates based on Random positivity rates that are not part of the data. It is sufficient to conclude that decreasing Random positivity rates have, on the average, predicted decreasing Post-Accident positivity rates at least from 2003-2011. On vessels where comprehensive chemical testing is required, lower Random positivity rates result in fewer serious marine incidents with drug involvement, thereby enhancing the safety of the maritime transportation industry.

Conclusion

Chemical testing appears to have discouraged drug and alcohol use. Analysis of 2003-2011 Post-Accident data showed positivity rates from small passenger vessel crewmembers subject to comprehensive chemical testing to be significantly lower than those from commercial fishing vessels not subject to comprehensive chemical testing. Put another way, there is less likely to be drug and alcohol use in the more highly regulated segments of the maritime industry. Further, chemical testing also appears to have reduced the potential for marine casualties related to drug and alcohol use. Again, the 2003-2011 data showed the SPV group had significantly fewer Post-Accident positive drug and alcohol tests per SMI than CFVs. Finally, chemical testing appears to have enhanced the safety of the maritime transportation industry. The 2003-2011 data showed Random positivity rates are fairly accurate predictors of Post-Accident positivity rates among those vessels with comprehensive drug testing requirements.

About the Author

Walter J. Brudzinski is Chief Administrative Law Judge, U.S. Coast Guard. B.A. University of Maryland; J.D. George Mason University (with distinction); Master's and Ph.D. in Judicial Studies, University of Nevada.

Author's Note

The views are those of the author and do not necessarily reflect the views of DHS, the Coast Guard or its leadership, or the Office of Chief Administrative Law Judge. The author expresses appreciation to Captain David S. Fish, USCG Ret., former Chief, Office of Investigations and Casualty Analysis and his staff for their suggestions and assistance, especially Mr. David H. Dickey and Mr. Robert C. Schoening.

Editor's Note

This article originally appeared in the Maritime Professional Q3 2013. It was based on post-accident drug and alcohol testing results from 2003 through 2011. Nine consecutive years of data used to calculate statistically significant differences in drug and alcohol positivity rates between compared categories created a high degree of confidence in the results. Absent significant changes in future drug and alcohol testing requirements, it is unlikely updated data would change the findings and conclusions.

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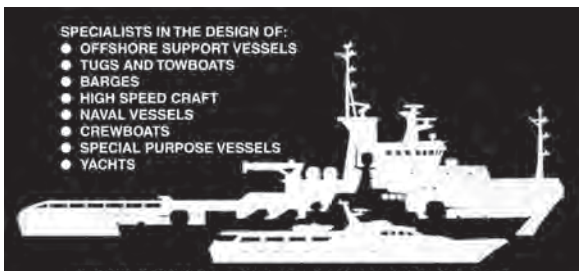

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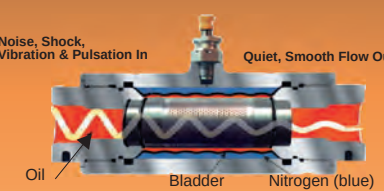

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