January 2023

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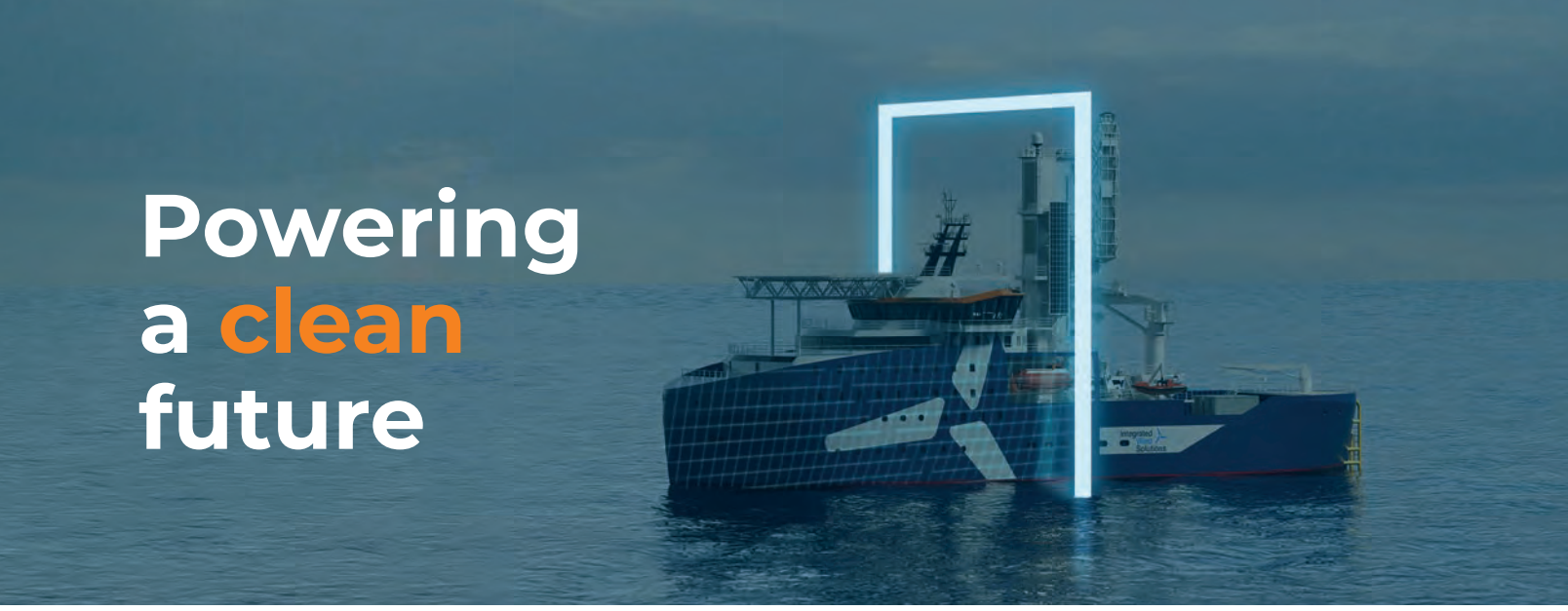
Photo on the Cover: GLDD hopper dredge Galveston Island launch. Photo courtesy Conrad Shipyard and Berard

Photo this Page: DDG 125 launch. Credit: Heger Dry Dock



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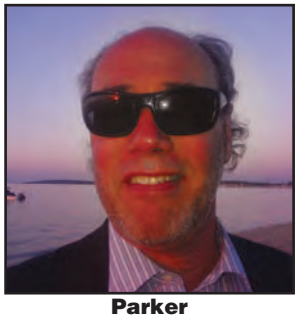

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I must admit that the two+ year hiatus from business travel due to COVID was a most welcome break, particularly as I personally have crisscrossed the globe many times in nearly 30 years of business travel beforehand. But as we got back out and about in 2022, the value of the in-person meeting was highlighted time and again, none more so than this January 2023 edition. Don't get me wrong, as an organization we look at the physical travel aspect of our business through a different lens today than we did in late 2019, as there are undeniable efficiencies in using TEAMS and ZOOM as a means to augment. But it's those chance meetings that simply cannot be replicated in the online environment.

That scenario played out on the sideline of the one-day ABS Offshore Wind Conference in New Orleans in December, when during a break between presentations I was talking to a long-time friend and I met **Tim Clerc**, VP Engineering, Seacor Marine. I, of course, have known the Seacor brand from its earliest days, but I had not personally known Clerc until December 2022. Via a conversation that lasted less than 10 minutes, I learned a good deal about Seacor's mission to transform its fleet to hybrid, with it's 10th vessel in the works now. Following up a few days later, Clerc granted an interview just before the holiday shutdown, and starting on page 14 is our interview, as Clerc who shares with MR his organization's experience – and best advice – on taking the hybrid leap.

The power of the personal meet was apparent again the following week on a trip to Denmark and Sweden, the impetus of which was to visit with leadership at the World Maritime University for the signing of our second 5-year MOU to produce the annual MarTID survey of global maritime training practices. To make the 3000+ mile trek even more productive, I stayed in the area for the week to pop in on some key organizations and executives in the region. While you'll see the fruition of those visits in coming edition, my visit with MAN Energy Solutions and **Bjarne Foldager** at its Copenhagen location was most fortuitous.

I, like most of you, live online, on email and on the phone, and the flow of information is staggering and growing. I've likely read dozens of times regarding MAN ES' efforts on ammonia engines. But there is nothing like standing outside the MAN ES R&D Center on a freezing December day to witness the final touches being put on the ammonia test tank apparatus, then stepping inside and atop the actual test engine itself, eventually returning to the MAN ES meeting room and discovering that – by power – more than 54% of the MAN ES two-stroke engines ordered in 2022 are dual fuel.

While the 'future fuel' debate in maritime will continue to rage for many years, the movement toward cleaner, greener fuels is here and now. Turn to page 18 for more insights on how MAN ES, the world two-stroke leader, is developing its engines today for a methane and ammonia fuel future.

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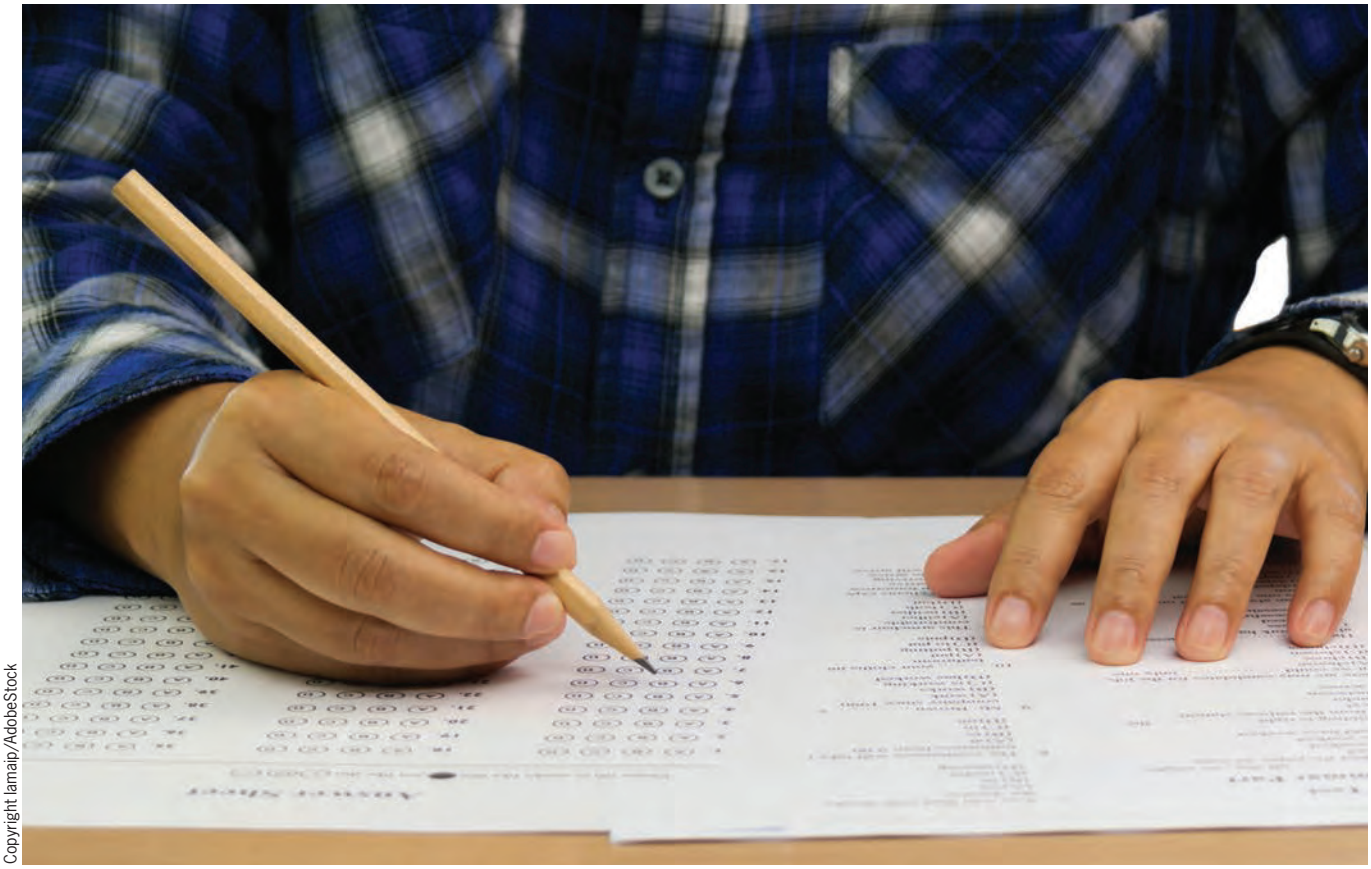
Tip #43

Testing ... *What's the Point?* (Part II)



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In the previous edition of *Training Tips for Ships,* we made the point that assessment can never tell us whether a candidate has all the knowledge required for a role or is able to perform the skills necessary under all conditions. Instead, assessment is essentially an audit or sampling process whereby we test a subset of skills or knowledge in the hope that what we learn about that subset can be extrapolated to all the required knowledge and skills. Understanding this core truth about assessment creates a number of implications about how we need to train and test for optimal performance. Let's discuss some of them here.

One critical implication is that since we are not testing everything, we had better ensure that learners do not use knowledge of that fact to study only what they expect to be tested. Said another way, one core value of testing is the incentive it can create for the trainee to learn as well as they can and as much as they can. If they want to pass the test and they have no idea what is going to be on that test (i.e. they don't know what items will be "sampled"), then they have no choice but to study everything equally. This is the goal we are trying to achieve - motivation to study as well and broadly as possible. If this is done, then learning is improved, and assessors can generally extrapolate the test results to those parts of the curriculum that were not explicitly tested - which is good.

Understanding this, we have to be very careful about our assessment practices because it is easy to "break" the audit

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effect, removing the motivation to study broadly and rendering useless any conclusions about those items we did not test. There are many common testing practices that break the audit effect entirely.

One such example is giving the same test to multiple learners. Doing so will create an incentive in them to share the test details, removing their incentive to study broadly and our ability to extrapolate. The end result is they know less, and we know less about what they know.

Another great way to break the audit effect is to allow for exams to be "open book". An open book exam will provide you with information about whether the candidate was able to find the answers to the questions on the exam (and may even teach him or her the answers in the process), but will provide no information about knowledge and skills not present on the exam. The only valid reason to give open book exams is to test the candidate's ability to successfully find information - so if that is your goal, they can be a good choice.

A third example of how to break the audit process is to allow repeated taking of an exam, especially with little or no required time interval in between. Efficient trainees will quickly determine that the fastest way to pass the exam is to take it over and over until they manage to achieve a passing score. Many can and will do this without ever studying the materials. As in the cases above, they will learn very little in the process, and our test results will tell us almost nothing of their readiness to perform.

Testing is a critical part of the training process. Sadly, it is easy to get it wrong. However, it is also easy to get it right - so long as there is a good understanding of what testing actually is. Knowing that testing is necessarily the process of sampling knowledge and skills makes it easy to make intelligent choices when designing and delivering your testing program.

There is more to be said on assessment and we will do so in future Training Tips for Ships. Until then, keep well and sail safely.

NAVY BUILDS UP ADDITIVE MANUFACTURING ON SHIPS

By Edward Lundquist

The U.S. Navy has long valued the potential of additive manufacturing (AM) and 3D Printing.

AM refers to the depositing of material layer by layer to create an object. For the Navy, it's not practical to carry every replacement part for every system on a ship, and it can be difficult to forecast if or when parts will fail. AM provides a flexible source of supply in being able to make parts instead of ordering them and waiting for them to arrive, especially for warships at the far end of the supply chain. Printing repair parts on demand can save time, lower costs and reduce the need to carry extensive parts inventories.

While there are many things one can do with AM, such as rapid prototyping, the holy grail has been the ability to fabricate parts at sea to repair things quickly. Imagine not having to carry multiple spare parts for every piece of equipment, or having to rely on a lengthy supply chain to get urgently needed parts from a supply depot.

Desktop 3D printers are widely available, starting at about $300 for a home system. Many ships have 3D printers that make relatively small plastic parts.

"We've been using polymer plastic printers on ships and submarines for several years, but they are essentially desktop

U.S. Navy photo by Chief Mass Communication Specialist Ace Rheaume

units that make relatively small plastic parts. The feedback we were getting from the fleet is that they need larger metal parts," said Jim Pluta, additive manufacturing (AM) program manager at Naval Sea Systems Command (NAVSEA).

Now the Navy has installed two different kinds of metal 3D printers on Navy ships, with an aluminum system on the west coast, and a stainless steel system on the east coast.

A Xerox Elem Additive Solutions ElemX liquid metal 3D printer was delivered in a container aboard USS Essex (LHD 2) in July 2022, becoming the first metal additive manufacturing machine installed on a U.S. naval vessel. The ElemX printer is modular, and after operating aboard Essex during the RIMPAC 2022 multi-national fleet exercise last summer, the CONEX box was transferred to USS Boxer (LHD 4) to continue the evaluation.

The ElemX printer was a collaboration with Commander Naval Surface Force Pacific (CNSP) and NAVSEA leveraging the Naval Postgraduate School (NPS) cooperative research and development agreement (CRADA) with Xerox, which is a powerful tool to partner quickly for win/win applied research. "The ElemX effort not only demonstrated the technology in shipboard research use cases, but created a self-contained, mobile 3D metal printshop by outfitting a common shipping container that can be put on any ship, or plugged into any power source, such as a field generator so Marines can also have that capability," said Capt. Jeremy Gray, NPS Surface Warfare Chair for CNSP.

On the east coast, a Phillips Hybrid Additive Manufacturing system arrived aboard USS Bataan (LHD 5). The Bataan project is intended to be a permanent fixture on the ship.

The Bataan's equipment, installed under a joint effort between Commander, Naval Surface Force Atlantic and Naval Sea Systems Command (NAVSEA) Technology Office, and supported in design and execution by Johns Hopkins Applied Physics Laboratory, includes the Phillips Additive Hybrid system, which integrates a Meltio3D laser metal wire deposition tool head on a Haas TM-1 computer numerical control (CNC) three-axis mill.

While both are metal printers, the ElemX platform employs a fundamentally different AM process than the Philips Additive Hybrid system on Bataan. The ElemX printer makes aluminum parts, while the Phillips system uses 316 stainless steel. The ElemX uses a molten metal droplet deposition,

Wasp-class amphibious assault ship USS Essex (LHD 2) onloads a 3D printer during Rim of the Pacific (RIMPAC) 2022, July 8, 2022.

U.S. Navy photo by Mass Communication Specialist 3rd Class Bradley Rickard

Machinery Repairman 1st Class Cory Hover, leading petty officer for the Wasp-class amphibious assault ship USS Bataan (LHD 5) machinery repair shop, speaks with Commander, Naval Surface Forces Atlantic Rear Adm. Brendan McLane about the ship's newly installed additive manufacturing equipment, Nov. 23, 2022. This is the first Naval Sea Systems Command sponsored Hybrid system installed on a U.S. Navy ship and will permit the capability to additive manufacture metal and plastic components locally.

where the Phillips Hybrid system is a wire-fed laser system using a directed energy deposition (DED) process to create a nearly-complete object, and then, as a hybrid system, uses the CNC milling head to finish the part.

While many industrial 3D metal printers use powdered material, which can be reactive, the wire-fed systems are much safer for shipboard use.

According to Bataan's executive officer, Capt. Paul Burkhart, using the 3D printer to make parts on demand doesn't replace the supply system. But, Burkhart said, it does provide a way to fix a part or component to get a system it operational again.

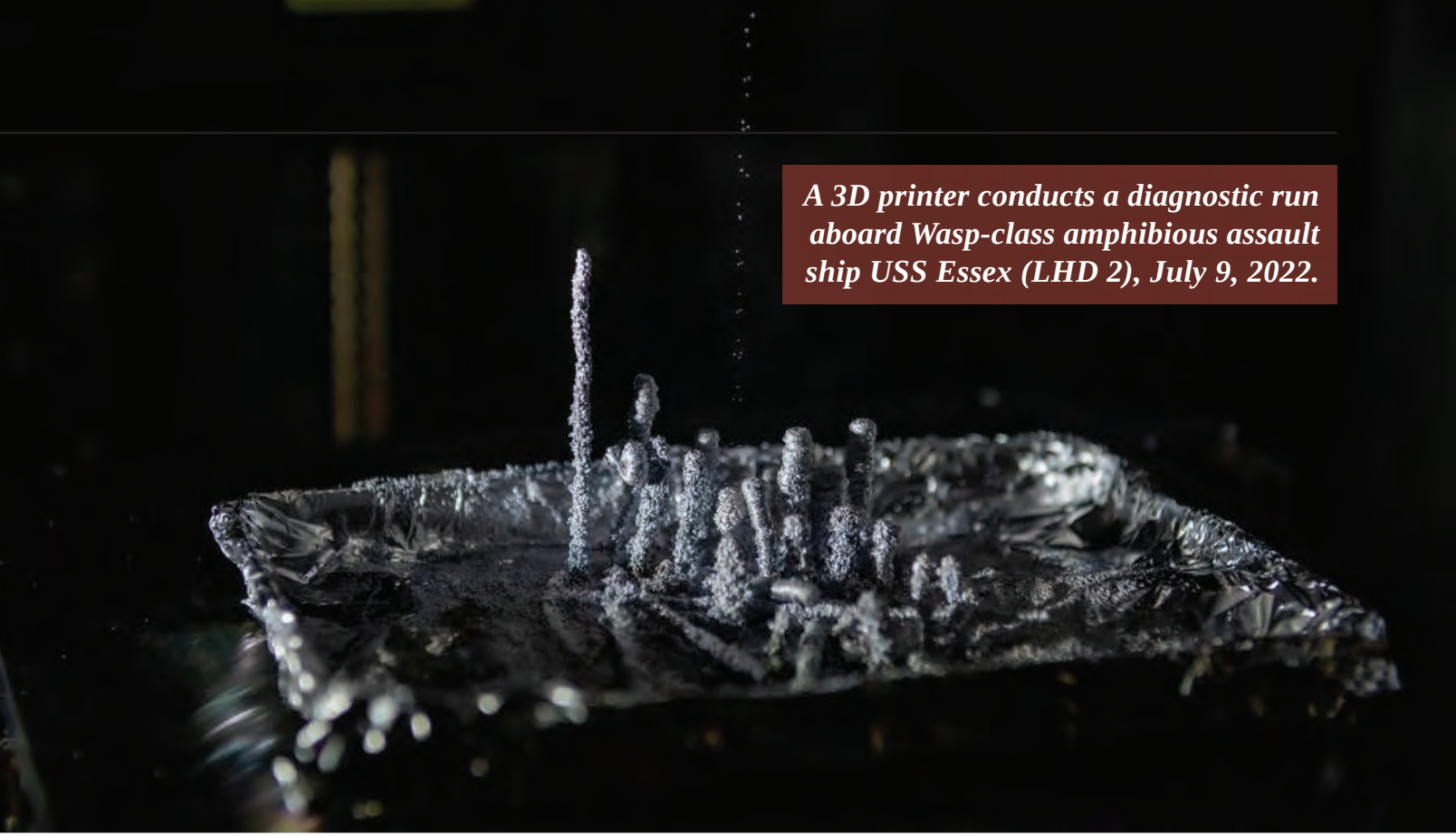
"Instead of having to order the whole, large assembly, and wait for it to get delivered wherever we are in the world, we just manufacture the sub-component or part that's required, especially if it's something we don't normally carry," said Burkhart.

Burkhart said that a group of Bataan Sailors received training from the manufacture to operate the system, and teach others how to use it.

Because some Navy ships with repair shops already have the Haas CNC system, that system can be "upgraded" to be a Hybrid AM system.

Jonathan Hopkins, who leads the additive manufacturing team at NSWC Carderock Division, said the Bataan's system complements the training and expertise that Navy people already have. "Stainless-steel welding is a capability found on our larger ships, and the wire feed stock for the printer is the same as used in our welding machines—it's in the supply system and is commercially available. For the ships that already have the Haas CNC system, it's possible to add the Meltio system and Phillips integration to existing the CNS tooling to upgrade a ship with this capability."

The San Diego-based Essex and Boxer and Norfolk-based Bataan are 843-foot, 41,000-ton Wasp-class multi-purpose amphibious assault ships that can carry 2,500 Sailors and Marines, along with boats, vehicles and aircraft.



A 3D printer conducts a diagnostic run aboard Wasp-class amphibious assault ship USS Essex (LHD 2), July 9, 2022.

U.S. Navy photo by Mass Communication Specialist 3rd Class Isaak Martinez

By permission of SEACOR Marine

Interview: Tim M. Clerc, *VP Engineering, Seacor Marine*

Tim Clerc's maritime career spans half a century, starting with his cadet training in 1969 in the U.K. He sees hybrid technology as one of the most transformational technological developments in maritime in that span, and the company is currently awaiting its 10th hybrid, the Seacor Yangtze. Clerc discusses the hybrid strategy and offers some practical insights.

By Greg Trauthwein

If you had to pick one technology that you think has made the business of running ships more efficient, more cost effective, what would that be?

I think one of the most important technologies that I've seen in 50 plus years is hybrid, most importantly what hybrid can do with regards to reducing fuel consumption and reducing emissions load. I look back at some of the ships I sailed on as an engineering officer, and the improvements since then I couldn't have even imagined 50 years ago. Also, particularly for offshore vessels, dynamic positioning (DP).

Seacor is well-known, but can you give us a 'by the numbers' look at the organization today?

Seacor was founded by Charles Fabrikant in 1989, and over the years Seacor Holdings has encompassed many different business lines. Today, Seacor Marine Holdings is headed up by John Gellert, and we have in excess of 60 vessels. Importantly, the age profile of our fleet (about eight years old) is half the industry average. We've just came out of seven dreadful years for the OSV market and we, unlike the majority of our competitors, managed to keep our head above water. We didn't reorganize,

"What are the toughest things on a conversion like this? First and foremost, it's having the funds available! **There's a lot of PSV's out there that are crying out for such upgrades such as these [but as an industry, we need to get creative in finding ways to fund these conversions]**. *One thing that we're looking at and hope to pioneer is an 'energy as a service' – leasing energy containers – which could help to get over the CapEx hurdle, to start."*

Tim M. Clerc, VP Engineering, Seacor Marine

we didn't go bankrupt, but it did give us an opportunity to right-size the fleet and really focus on that assets that matter.

During that time we brought nine hybrids to market, without the benefit of grants or subsidies; we had to do it ourselves. We started looking at hybrid technology back in 2013, and it took us another three years, but in true Seacor fashion, we have really gone for it.

Our fleet today is diverse, made up of PSV's, both conventional and hybrid, fast support vessels, fast cats and premium lift boats. There have been a lot of 'firsts': we were the first to DP1 fast support vessel; we were the first with a DP2 fast support vessel, and importantly, we're the first with a DP3 a fast support vessel. We have presence here in the US Gulf, Mexico, West Africa, the Persian Gulf, Central America and Guyana.

Can we look closer at the Seacor hybrid fleet, as you have number 10 in the works right now.

I suspect you could hybridize anything if you had enough money, but what are the real benefits? For us it's hybridizing modern diesel electric [vessels, because] you are already halfway there, if not more. Those were the initial three target vessels. And then we were able to build on that with a series of seven vessels under construction in China, which we took over in the shipyard. Seacor Yangtze is the vessel currently under construction.

[In choosing to build new or convert to hybrid], you have to understand why you're putting battery hybrid on board. Hybrid doesn't necessarily have to mean batteries, although they do play an important part in most hybridization. But batteries, at the moment, make the most sense. At least it does to us.

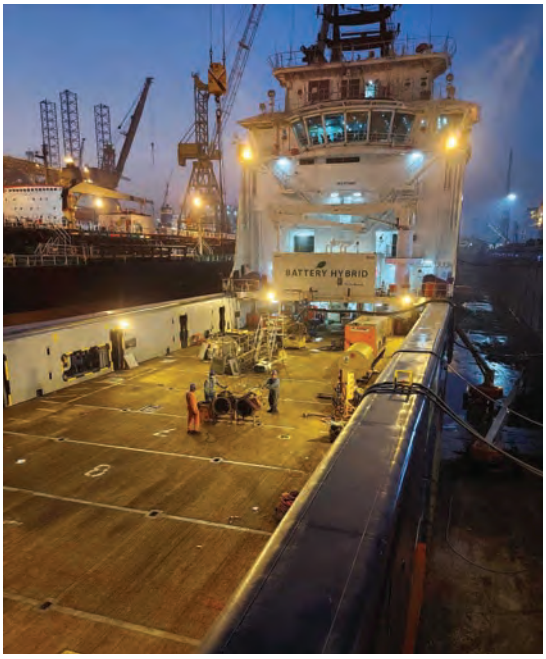
So tell us a bit more about the Seacor Yangtze.

The vessel was under construction at Cosco (Guangdong) Shipyard. She is a UT-771 CDL class, clean design length, diesel electric install. It has Caterpillar main engines, four 3512 engines, a full Rolls Royce package with alarms, automation, power management, energy management, and DP onboard. It's a modern PSV and that was delivered around 2018. In total in China during that time we delivered five UT-771 CDLs both in Cosco Guangzhou and Cosco Zhoushan shipyards. We also delivered out of the yard six WP class UT-771's, and we hybridized those in the yard prior to delivery. All of those boats came out and went immediately to charter where they remain, and we've operated hybrid vessels in the North Sea, the Mediterranean, West Africa and in Guyana. Importantly, we were the first to operate hybrid vessels in the Persian Gulf on a long-term fixture with Aramco. Some say it's better to be second rather than first, but we were fortunate to have great partners in Kongsberg, Rolls Royce and ABS.

What's your best advice to fellow shipowners that are considering hybrids: what are the challenges, what are the lessons learned?

What are the toughest things on a conversion like this? First

By permission of SEACOR Marine



and foremost, it's having the funds available! There's a lot of PSV's out there that are crying out for such upgrades such as these [but as an industry, we need to get creative in finding ways to fund these conversions]. One thing that we're looking at and hope to pioneer is an 'energy as a service' –leasing energy containers – which could help to get over the CapEx hurdle, to start.

The big thing with a PSV is space. We are not in the business of carrying fresh air around, so when those vessels come out of the yard, we have used every available space on board to fit our equipment and maximize cargo carrying capacity. Space is always going to be a challenge. A big one is space in the switchboard, as a lot of switchboards do not have available room for additional breakers. You end up adding additional switchboards, but then we need the additional space for those switchboards. It really comes down to fundamental project planning: writing a thorough spec; getting engaged with the designers and classification societies, being prepared to sit down and talk through the project with them.

And then good partnership with and supervision in the yard. Understanding that you're going to have to have exhaustive trials once installed [to ensure the crew is well trained and prepared for contingencies, and to ensure that the system is operating as specified].

Best advice? Do your homework and understand why you want batteries on board your boat. What does it really help you do? How can they help you better support your customers? There is myriads of data available that people very rarely look at. When we started our first hybrid, we looked at 66 million recorded data points, and that's just on power generation and power demand. In fact, we worked with DNV on a joint industry project regarding hybrid energy in the offshore domain. So we were able to look at that and then we could see what benefits could be gained from hybridization.

One last thing: hybrid systems are all about integration. Work with a trusted integrator, someone you have confidence in and someone that can talk you through it. We are by no means hybrid experts. We know a fair bit about them and we've been very successful in that respect. But always keep an open mind, always listen to other ideas. We don't have the monopoly on good ideas. We believe we have quite a few good ones, but there's a lot of smart people out there that want to be engaged in this technology. Keep an open mind.

You've mentioned batteries several times. Who do you use for your batteries?

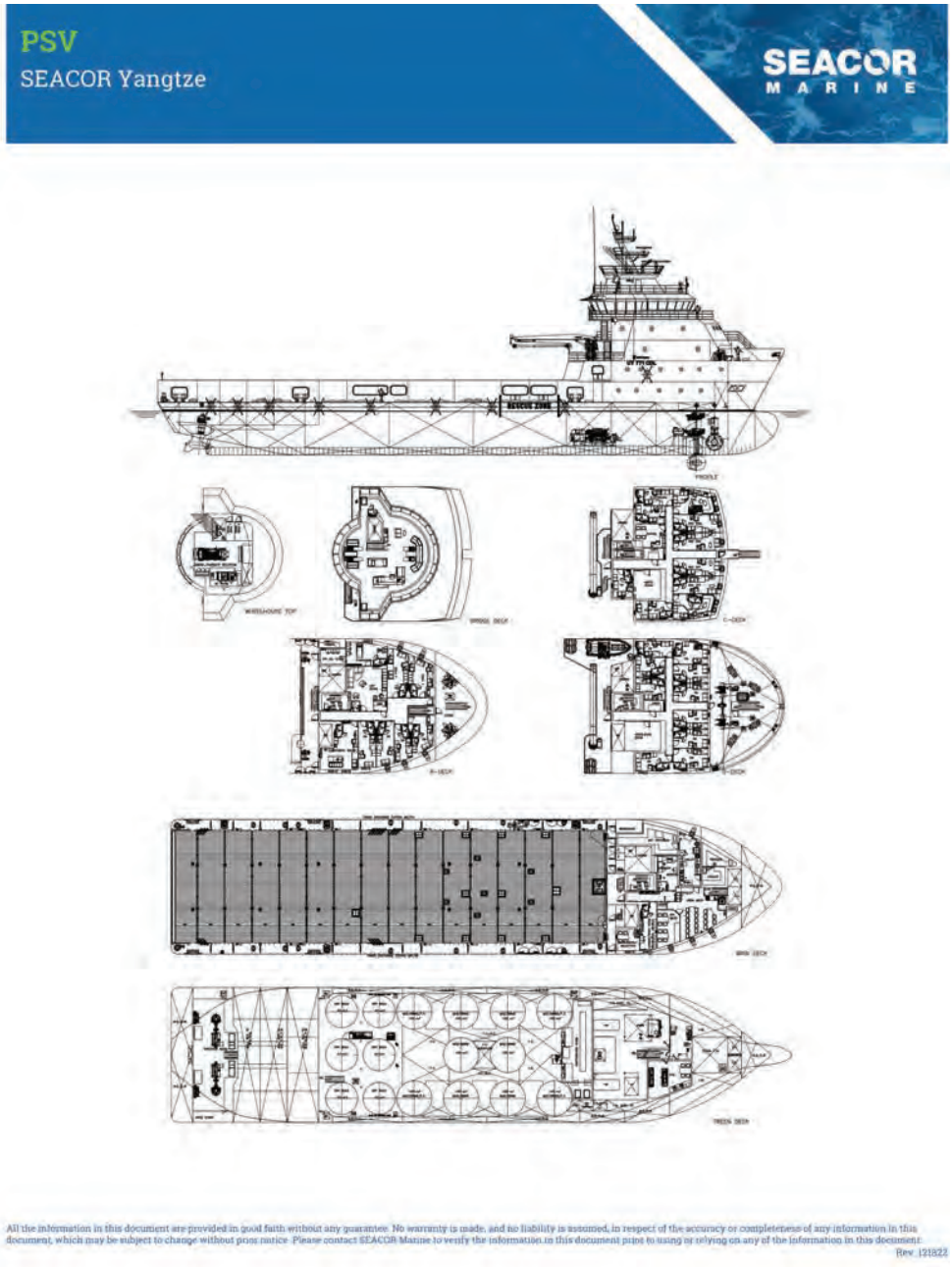
I think hybrids really start with the batteries. We have had very good success working with Corvus for our batteries, particularly its Orca battery modules. Using the Lighthouse system, we can monitor our battery arrays and modules down to the cell level, looking at a cell and knowing exactly what the temperature should be.

For batteries, we look at a 10-year marine life. We check the state of health regularly and we can see on the graph if we're operating the batteries too hard or too lightly? Also, we can't forget the safety aspect of operating lithium-ion batters. Battery management systems, energy management systems have to be spot-on. Also, the design of the modules themselves, how each cell is protected from the other ones. We're very happy with the service and innovation we get from Corvus.

We touched on this briefly, but from your experience, can you give insight on additional training needed for the seafarers to operate these hybrid systems?

It starts with the talent you have available. When we do one of these conversions, the crew are an integral part of it. They work very closely with the commissioning engineers when they're out on trials, but we also run additional training modules, too. We're stepping up that effort, as it's been very difficult during COVID to move people around. That's easing up now, but we're also looking at [adding] virtual training [to the mix with hands-on training].

Also important is that interchange of knowledge and experience between the various vessels that operate hybrid. Thankfully the issues we've had have been mild. We've changed out the battery module, but probably the biggest issue with changing out battery modules is getting them to the vessel: we can't fly them. Normally we keep some spares and we keep them charged to about 30% load so they can just slot in. The physical change out of a module is very easy. But training, especially from safety aspect of operating batteries, is important, and we believe that with the battery management system and energy management systems we have in place, the likelihood of a fault causing a problem is very slight.



MAN ES

MOVING FORWARD ON AMMONIA ENGINES

As shipowners ponder future fuels, MAN Energy Solutions is sailing full speed ahead optimizing dual fuel marine powerplants while preparing to start testing ammonia fueled engines in early 2023. ***Bjarne Foldager****, Senior Vice President, head of two stroke business at MAN ES hosted* ***Maritime Reporter & Engineering News*** *in Copenhagen for a look behind the scenes at a cornerstone of its mandate to* ***'Move big things to Zero.'***

By Greg Trauthwein

***MAN ES** will start testing on its ammonia engine in Copenhagen in Q1 2023.*

***All images courtesy MAN ES**

Just 10 years ago, in December 2012, word came that General Dynamics NASSCO finalized a contract with TOTE, Inc., for the design and construction of two 764-ft.-long, 3,100 TEU LNG-powered containerships, effectively setting a new benchmark in green ship technology: at the time the largest ships of any type in the world primarily powered by liquefied natural gas (LNG).

A short decade later, Bjarne Foldager, Senior Vice President, head of two stroke business at MAN ES, reports that in 2022, 54% of all new two-stroke engine orders from the global power leader – as measured in kW – will be dual fuel, a significant jump from 2021 when 23% of new engine orders were dual fuel.

While LNG still dominates the dual fuel choice today, that is starting to evolve too as LNG is not the fuel to get shipowners over the 2050 emissions hump. A broad array of new fuels – including SNG, biofuels, hydrogen, methanol and ammonia – are entering the mix as shipowners eye options that will enable them to more easily reach ever stricter emission and performance mandates.

MAN ES projects that 2035 will be the tipping point where ammonia will overtake methanol in terms of demand. "We will obviously have to wait and see," said Hrishikesh Chatterjee, Promotion Manager, MAN Energy Solutions. "Many times when we make our projections, we are conservative. [But] we are expecting ammonia to be a game-changer in the dual fuel segment."

In late 2022 MAN ES' portfolio of two-stroke, dual-fuel engines passed a milestone, with more than 1,000 units on order or in service, with the ME-GI (-Gas Injection) engine leading the way with more than 500 orders. The first engine tests of the ME-LGI (-Liquid Gas Injection) platform began in 2015, followed by the first sea-trial for the ME-LGIM (methanol) engine in 2016. Development of an ethane (ME-GIE) unit followed in 2016 with sea-trials already in 2017. Currently, more than 240 dual-fuel engines have entered service, while an MAN B&W ammonia-fueled engine is due to be delivered to a shipyard by 2024. In total, low-speed, dual-fuel MAN B&W engine orders include: ME-GI (538); ME-GIE (37); ME-LGIM (72); ME-LGIP (139); and ME-GA (214). In breaking down the adopter of dual fuel technology, the pie chart is dominated by containerships and tankers, with a commanding 40% of the market apiece.

But today in Copenhagen at the MAN ES Research and Development Center, while there is still much attention paid to maximizing the efficiency, performance and slashing emissions of existing diesel and dual fuel powerplants, the future fuel discussion had turned squarely on two fuels: methanol and ammonia.

PROGRESS ON AMMONIA

On a cold December day, the waterfront site where MAN ES resides is bustling with activity as the power plant company works to finalize infrastructure to start testing its ammonia engine in Q1 '23, aiming to deliver the first commercial engine in 2024. Working in step with its Japanese licensee Mitsui, the first engine being designed is a 60 bore model, a size selected premised on its popularity to power feeder containerships, gas carriers and bulk carriers.

"I wanted to show you what we are doing here," said Foldager. "This is what the world is waiting for: ammonia. We are ready to start burning ammonia on our test engine."

The set-up to test run the ammonia engine takes great care, particularly as the company is situated in the middle of Copenhagen, in close proximity to a residential and public areas.

While there remains some apprehension to ammonia as a fuel in maritime premised on its toxicity, Chatterjee was succinct: "If it works in Copenhagen, it will definitely work on the ship. Failure is not an option."

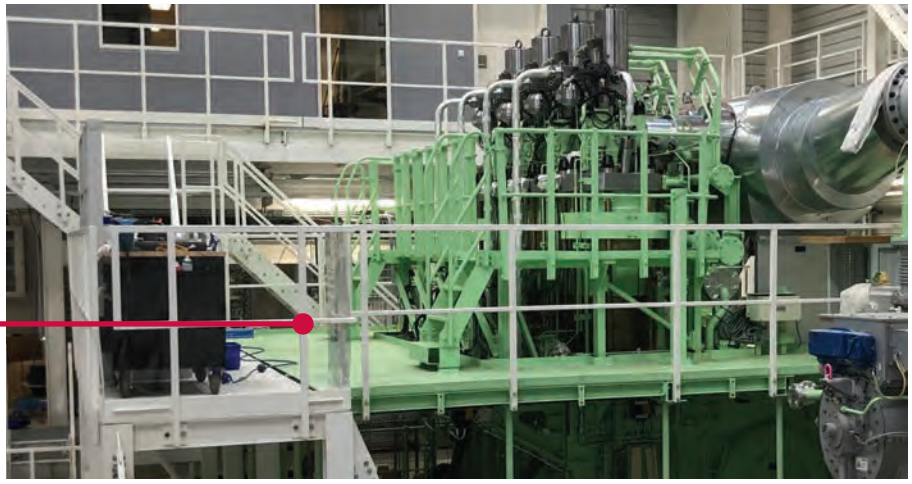
To that end, risk identification and mitigation is the cornerstone, and Chatterjee said that "safety is at the center of everything," with work being conducted on emissions, combustion, odor/venting, maintenance intervals, corrosion of materials, elastomer compatibility.

On site for the testing, the company is permitted to store a maximum of five cubic meters of ammonia, and in conducting its risk assessment of the operation concluded that the biggest risk came in the transfer of ammonia from truck to storage tank. The final piece of the pre-test puzzle is the construction of a special shed built around the ammonia tank as well as the ammonia bunkering truck area, sheds with a water spray system and underground storage tank designed to effectively keep potential accidental discharge under control.

Testing the engine starts by running fuel through a single cylinder, a cylinder that is outfitted with hundreds of sensors and cameras, high speed cameras taking more than 1000 pictures per second that allow MAN ES to closely monitor the combustion process and to quickly and easily modify the parameters to maximize the unit's efficiency. The new ammonia

Bjarne Foldager** (left), SVP, head of two stroke business at MAN ES hosted **Maritime Reporter** in Copenhagen for a look behind the scenes at its **ammonia engine test bed & facilities.

***MAN ES** will start testing on its ammonia engine in Copenhagen in Q1 2023.*



engine is designed on the diesel cycle principle because "we believe it is more robust: ammonia is not a hydrocarbon, it takes a lot more effort and energy to combust it," said Chatterjee. That said, the biggest hurdle is combustion optimization.

"Typically, we run a number of small tests, 10-15 minutes to try something out and then we will change one parameter and run again," said Foldager.

A top concern in any engine development is fuel combustion, from timing to location to angle to amount of fuel spray. "The goal is to have an optimal combustion, and for us, the optimal combustion is where we have the highest possible energy efficiency," said Foldager. "We want to get every single calorie out of the ammonia as we can." In addition to completely burning the fuel for economic reasons, if all of the ammonia is not used in the process that means waste that will need to be handled via aftertreatment. The fuel injectors, in particular, are a point of close development and testing, with close attention on the materials used to facilitate not only optimal combustion but lifecycle maintenance. Development of the ammonia injectors "is quite a big task. The rest of the engine is identical to a normal engine," said Foldager. "It's really the top cover with all these extra gas blocks and valves and having both the alternative and the normal fuel injectors."

Plan A is a combustion cycle that consumes the full amount

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of ammonia; plan B is aftertreatment.

According to Foldager and Chatterjee, engine optimization and tuning will be paramount to keep in check one of the most harmful remnants of burning ammonia as fuel: nitrous oxide (N_2O), which is a more harmful greenhouse gas than carbon dioxide. The current plan is use SCR aftertreament to clean capture N_2O, ammonia slip and NOx, too.

In step with effective combustion, Foldager said overall engine reliability is paramount. "It has to be reliable. There's only one engine in the ship, it's the heart of the ship, it has to run 24/7. Third, we have to make sure that the emissions are acceptable."

As designed, "the ammonia is in single wall pipes, but as soon it gets into the engine room, it will go in double wall pipes with an inner pipe and an outer pipe," said Foldager. "Fresh air needs to be continuously circulated through the outer pipe to detect leakage from the inner pipe. We also have a compressor for the ventilation of the double wall pipes."

MAN ES has also developed its own ammonia catchment system, "as a safety feature onboard the ship where we could capture ammonia in the engine room if needed, or we have to empty pipes for whatever reasons," said Foldager. "Water will be a big part of it because that will absorb (the ammonia) In this unit until we can separate water and ammonia again. The water we can reuse or pump out, the ammonia can go back to the tanks, because ammonia will be expensive."

According to the International Energy Agency (IEA), about 180 million metric tons of ammonia is produced annually, with production expected to rise nearly 40% to 250 million metric tons by 2050. Today, China is the largest producer of ammonia (30% of the production volume generating 45% of the associated CO2 emissions), with the United States, the European Union, India, Russia and the Middle East accounting for a further 8-10% each. It is traded globally, with exports via ship equating to about 10% of total production.

The flip side of ammonia is, today, it relies heavily on fossil fuels for its production, and hence emission intensive, too. Long-term, a ramp-up in 'green ammonia' is needed. Another disadvantage to ammonia is its toxicity, and Foldager said that even now, at the research stage, efforts to identify and mitigate risks, from the handling to the burning of the fuel, is central to it's long-term success.

"One accidental spill on a ship could present a major setback for ammonia as a fuel and for the whole decarbonization of the maritime industry," said Foldager. "So we are learning a lot here and I think it's not only about the engines, it's about the safety of the whole system."

With roughly 18-20 million metric tons of ammonia already moving on ships in trade globally, Foldager imagines that these crews and carriers will be instrumental in helping to establish the rules regarding the safe use and handling of ammonia in the maritime sector in masse.

THE DUAL FUEL FUTURE

In planning for future maritime fuels, MAN Energy Solutions decided to survey it's customers on their short-, medium- and long-term plans, a survey that resulted in more than 500 responses. When asked: "Which type of fuel are you planning to use for your next new-building project?" the poll found in this short- and medium-term scenario LNG/SNG and Biogas are taking the lead, closely followed by

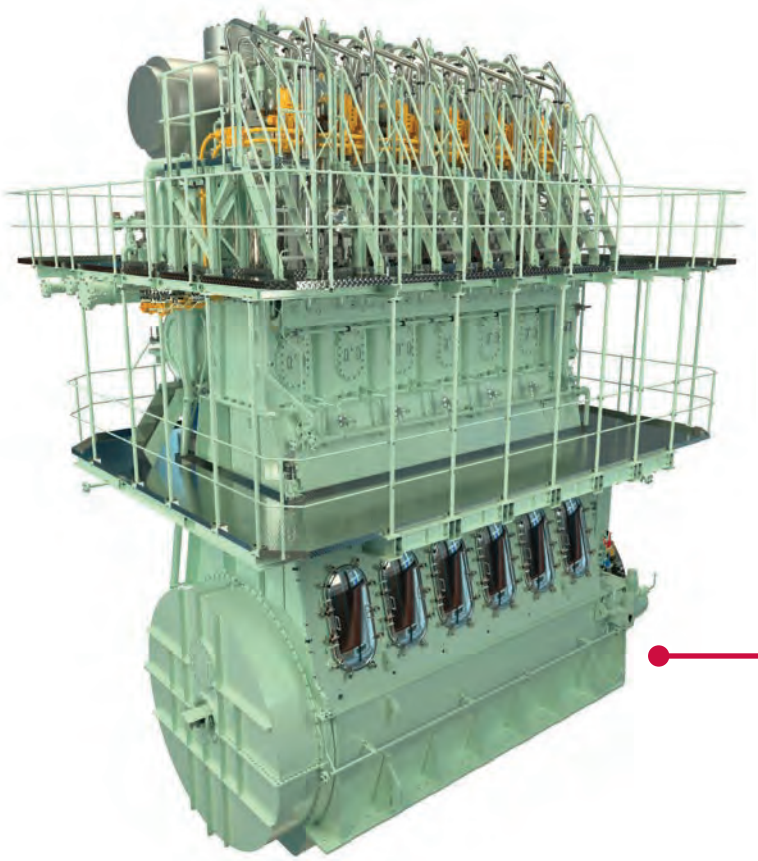


Illustration of the ammonia engine.

MGO/ULSFO/VLSFO; with ammonia, hydrogen, methanol and biofuels emerging in the 'future fuels' category. Noteworthy is that conventional fuel types such as HFO with a scrubber are still considered a viable way for upcoming projects.

When looking at projects past 2035, the picture starts to change more dramatically. For two-stroke engines LNG/SNG and Biogas still lead, but are followed closely by ammonia, hydrogen and methanol.

But also the conventional fuel types such as MGO/ULSFO/ VLSFO are still considered important.

On the four-stroke side a different focus can be found with Hydrogen taking the clear lead, followed next by LNG/SNG/Biogas, Ammonia and Methanol.

Original dual fuel engine (LNG) developed at MAN ES, now with more than two million running hours, by Foldager's estimation are 10-15% more efficient than Otto cycle engines, meaning less LNG is burned, less LNG is needed in the fuel tank, and in some cases, the engines can have one less cylinder premised on better efficiency.

While much of the discussion in Copenhagen focused on ammonia, Foldager said the popularity of methanol as a fuel "is picking up very, very fast, while LNG is still today the leader in dual fuel uptake."

Today, MAN ES has more than 80 orders for dual fuel methanol engines, with hundreds more in negotiation. "It's the shipowners that are pushing for (methanol) right now," said Foldager. "I think the reason why methanol is so 'popular' is it's a clear way to decarbonize it if you have carbon neutral methanol."

Important, too, is the dual fuel methanol technology is proven, with "more than 240,000 running hours since 2016," said Foldager. "It works, it's a proven the technology, and we know how to install it onboard ships. The infrastructure is relatively simple. It's low pressure, the tanks are relatively simple. If you want to decarbonize now, then it's basically methanol."

Earlier this year Hyundai's shipbuilding division (HHI-SBD) ordered 6 × MAN B&W G95ME-C10.5-LGIM dual-fuel main engines in connection with the construction of 6 × 17,000 teu container ships for A.P. Moller – Maersk. To be built in Korea by Hyundai's engine machinery division (HHI-EMD), the engines will be capable of running on green methanol.

Image courtesy Asyad Dry Dock

MIDDLE EAST REPAIR YARDS REMAIN CENTER STAGE

By Paul Bartlett

Asyad Dry Dock in Duqm, Oman, was previously Oman Drydock Company. Its new name reflects its ownership by Oman shipping and logistics group, Asyad.

Image courtesy ASRY

In the 45 years since the Arab Shipbuilding & Repair Yard (ASRY) opened on reclaimed land in Bahrain, the Middle East has become one of the world's ship repair hotspots. A broad range of shipyards now service both regional and global markets.

Regional yards have a ready market, with hundreds of offshore rigs working across the region together with the service ships that support them. Then there are thousands of tankers and gas carriers that arrive each year to load energy cargoes for far-flung destinations. The region's repair yards are in steady demand for routine repairs, surveys, and conversion projects.

However, the backdrop is changing as the supply of ship repair capacity continues to increase. An entirely new generation of repair facilities has gained a foothold across the region, with yards now specializing in repairs across all sectors, as well as more complex conversion projects and others linked to renewable energy.

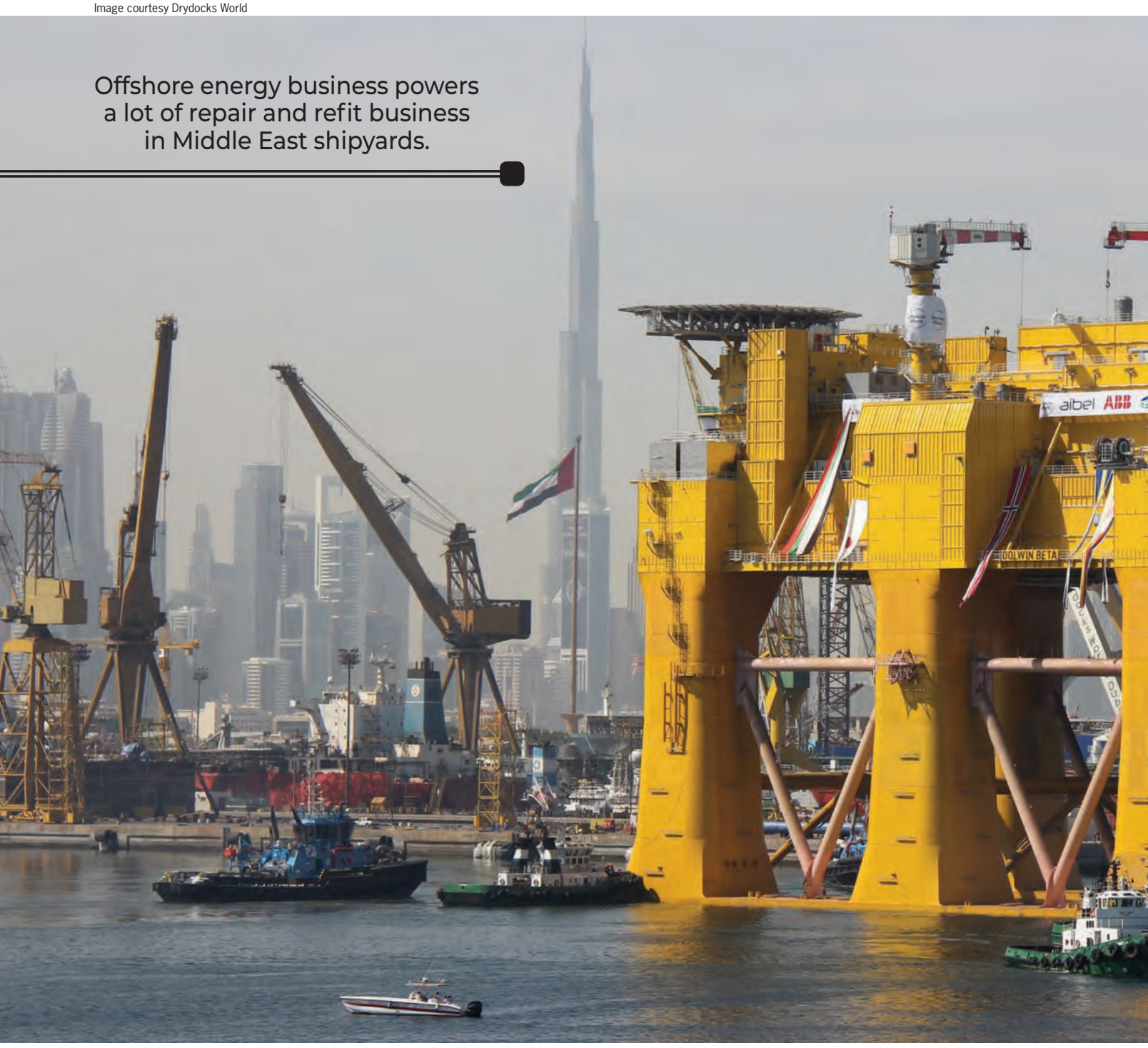
Willem Moelker is Sales & Marketing Director at Sharjah-based joint venture shipbuilder and repairer, Albwardy Damen. Speaking to ***Maritime Reporter*** recently, he described some recent regional repair developments. The recovery in oil prices has triggered a wave of new investment, he said, not only in oil and gas but also in civil infrastructure projects which themselves generate demand for workboats and service vessels.

Carbon Intensity Climbs Agenda

The drive for carbon reduction has now arrived in the Middle East, Moelker noted, partly in preparation for next year's COP 28 in Dubai. Local owners are adapting, he said, highlighting a recent deal in which Albwardy Damen converted two DP2 platform support vessels to run on battery-assisted propulsion in a package supplied by Wärtsilä. Scope for sustainable energy projects both on land and sea are also climbing the agenda.

Image courtesy Drydocks World

Offshore energy business powers a lot of repair and refit business in Middle East shipyards.



At its nine-year-old shipyard, built from scratch on arid land in Hamriyah Free Zone, Sharjah, Albwardy Damen undertakes repairs, conversions, and new construction. With service hubs in the busy bunkering port of Fujairah and its anchorage as well as Dubai Maritime City, the company offers a flexible one-stop-shop model. Specializing in smaller vessels, U.S. clients feature regularly on its books.

"We are well known by U.S.-based owners sailing in the region," Moelker said. "On the repair side, we serve U.S.-based customers servicing both commercial as well as government-related assets. And we are currently constructing two Stan Tug 2308s for U.S.-based Tidewater. We also have a 260-foot Multibuster, an easily adapted multipurpose service vessel, on her way to a European owner for the renewable sector."

At a regional level, rapidly expanding populations with high spending power are driving growth in container traffic from east and west. Meanwhile, Qatar's massive LNG reserves have provided the basis for the world's largest fleet of LNG carriers and the development of dedicated repair facilities to service them at Nakilat-Keppel Offshore Marine as well as a broad marine service sector in Ras Laffan.

Now, the country's North Field development project will increase LNG exports by more than 40% from 2025. A large number of new LNG carriers are currently under construction for this vast project.

Meeting Client Expectations

Shipyard sophistication across the region has accelerated to meet customer expectations. Leading yards report a growing volume of projects including conversions, upgrades and retrofits as owners tackle shipping's digital and decarbonization challenges. Regular surveys and drydockings still provide foundation business, but more complex projects on ship, rigs, and renewable energy are increasingly important.

Executives at ASRY note that recent work scopes have included more complex projects, citing as an example the landmark conversion of the 2001-built Suezmax tanker, Cap Diamant, into a floating storage and offloading (FSO) vessel, MT Teli, ultimately for Houston-based Vaalco Energy. The successful project outcome, for the FSO's operator in Greece, is thought likely to lead to other similar projects, managers said.

The 150-day conversion, completed in mid-2022, has enabled the Houston energy firm to reconfigure its setup at the Etame Marin field off the coast of Gabon. It has replaced BW Offshore's FPSO, Petroleo Nautipa, and has radically altered the underlying economics.

Commenting on the project a few months ago, Vaalco's CEO, George Maxwell, said: "This new FSO, which is scheduled to be online in September 2022, costs almost 50% less than the current FPSO and is expected to reduce our overall costs by approximately 17-20%. This will significantly improve our margins, enhance our cash flow generation, and sustain our operational excellence and robust financial performance at Etame through 2030."

Meanwhile, U.S.-based Maersk Line has undertaken an innovative decarbonization project at ASRY. Container vessels have been modified to increase cargo capacity by 500 TEU. The project has cut carbon emissions significantly, yard sources report, and may lead to other similar projects.

Importance of U.S. Custom

Some 300 miles to the east lies Drydocks World, until recently the region's largest repair yard. Executives there stress the importance of the U.S. market as a source of revenue generation. Recently completed projects at the Dubai yard include upgrades to some 20 offshore rigs, as well as the conversion of tankers to floating production storage and offloading (FPSO) units, and the retrofit and upgrade of vessels with various sustainable technologies.

Managers are currently in discussion with a major U.S.-based company on another FPSO conversion. And talks are under way on the shipyard's possible involvement in various American projects, particularly off the country's east coast,

where renewable energy capacity is set to expand rapidly in the years ahead.

DDW has established a sound track record in the renewables sector. At the end of 2021, the shipyard delivered a 700MW topside, comprising worker accommodation and power grid processing equipment, for the Hollandse Kust Zuid wind farm in the Dutch sector of the North Sea. The facility is set to generate a total of 1,500MW of renewable energy, enough to meet the annual consumption of more than two million households in the Netherlands. The facility is scheduled to become fully operational later this year.

Other projects include the conversion of a ship into a crane vessel, Bokalift 2, in preparation for a range of offshore renewable energy projects. The project, which prepared the vessel for the installation of a 4,000-tonne Huisman Offshore Mast Crane, involved some 9,000 tonnes of new steel to increase stability, the creation of an 8,970 square yard working deck, and accommodation for 150 persons. The

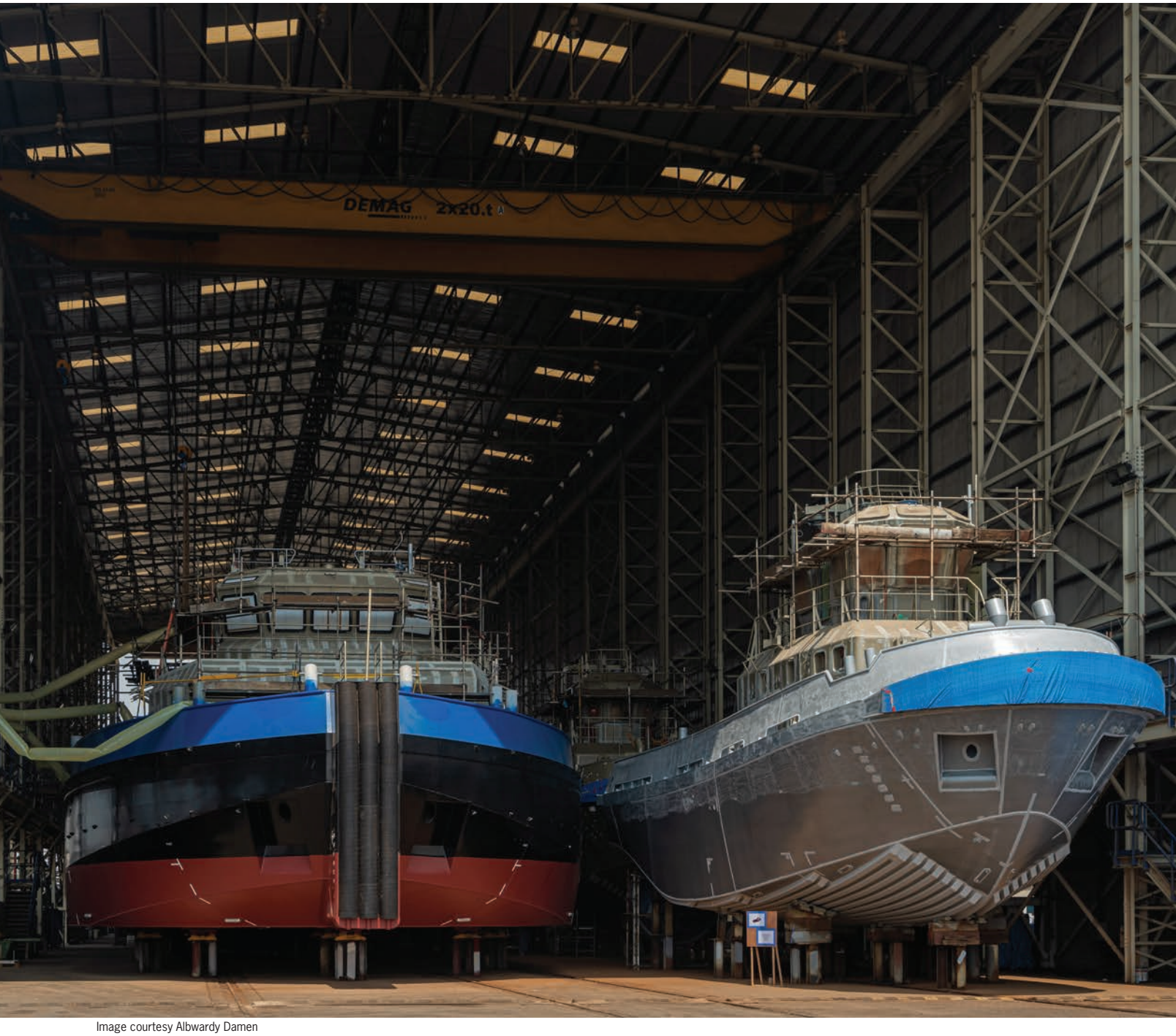


Image courtesy Albwardy Damen

vessel is now deployed in the transport and installation of wind turbine foundations on the Changfang and Xidao wind farm in Taiwan.

A highlight of the shipyard's sustainability drive was the 2022 signing of a partnership agreement with UK-based Silverstream Technologies to promote the use of air lubrication technology on existing vessels undergoing surveys and/or environmental upgrades. Silverstream boss, Noah Silberschmidt, has closed several substantial deals with ship operators recently and is now focusing on approved installation agreements with major repair yards of which DDW is a front-runner. The air lubrication technology has already been installed on various ship types including LNG carriers, roro ships, bulk carriers and cruise vessels.

At a corporate level, DDW is on track to become completely net-zero by 2040, according to yard executives. This endeavor is a clear sign of direction of travel, as the facility evolves from being a shipyard to becoming a pioneer in renewable energy construction. Meanwhile, the sustainability drive is evident in many aspects of the shipyard's activities, with the notable example of a partnership with the Dubai Electricity and Water Authority to safeguard the marine environment at its shipyard sites.

Rapid Expansion

In addition to the many small yards and service facilities around the Gulf coast and notably the UAE, there are two other large facilities of note. Recent expansion at the recently rebranded Asyad Dry Dock in Duqm, Oman, has pitched the yard high on the region's list of key players. Previously Oman Drydock Company, the shiprepairer's new name reflects its ownership by Oman shipping and logistics group, Asyad. The facility has two graving docks with a capacity of up to 600,000dwt and 1.8 miles of quayside.

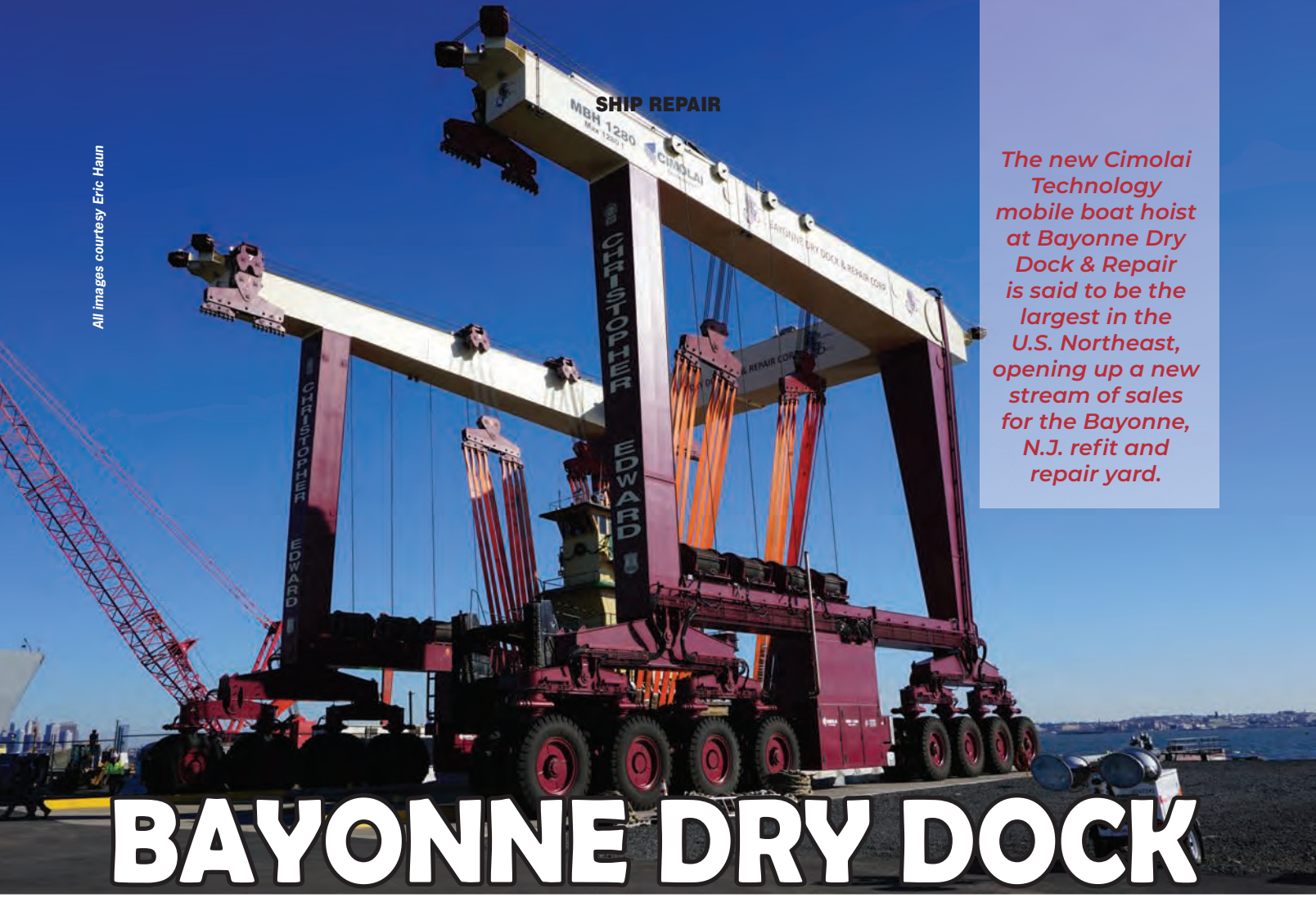
Further expansion at the shipyard complex is under way, with commissioning of a floating panamax dock due any time now. This is a timely development: the yard's CEO Dr Ibrahim Al-Nadhairi recently revealed that Covid-related restrictions in South East Asia had generated new business opportunities for Middle East repairers as repair business moves west.

Meanwhile, in Saudi Arabia, the region's largest repair and construction complex, International Maritime Industries (IMI), is ramping up operations. A joint venture between Saudi Aramco, Lamprell, Bahri, and Hyundai Heavy Industries, the vast complex has been built to undertake ship and offshore construction, repairs and all related business. The purpose-built facility is sited at Ras Al Khair on Saudi's Gulf coast and already has an eye-watering forward book.

IMI holds newbuilding commitments worth $10B over ten years with partners Aramco, 20 rigs, and Bahri, 52 vessels. And although the assets are destined for hydrocarbon-related business, the shipyard's managers have adopted a strong 'green' strategy.

It aims to exceed local and global environmental compliance and to become an active contributor to the Saudi Green Initiative and UN Sustainable Development Goals. A key component of the strategy is 'circularity' – the four 'R's' – Reduce, Reuse, Recycle, Recover. This will be achieved through various decarbonization initiatives including the development of renewable energy and the adoption of alternative fuel technology.

Earlier this year, IMI announced a tie-up with Columbia Ship Management to collaborate on ship design, construction, and repair. Through a MoA, the two companies now combine the region's largest shipyard complex and a leading ship manager with services including vessel operation, crewing, training, and newbuilding and repair supervision.



All images courtesy Eric Haun

The new Cimolai Technology mobile boat hoist at Bayonne Dry Dock & Repair is said to be the largest in the U.S. Northeast, opening up a new stream of sales for the Bayonne, N.J. refit and repair yard.

BAYONNE DRY DOCK CHRISTENS NEW MOBILE BOAT HOIST

New boat lift adds capacity and honors a fallen hero

By Eric Haun

Bayonne Dry Dock & Repair Corp held a christening ceremony on December 9 for its new mobile boat hauler, dedicated in honor of Christopher Edward Cranston, a NYPD Detective who died of a 9/11-related illness in July 2019.

The late Staten Island native — a first-responder during and in the aftermath of the September 11 World Trade Center attacks — was the brother of the Bayonne, N.J. ship repair yard's president, Mike Cranston, who said the new lift is a fitting tribute to someone who always prioritized family and service. "Chris was a very good friend as well as my brother, and the lift pays tribute to someone we all looked up to and respected," Cranston said. "[The dedication] is a great honor for the harbor, I think it's a great honor for our family, and it's certainly a befitting honor for my brother."

For Bayonne Dry Dock, which has been in business providing refit and repair to government and commercial vessels since 1997, the new Cimolai Technology mobile boat hoist expands capacity to allow more vessels—particularly barges, tugs and other workboats—to be serviced in the yard simultaneously.

Cranston said Bayonne Dry Dock spent $25 million for the project, including the hoist itself, as well as necessary infrastructure improvements for the facility to be able to absorb the

The new boat lift is dedicated in honor of Christopher Edward Cranston, a NYPD Detective who died of a 9/11-related illness in July 2019.

[L to R] **Jimmy Davis**, *Bayonne Mayor; Assemblyman* **William B. Sampson IV** *(NJ District 31);* **Kevin O'Toole**, *Chairman, Port Authority NY/NY; Msgr.* **David Cassato**; **Mike Cranston**, *President Bayonne Dry Dock & Repair;* **Clare Cranston**, *widow of Detective Christopher Cranston;* **Bethann Rooney**, *Director, Port Authority NY/NJ, Msgr.* **Jamie Gigantiello**, *FDNY Chaplain; Rep.* **Mikie Sherrill**, *11th Congressional District.*

weight of the lift and handle more vessels at any given time. Bayonne's newly constructed laydown area has enough space to dry dock up to eight tugs at a time for services ranging from quick fixes and inspections to comprehensive overhauls.

The new hoist is powerful and versatile, able to lift up to 1,280 metric tons and capable of accommodating vessels with breadths up to 50 feet, making it the largest of its kind in the U.S. Northeast and opening up a new avenue of sales for the yard, Cranston said. The new hauler has lifted dozens of vessels since becoming operational in July 2021, and with the increased workload, Bayonne Dry Dock has been able to grow its workforce by 20%, Cranston noted.

Notably, the mobile boat hauler allows workboats to be repaired locally without having to travel out of town, providing immeasurable value to the port and the vessel operators within, as well as local economies and national security, according to Bethann Rooney, director of the Port Authority of New York & New Jersey. "All of the small vessel operators that are absolutely vital to the maritime industry can now be serviced right here in the Port of New York & New Jersey at Bayonne Dry Dock," Rooney said. "Everything from emergency support and law enforcement, fire vessels, ferries, pilot boats, ferries and whatnot."

HEGER DRY DOCK GETS TO WORK ON AFDM FOR U.S. NAVY

Born in 1998 and celebrating its 25th anniversary in 2023, Heger Dry Dock holds a unique position as one of the few engineering firms in the world dedicated to the design and lifecycle engineering of drydocks, primarily floating dry docks. ***Premal Shah, P.E., President and Principal Engineer****, discussed some of the company's recent contract wins with Maritime Reporter & Engineering News.*

By Greg Trauthwein

Specializing in the design and lifecycle maintenance of floating dry docks, Heger Dry Docks was founded 25 years ago, and still run today by one of its co-founders, Bob Heger. "We are experts in floating dry dock designs," said Shah. "We're a design and engineering company and we deal with dry docks; about 90% of our work deals with floating dry docks."

While all of its business is in the U.S., it has experience internationally, designing drydocks for customer that have had them built outside the country. "There is simply not enough capacity in the U.S. shipyards to build something large [like a drydock]," said Shah. "Most of the larger shipyards in the U.S. are busy building Navy ships, so they don't want to take time away from their workforce to build a one-off dry dock. So most of our large designs get built elsewhere outside of the U.S."

While the capability to build the drydocks lies mostly outside of the U.S., Shah estimates there is a high demand for the units in the U.S., a "shortage of dry docks." A strong driver re-

All images courtesy Heger Drydock

cently has been the U.S. Navy and its shipyard infrastructure optimization program (SIOP), which is working to identify – and help alleviate – bottlenecks that it sees in the coming 20 to 30 years, particularly as it embarks on a substantial shipbuilding program through 2035.

"They've essentially started these massive programs, billions of dollars of funding allocated to the four main shipyards: Portsmouth Naval, Norfolk Naval, Puget Sound, and Pearl Harbor: and they're initiating all these efforts to build new dry docks," said Shah.

While graving drydocks have a much longer life span, with units built in the 1920s and after still active, they represent mammoth civil engineering projects with similarly sized mammoth budgets in dollars and manpower. A floating drydock has a much more modest life-span – 50 years or more if properly maintain, but a similarly sized floating unit is much cheaper.

"The main driver is the cost. Let's say you're setting up a shipyard from ground zero and you want to invest in a dry dock that can lift a substantial capacity vessel," said Shah. "A graving dry dock is 10 to 15 times more expensive than a floating dry dock. From a capital investment perspective, it makes more sense to have a floating dry dock."

"I can't remember the last time anybody designed or built a graving dry dock for a commercial yard," said Shah. "But the Navy, of course, can afford them, and they're looking for longevity." He notes that most of the Navy yards do not operate a floating dry dock.

Depending on vessel size, there are other options to dry dock a vessel, with travel lifts, ship lifts and marine railways offering solutions. But if you are targeting vessels in your business model that are over 10,000 tons, "your only options are a floating dry dock or a graving dry dock," said Shah.

Heger Dry Dock has a long list of projects and clients over the past 25 years, but a more recent contract to build a U.S. Navy asset, an Auxiliary Floating Dry Dock Medium (AFDM), is keeping the company busy. Measuring 700 x 160 ft. with a lifting capacity of 18,000 long tons, the AFDM will be designed to accommodate destroyers, cruisers, the new LCS type vessels which are homeported in and around San Diego.

To download the revised 2022 edition of the *"Dockmaster Training Manual,"* visit:
https://hegerdrydock.com/wp-content/uploads/2022/06/2018-DOCKMASTER-MANUAL-NEW-COVER.pdf

"There were a bunch of them [drydocks] built in the 1930s and 1940s, and there were some other smaller dry docks built in the 1960s," said Shah. "But nobody has designed or built an AFDM or any kind of floating dry dock for the Navy in the past 40-plus years."

Heger Dry Dock were recently awarded a new AFDM design project along with its design-build partner in Mobile Alabama, Austal USA. "So we're designing this AFDM, which is a significant project for us because nobody has done this in a few decades," said Shah.

When built at Austal in Mobile, the AFDM will be located at the naval base in San Diego.

"Once it's all done, it will be a huge feather in our cap, because a privately held company has not designed a floating dock for the Navy in many decades," said Shah.

Photo courtesy Bernhard Schulte Offshore /Matthias Giebichenstein

RETROFITS COULD ACCELERATE U.S. OFFSHORE WIND DEVELOPMENT

The US Administration's strategy to fast-track offshore wind development is exciting for overseas shipbuilders and service providers in the field. Joint ventures meeting Jones Act requirements will support accelerating development. Some question, however, whether ambitious 2030 targets can actually be achieved.

By Paul Bartlett

Illustration courtesy Ulstein

Ulstein designed GLDD subsea rock installation vessel for US offshore wind.

Ulstein group is a front runner. The Norwegian-based company has already provided the design for a rock installation vessel now under construction for a joint venture between Houston-based Great Lakes Dredge & Dock (GLDD) and Netherlands based Van Oord. Now being built at Philly Shipyard and due for delivery in first half of 2024, the ship will be the first Jones Act-compliant offshore wind support vessel to be built in the US. It will be deployed on the Empire I and II wind farms off the coast of New York.

Lars Ståle Skoge is Commercial Director at Ulstein Design & Solutions AS. "There is a great potential for European companies like Ulstein to contribute to develop the offshore wind market in the US, and get a quick start based on the learnings from the European offshore wind industry," he tells ***Maritime Reporter & Engineering News***.

His Rotterdam-based colleague, Nick Wessels, outlines the company's strategy of diversification. Ulstein is offering a wide range of offshore wind designs for different tasks, he reveals, but it is also offering scope to upgrade existing vessels.

"We have several designs available that are suitable for US operations," he explains. "These include feeder jack-up installation vessels, feeder transport units to ship foundations and turbine components to jack-up vessels, and heavy-lift foundation installation ships." The designs can all be customized to meet specific clients' requirements.

Head start

It is no secret that Ulstein is in discussion with various offshore wind companies in the US but company executives cannot reveal more details. Wessels says that the selection of an Ulstein design by GLDD provides a head start. The US company required a Jones Act compliant, dynamically positioned vessel that could be constructed in a US shipyard to undertake scour protection on offshore wind foundations.

There are specific requirements for vessels to be deployed in the US. Apart from the Jones Act itself, ships designed for US deployments must also meet US Coast Guard requirements. And, depending on customer and shipyard, designing in imperial units may be a significant plus point, Wessels reveals.

"Typically, we see that build time in the US is longer than in Europe, for example, and we constantly evaluate the possibilities and the best project approach," he explains. "Our Dutch design office typically works on one-off designs that are fully tailored to client specific requirements. We prefer to work with the shipowner for the concept and basic design as they know what they want to do with the vessel in terms of operation.

"It allows the shipowner to tender with several shipyards," he continues. "After that, we are happy to support either the selected shipyard in the actual building of the vessel if so desired or to keep supporting the shipowner's newbuilding team."

Title XI boost

Analysts believe that the Administration's mid-year move to boost investment in the offshore wind sector through Title XI funding could lead to a series of new contracts in US yards. It will certainly help to offset higher US construction costs and it could help timing at the front end by finalizing funding faster.

However, experts have already warned that a shortage of suitable installation and support vessels over the second half of the decade is likely, just as infrastructure development is set to accelerate. This could cast doubt on President Biden's target of 30GW of offshore wind energy by 2030.

Some believe that the Jones Act requirements may also slow down fleet development because US shipyards are new to this potentially lucrative sector. However, others point to joint venture opportunities with designers and builders in regions where offshore wind is already an important component of energy supply.

Fast track

Meanwhile, the opportunity to upgrade or convert existing offshore vessels could provide a fast track. Ulstein has completed a number of conversion projects including the two PX121 platform supply vessels, Esvagt Leah and Esvagt Heidi. Both ships, originally built at Ulstein Verft, returned there in 2021 to be upgraded with more environmentally friendly power systems and converted into emergency response and rescue vessels.

Another more extensive upgrade is currently in progress in Ulsteinvik. The shipyard is currently engaged in the upgrading of the Service Operation Vessel (SOV), Windea Leibniz, built in 2017, which features a TWIN X-STERN. This unique Ulstein hull form provides the vessel, managed by Bernhard Schulte Offshore, with significantly better seakeeping qualities, widening the weather window.

The SOV has already worked successfully for Siemens Gamesa on the Sandbank and DanTysk wind farms in the German North Sea. But her operational window will now be significantly increased by a series of modifications. These include the recently completed installation of an adjustable pedestal for the gangway and a 50% increase in single cabins for charterers, providing accommodation for 60 persons. This will mean a change in the vessel's status from SOV to Construction SOV (CSOV).

Thumbs-up from ships' crews

The ship's TWIN X-STERN, in particular, has proved popular with shipboard personnel. Not only does stern-to-the-sea operation often simplify and extend day-to-day working, but it also makes life on board more comfortable in heavy weather. Although the SOV is likely to be redeployed on projects in the North and Baltic Seas, the new features demonstrate how upgrades or conversions could hasten the supply of support ships in the offshore wind sector.

In another upgrade, early in 2022, Norway's Norside Wind AS opted to convert the platform supply vessel, Farland, into a walk-to-work vessel for the offshore wind sector. The vessel, of Ulstein PX121 design, has been equipped with a motion-compensated gangway, an Access & Cargo Tower, a new accommodation module, and a battery package. The converted vessel will now operate under the name Norside Cetus.

Although Russia's invasion of Ukraine has transformed the energy backdrop, generating a rebound in oil and gas exploration as energy security becomes the number one priority, there are still significant numbers of support vessels that could be upgraded for operation in the offshore wind sector. And as the US intends to ramp up offshore wind development as quickly as possible, retrofits and conversions could offer an interesting option.

Pedestal installation on the Windea Leibniz 30 Nov 2022.

Illustration courtesy Ulstein

New Shiplift for BAE Systems Jacksonville

BAE Systems announced it will spend $200 million for upgrades aimed at increasing capacity and flexibility at its Jacksonville, Fla. ship repair yard. The investment covers the preparation, construction, procurement and installation of a modern Pearlson shiplift and land-level ship repair facility, giving the yard the capability to service a greater number of vessels more efficiently.

Located two miles from the Atlantic Ocean, at the intersection of the St. Johns River and the Atlantic Intracoastal Waterway, BAE Systems Jacksonville Ship Repair provides repair, maintenance, overhaul, conversion and marine fabrication services for a wide range of commercial and government vessels, from tugs to warships, serving both domestic and international fleets.

The shipyard, which drydocked 15 vessels last year, expects to accommodate even more vessels calling upon the port of Jacksonville in the years ahead, according to Tim Spratto, general manager at Jacksonville Ship Repair. "We anticipate a sustainable workload from the Navy, Coast Guard and other government customers' vessels in the port," Spratto said. "Growth in workload is expected from the commercial ship repair market with the introduction of this new ship repair capacity in Jacksonville."

Central to the yard's new repair complex will be a new shiplift, used for hauling ships out of and back into the water, as well as a self-propelled modular transport system for carrying ships to and from the new land-level facility.

Douglas Pearlson, president and CEO at Miami-headquartered Pearlson Shiplift Corporation, said his firm worked with BAE Systems to define and deliver a design that met both current and future ship repair needs, and he noted that the companies conducted an in-depth study of vessels operating in the area as well as anticipated growth for JAXPORT and Naval Station Mayport in the decades ahead. "Pearlson's team worked with BAE Systems personnel on the ground in Jacksonville to deliver a comprehensive, detailed design that meets the shipyard's needs. This included numerous working groups and round table sessions to ensure that there are provisions in the design to conduct ship repair work more efficiently and effectively with this new state-of-the-art shiplift and land level facility," he said.

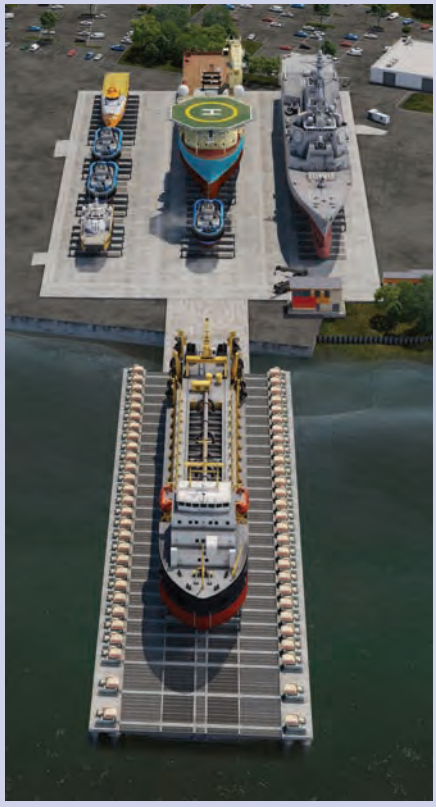


Image: BAE Systems

BAE Systems will install a modern Pearlson shiplift

The end result will be a complex that boosts ship repair capacity near a significant trade hub and major U.S. Navy homeport. "The new Pearlson shiplift and land level facility for BAE Systems Jacksonville Ship Repair, when commissioned, will be the largest in North and South America and the most modern shiplift in the world. It will be capable of lifting and launching ships in excess of 25,000 long tons, with a platform that is 492 feet long and 110 feet wide," Pearlson said.

Notably, for BAE systems, the new shiplift complex will increase its drydocking capacity from two large-hulled ships to as many as six vessels simultaneously. The facility will be able to accommodate vessels up to 600 feet long, 100 feet wide and displacing up to 10,000 tons. "The new facility will expand BAE Systems' docking capacity by 300%, all enabled by a modern Pearlson shiplift system capable of lifting a Ticonderoga-Class Guided Missile Cruiser, Arleigh Burke-Class Guided Missile Destroyer, the new Constellation-Class Guided Missile Frigate or a Panamax commercial vessel, with laydown area ashore to refit and repair multiple vessels at one time," Spratto said.

"This investment by BAE Systems recognizes the significant advantages that a Pearlson shiplift system can provide in terms of efficiency and capability to shipyards. Through the construction of one shiplift, BAE Systems will be provided with the capability to work on a multitude of vessels at any given time," Pearlson said. "When completed, BAE Systems Jacksonville Ship Repair will join more than 275 shiplifts in 65+ countries around the World that are supported by Pearlson Shiplift Corporation."

Jacksonville Ship Repair plans to begin on-site construction activities in early 2023, and Spratto said the yard will continue to function at full capacity with two marine railways and a 13,500-ton drydock through much of the construction period until the shiplift and land-level facility are certified and commissioned in 2025. *– By Eric Haun*


Candy, Scieco InTank


Dedeurwaerder, Bio-SEA


Marshall, Ecochlor

BWMS: FIT FOR REFIT

Since the ballast water management system discussion started, a clear concern was the ability to fit new equipment on existing ships, placing a strain on both space and power. Last month *MR* caught up with a few key suppliers to for their insights on market development.

How many BWMS have you sold and installed to date?

Maxime Dedeurwaerder, BIO-UV
Last year has proven to be the best on record, with roughly 200 BIO-Sea units delivered. All told, we have about 700 units in service or pending commissioning and almost 100 units on order.

Andrew Marshall, CEO, Ecochlor
Ecochlor has installed 317 systems, with another 54 on order, for a total of 371.

Giles Candy, Scienco InTank
In 2022 Scienco/FAST sold a dozen InTank systems and completed 14 installations. Currently most sales are to operators like Boskalis, Vallianz, Saipem. Their vessels, with semi-submersible operations, benefit using InTank because all treatment and neutralization happens in the ballast tanks; a semi-sub can arrive on site with all tanks treated and neutralized.

The new Scienco/FAST InTank FITT BWTS.

Image courtesy Scienco/FAST

How is your system optimized for efficient refit?

Candy, Scienco InTank
Installations of InTank have been completed at sea on vessels up to Cape Size. With prefabrication of piping, and small size of the hardware there is great flexibility in how a retrofit can be successfully executed. This year has also seen Scienco/FAST design InTank FITT, pictured. At only 0.5m2, also filter-less, it is a quantum leap forward for both cost and installation simplicity in the smaller end of the commercial vessel market. We are looking forward to the first installations in 2023. While InTank involves the installation of significant additional piping in a retrofit context, it is small diameter straight run. There is no fitting of large diameter pipes to filters barely squeezed into pump rooms. InTank does not use filters, and apart from the <1m2 Dosing Module (installed by the ballast pump / line), InTank's small modules (Bulk Chemical and/or Electrochlorina-

The EcoOne BWMS has many benefits for the offshore market.

Image courtesy Ecochlor

tion and Dechlorination) can be installed flexibly in the machinery space or in a deck house. In fact, we recently received an AIP for installation of a non-EX (less expensive) InTank deckhouse above the deck of a MR tanker.

Marshall, Ecochlor

In 2021, we launched our EcoOne filterless BWMS. At the time, Argo Navis Engineers, Ltd. were involved with two engineering studies with the EcoOne system that concluded the retrofits could be completed roughly 25% faster when compared to a standard BWMS with filter and may eliminate as much as a week in the time needed for the retrofit during drydock. In addition, because of the smaller bill of materials, owners could realize up to 40% savings in piping and between 30 to 50% for cabling, not including the saving for any owner's supplied equipment. Another benefit is that the treatment system does not have to be installed in the engine room, with flexibility in deckhouse locations.

Dedeurwaerder, BIO-UV Group

As the market matures and moves to support and service, we have seen increased focus on system integration and engineering. This means shipowners are getting much more involved in the process, to ensure systems and technologies are compatible with the operational profile and trading pattern of their vessels. If the vessel is to trade in Asian waters much of the time, robust filtration and UV dosing is an important factor. Also, ship operators must decide if a ship's operating profile can be adjusted – to enable ballast hauls between two ports where water conditions are challenging.

Can you share details on a recent installation case study?

Dedeurwaerder, BIO-UV

Last year we had an at-sea retrofit of a BIO-SEA L03-087 modular unit abord the 4,350-dwt Greatship Maya which maintained rig supply operations offshore Labuan, Malaysia, throughout the installation. Prior to installation we surveyed the site, taking 3D scans of the ship's machinery spaces to simplify pipework, electrical wiring, system integration and installation. This also revealed some space limitations which ensured we were able to design and build a ship-specific solution, allowing our engineering partner 3C Metal to get the BWTS in place without modifying the steel structure.

Candy, Scienco InTank

The number of semi-submersibles selecting InTank highlights the value it brings to this operation – allowing normal flood/drain operations for load pick-ups and drop-offs. The last of seven Boskalis vessels were retrofitted last year. However, something we had not appreciated before has now come to light with our recent project barge installations: InTank allows these barges to be used to receive ballast from a vessel that may need to discharge untreated ballast. This size of barge can service the ballast capacity of very large commercial ships providing an economic

solution for ports unwilling to receive untreated ballast. Transfer is completed simply and quickly – it is not complicated by treatment – the barge can complete full "D2" treatment and discharge at will, allowing the customer vessel to immediately get on with its work. As owners begin to understand that discharge compliance will be enforced, and as InTank continues its progress in simplifying retrofits, the operational freedom and control over compliance that InTank brings will be seen as increasingly valuable. As noted previously, we have already completed retrofits of retrofits. InTank is already installed from MR to VLCC, Handy to Cape. The new InTank FITT system with its easy filter-less installations for smaller commercial vessels will only increase its appeal.

Marshall, Ecochlor

I can share two! The EcoOne BWMS has many benefits for the offshore market. For example, semi-submersibles usually rely on gravity ballasting, which excludes any BWMS requiring an inlet press (e.g., for filtration). Our EcoOne system can use both gravity ballasting and deballasting, which is a benefit for Mobile Offshore Drilling Units (MODUs).

For stability reasons, semi-subs usually ballast via four sea chests located in the far corners of the rig. Any full-flow BWMS would require the installation of four separate units, which would cause some issues with tight spacing of the pontoon. With the EcoOne BWMS, we can serve up to four separate ballast sub-systems simultaneously utilizing one system. We are currently working on an installation on a semi-submersible drilling rig and along with the benefits listed above, the retrofit will not require massive modifications of the large diameter ballast pipes, but will only need unidirectional one-inch piping from the central treatment container to the injection location. For this retrofit, it was proposed by the integration engineers that we run two disinfectant lines in each elevator shaft (port and starboard). Once at the pontoon level, one pipe will lead to the forward and the other to aft injection flange near the sea chest simplifying the installation process. This semi-submersible rig retrofit will utilize our new EcoOne Container Unit introduced in 2022 at SMM which can be place on deck for transit only and removed while the rig is stationary.

Another case was the refit of an EcoOne Hybrid BWMS onboard a Jones-Act ATB. The EcoOne hybrid system allows for the ability to filter where conditions dictate, retaining the same low level of Cl02 dose rate of the original system. Where water conditions permit, filters can be bypassed ensuring that the owner operator remain in control of their ballasting process at all times.

Of additional significance for the ATB is the modular nature of the Ecochlor range of systems. Installation can be entirely on deck allowing preparation of the retrofit to take place well in advance of the barge arriving at the shipyard.

The design and component layout of the hybrid system offer further benefits by utilizing key attributes such as ballast water treatment on intake only. Thus, reducing the installation footprint as well as offering significant reductions of time and materials. We recently completed an installation where the owners selected to add one smaller filter per pump, providing greater redundancy and security of ballasting operations, as well as reducing installation footprint yet further since the filter was installed in a form of an enclosure rather than full deckhouse.

Prior to the retrofit, the shipyard installed deck mounts and any work below the water line a year before the actual installation because the ATB was already in drydock for other repairs. Through a series of upfront conversations, we were then able to have the system installed without the need to dock at all. Upon equipment delivery, the shipyard was able to pre-fabricate the parts and then lift them onboard the ATB by crane and mount it in situ. This shortened the overall lead time for the installation since the crew was really only focused on the BWMS retrofit and not other drydock maintenance and repairs, ensuring that the owner had minimal valuable off-hire time.

The Bio-Sea system.

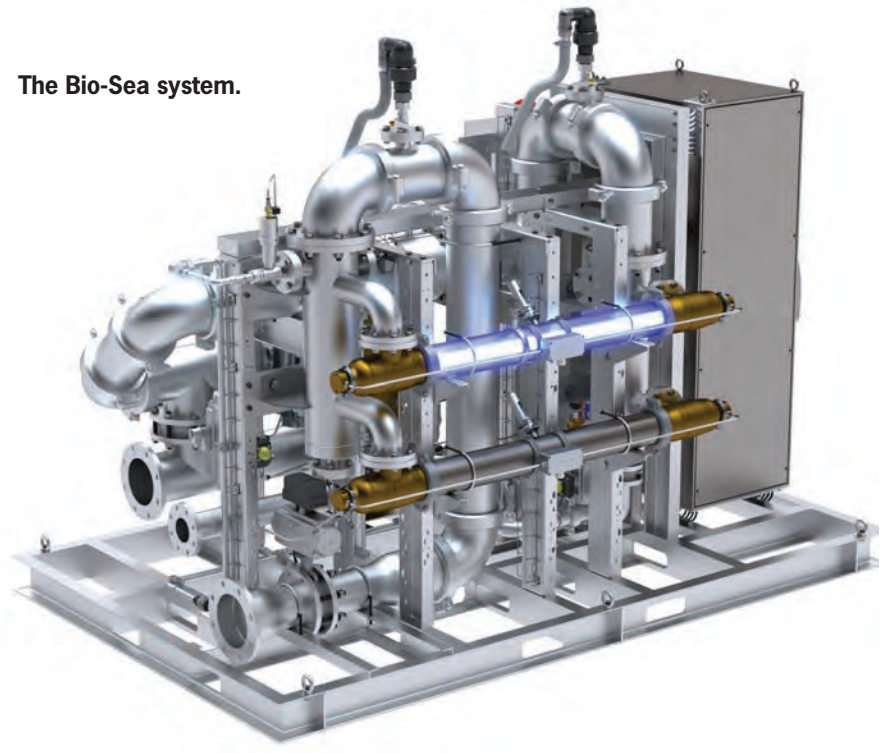


Image courtesy Bio-UV Group

Tech Files

Innovative new and emerging technologies

Armach Robotics, recently passed a critical milestone during a trial of its Hull Service Robot in full over-the-horizon (OTH) mode. At the end of 2022, Armach's hull service robot (HSR), in the water in Norfolk, VA, was monitored and controlled by staff at Armach's command center in Plymouth, MA, using a 4G modem providing over-the-air connectivity. During the trial, the Plymouth-based operator was able to fly the robot from its launch point at the pier, and make a controlled approach to the side of the ship. Once successfully established on the ship's hull, a short test cleaning protocol was commenced. Utilizing Safe C2, a distance operation solution by marine robotics specialist Greensea Systems, Inc., the trial demonstrated a unique advanced intervention task with an ROV, different from more traditional ROVs, representing another important milestone for Armach and its implication for industry use. During the trial, the HSR further demonstrated its obstacle detection and avoidance feature, its ability to recognize objects in its planned path of transit, autonomously navigate around these, and return to its originally planned path of operation. This technological advancement in remotely operated in-water operation is expected to have an impact on the efforts by the shipping industry to reach its decarbonization goals. The ability to deliver autonomous, efficient cleaning on micro-fouling means the cleaning process can be conducted in short time frames, and does not impact on the vessels' in-port turnaround time.

In addition to installation of these robotic units in port infrastructure, they are set to become resident on ships of all classes, able to conduct hull cleaning maintenance at the convenience of the vessel's schedule, irrespective of its location around the globe.

Dixie Trader installs Patterson Winches

When Dixie Towing acquired the Dixie Trader in 2021, the 1,800-hp tug, built in 1972, was approaching her 50th year in service and needed new deck winches to take on the saltwater dredging support that makes up Dixie Towing's primary business. The company recently opted to upgrade with products from Patterson Manufacturing. Dixie Towing Vice President Robert Gibbs Jr. said that Patterson winches were the "obvious choice" for their business.

"We needed a winch not only strong enough to handle loaded 'Super Jumbo' hopper barges but also resilient enough to operate reliably in an environment where splashing salt water and mud is unavoidable."

"Protecting products for corrosive environments, specifically saltwater, requires experience and attention to detail," says Taylor Grapes, president of Patterson Manufacturing. "Over the past 70 years, Patterson has continuously evolved our corrosion protection packages to ensure that, whether it is galvanizing or zinc plating, specialized paints, or use of stainless steel and other corrosion resistant materials, your product will hold up over time and provide you with long-lasting quality and perational efficiency."

The Dixie Trader is now outfitted with a pair of Patterson 40-ton, 7.5-hp galvanized winches that include their corrosion protection package.

In the Shipyard

Latest Deliveries, Contracts and Designs

Design: Harbor Power & Charging Barge

Elliott Bay Design Group (EBDG) designed a harbor power and charging barge, designed to offer ports and harbors a cost-conscious and high-performing option to minimize emissions from large vessels, both pier side and at anchor. Designed to deliver sever MW of continuous power generated by methanol, this floating mobile platform is designed to be capable of cold ironing even the most demanding vessels both at the pier and at anchor for up to two weeks before refueling.

In addition, it offers double duty as an "in-field" DC charging station for electric harbor tugs and other smaller service vessels. An independent ultra-low emission and nearly silent one MW system with 10 megawatt-hours (MWh) of reserve capacity continuously replenishes its reserve to provide fast charging capacity on-demand directly in the operating field of the vessels it serves.

The vessel is designed to be equipped with a Wärtsilä W32M Tier IV methanol generator for cold ironing and features e1 Marine's M30 hydrogen reformer technology coupled with PowerCell's PS-185 Fuel Cell system for fast charging. This unique combination of commercially available technologies offers exhaust emission reductions of 70%+ compared with conventional diesel at equivalent power, according to EBDG. Zero full cycle emission is also achievable with an optional Wärtsilä carbon capture system and certified green methanol fuel.

All of this capability is integrated into a barge platform less than 225-ft. long, with double hull protection of the methanol storage tanks and T1(b) Classification by Lloyd's Register and Marpol 21.1.2 compliance.

VERticale: Offshore Wind Installation Vessel

Vuyk Engineering Rotterdam presented its new foundation installation vessel (FIV), VERticale.

"VERticale is developed for an optimized deck layout," said Kuno van den Berg, Department Manager Operational Engineering, Vuyk Engineering Rotterdam. "The location of the offshore crane, motion compensated gripper and position of monopiles are all fine tuned for efficiency. VERticale aims for a minimum number of offshore handling operations. Not only loading and sea fastening is done in a controlled port environment, also upending. This results in less motion sensitive operations offshore and lower risk and increased weather window for the actual monopile installation. Thus, operating expenses (OPEX) are reduced".

The transport layout with vertical positioned monopiles results in a relatively compact vessel of 218 x 70 meters. For monopile or jacket installation, VERticale is outfitted with a 5,000-ton offshore crane.

"The challenge was to find a balance between vessel capabilities for installing future wind turbine generator foundations, with a clear focus on capital expenditure (CAPEX) minimization combined with the same or lower OPEX," said Nicky Mayenburg, Technical Sales Manager. "Other solutions and concepts have been studied, but most result in larger vessel dimensions and more complex handling operations when the vessel is offshore. The VERticale setup results in a balanced solution for installing future wind farms".

In the Shipyard

Latest Deliveries, Contracts and Designs

Photo courtesy NYK

LPG Dual-Fuel VLGC dubbed Lantana Planet

A naming ceremony was held at Kawasaki Heavy Industries' Sakaide Works for a new very large gas carrier (VLGC) that NYK will charter to Astomos Energy Corporation, a liquefied petroleum gas (LPG) company. The ship was named Lantana Planet by Mitsuru Yamanaka, EVP, Astomos Energy. Lantana Planet is sister ship of Lupinas Planet, which was completed in September this year. When LPG is used as fuel, exhaust gas from the VLGC will contain at least 85% less sulfur oxide (SOx) and 15% less carbon dioxide (CO_2) compared to conventional VLGCs equipped with fuel-oil engines.

Work starts on 50-ft. Hybrid RV

Snow & Company of Seattle started construction of a 50-ft. Hybrid research vessel for the Department of Energy's Pacific Northwest National Laboratory. Dubbed RV Resilience, the boat is designed by Incat Crowther with propulsion integration provided by Pacific Power. Hybrid propulsion will be accomplished by joining twin Volvo Penta D8-510 (374kW) marine engines, and two Danfoss Editron 20kW motor-generators. Power is stored using a Spear Trident battery system. This combination allows the vessel to operate in a zero-emission "quiet" state, which is more effective for marine research and will also reduce air pollution and carbon dioxide emissions.

The vessel will be stationed at PNNL's Sequim campus. PNNL-Sequim houses the only marine research facilities in the DOE complex. Resilience will be a multi-use platform for deploying research equipment, ROV's and diving operations in support of various research projects, including power generation and environmental surveys. Delivery is scheduled for summer 2023.

Photo Credit to Conrad and Berard

Conrad launches new Hopper Dredge

Conrad Shipyard recently launched Galveston Island, the first of two newbuild hopper dredges being built for Great Lakes Dredge & Dock Corporation, the U.S.' largest provider of dredging services. The new 6,500-cu.-yd.-capacity trailing suction hopper dredge is in the water and is scheduled to be in operation the first half of 2023.

The dredge will be equipped with a direct high-power pump-ashore installation, dredging system automation, dynamic positioning and tracking, U.S. EPA Tier 4 compliant engines, and have capabilities of running on biofuel to minimize the environmental impact.

The newbuild will replace one of the older hopper dredges in the Great lakes fleet, Terrapin Island, which is scheduled to be taken out of service during the fourth quarter of 2022 after a 42-year working life.

This Terrapin Island was planned for retirement upon the Galveston Island delivery, but based on her age the company has decided to accelerate her retirement to significantly reduce its operating, labor and maintenance costs and improve productivity for the overall fleet, Great Lakes said. Work planned for the Terrapin Island will be delayed until another hopper dredge completes its regulatory drydock at the end of December.

The retirement of the Terrapin Island will result in a non-cash write-off of approximately $8 million in the fourth quarter of 2022.

Great Lakes hopper fleet renewal program will be complete in 2025 with the delivery of the sister ship to the Galveston Island.

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

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

COMMUNICATIONS

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

DREDGING SERVICES

Great Lakes Dredge & Dock Co, LLC, 9811 Katy Freeway, Suite 1200, Houston, TX , USA , tel:(346) 212-1408, WHHanson@gldd.com contact: Bill Hanson, www.GLDD.com

ENGINE ORDER TELEGRAPH

Prime Mover Controls, 3600 Gilmore Way Burnaby B.C. V5G 4R8 Canada , tel:604 433-4644, fax:604 433-5570, Michael.Combs@pmc-controls.com

INERTIAL SENSING SYSTEMS

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

MEMS MOTION SENSING

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

METEOROLOGICAL INSTRUMENTS

R.M. Young Company, 2801 Aero Park Drive Traverse City, Michigan 49686-9171 , tel:(231) 946-3980, vsherman@youngusa.com contact: Viola Sherman

NAVIGATION AND CONTROLS

Prime Mover Controls, 3600 Gilmore Way Burnaby B.C. V5G 4R8 Canada , tel:604 433-4644, fax:604 433-5570, Michael.Combs@pmc-controls.com

SEALS

Seco Seals, Inc., 1370 Logan Ave. Unit K, Costa Mesa, CA , USA , tel:(714) 546-3478, sales@secoseals.com contact: Jim Scott, Jr., www.SecoSeals.com/Marine

SENSORS

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

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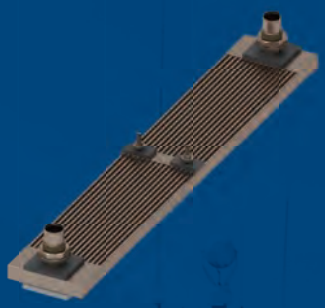

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