February 2022

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INTERVIEW
MIKKEL GLEERUP, CEO, CADELER

PATH TO ZERO
INSIDE MIT'S FUTURE ENERGY SYSTEMS CENTER

OFFSHORE WIND
THE MONEY STARTS TO FLOW

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NO. 2 / VOL. 84 / FEBRUARY 2022

On the Cover & Here
Fincantieri Marinette Marine has transformed its shipyard to deliver frigates for the U.S. Navy.
Source: Fincantieri Marine Group

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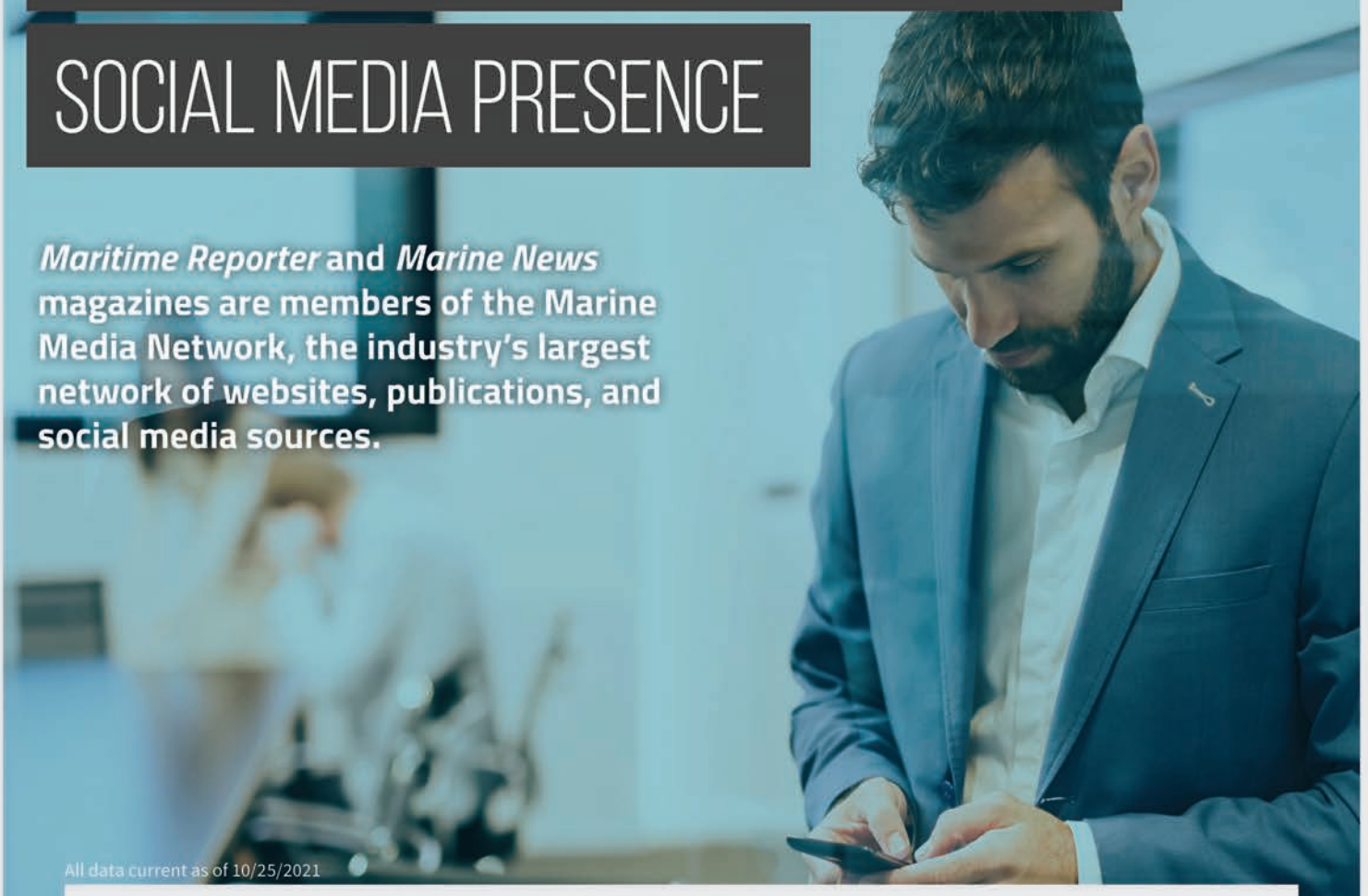

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Personally, there is no story that I like to cover more than a good shipyard story, and we have a great one this month with our cover feature focus on Fincantieri Marinette Marine (FMM) and its preparation as it gears up to build the U.S. Navy's new Constellation-class frigates.

We spoke with **Dario Deste**, CEO, Fincantieri Marine Group (FMG) and **Mark Vandroff**, CEO, FMM for an inside out look at how the company is investing, not only in FMM but in its 'system of yards', including Bay Shipbuilding and Ace Marine in Wisconsin, as well as its new ship repair facility in Florida. The story starts on page 38.

While 'government shipbuilding' is the number one focus of this February 2022 edition, focus number "1A" is offshore wind and all that it entails.

We have been beating the offshore wind drum long and loud for many years now, and while progress has been hauntingly slow, it appears that real money is starting to flow.

The latest report from **Philip Lewis**, Director of Research at Intelatus Global Partners, finds that at the end of January 2022, in the U.S. alone there were more than 45 projects in development representing $136B in CapEx expenditure and $4.4B in annual OpEx opportunity. The numbers surrounding offshore wind are starting to grow exponentially, but that growth has not yet translated into the bountiful number of new ship and boat contracts for U.S. shipyards that will be required to install and service the new offshore wind fields.

In that regard, **Greg Lennon**, ABS' new VP of Global Offshore Wind offers his thoughts in a recent interview with *Maritime Reporter TV*, an interview which is presented here in brief starting on page 22. Predictably much of the hold-up centers on finance, and more specifically getting funding for some of the larger, costlier assets when there is still a fair amount of uncertainty surrounding the long-term financial return. Lennon contends that creativity is needed, looping in key stakeholders in government and private equity, among others, to take these newbuild plans from the drawing board to the shipyard.

Finally, I'm happy to present our interview with Cadeler CEO **Mikkel Gleerup** on this company's ambitious plans in building a new fleet of advanced WTIVs for the international market. While the U.S. market has been stuck in neutral regarding pulling the trigger on newbuilds, Cadeler and many others in Europe are ordering large quantities of new, technically advanced tonnage across the full spectrum of vessel types and sizes. Our interview with Gleerup, which was recorded for our *Offshore Engineer* brand, starts on page 28.

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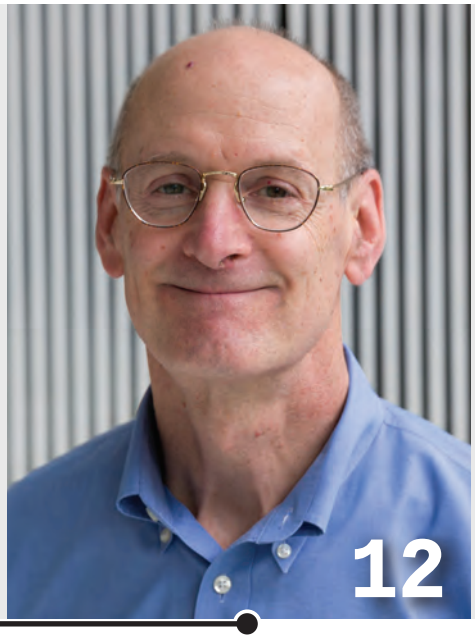
"Even if you're not going to put hydrogen on ships, hydrogen may be involved in producing that synthetic fuel. We have a number of projects underway that are tackling the question of hydrogen, ***including a project we're starting now looking at pathways towards gigaton scale, low carbon hydrogen production."***

Randall Field, Executive Director, MITEI Future Energy Systems Center



"The X-Class is special because it will be more capable, for example the X-Class can load more than 70% more cargo. *The cranes are much bigger, the overturning moment, which is really the number that we're looking at from an operational point of view, is significantly larger."*

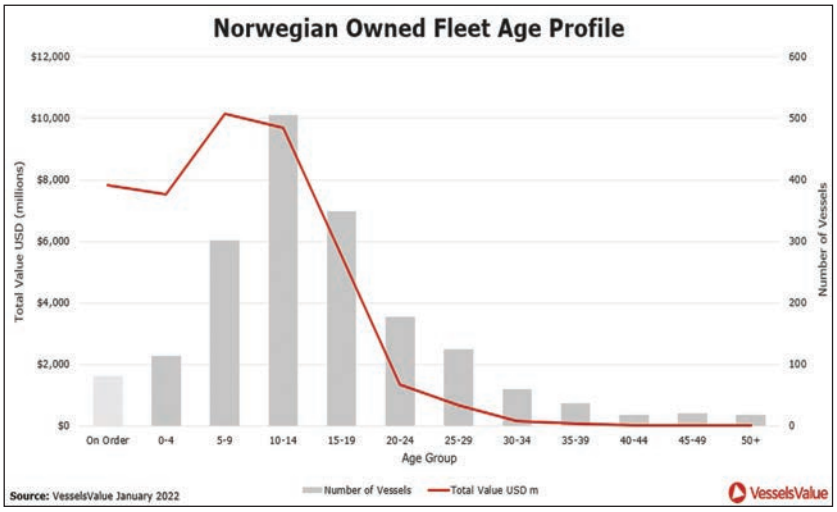
Mikkel Gleerup, CEO, Cadeler

"More vessels are needed, and while creative financing may come around to help close the gap on challenges in vessel financing, ***the problem on larger vessels, on a simplified level, is that matching the certainty of revenue with the payback period to recover those initial investments is still a challenge."***

Greg Lennon, Vice President, Global Offshore Wind, ABS

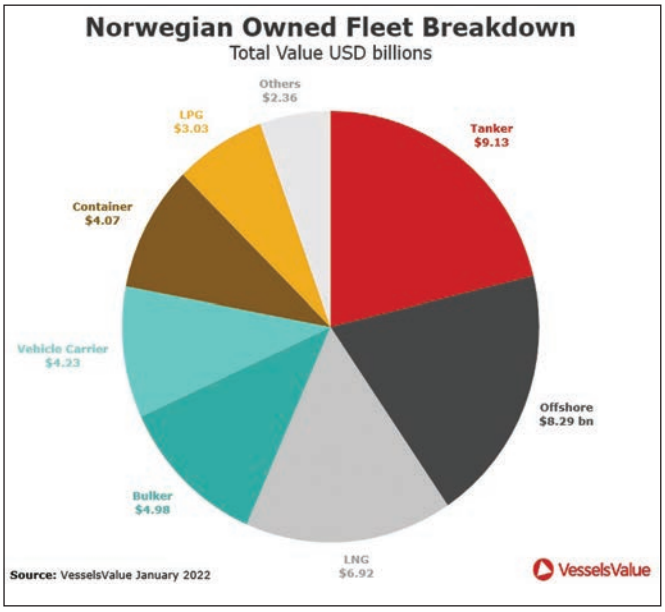
Norwegian Shipowners

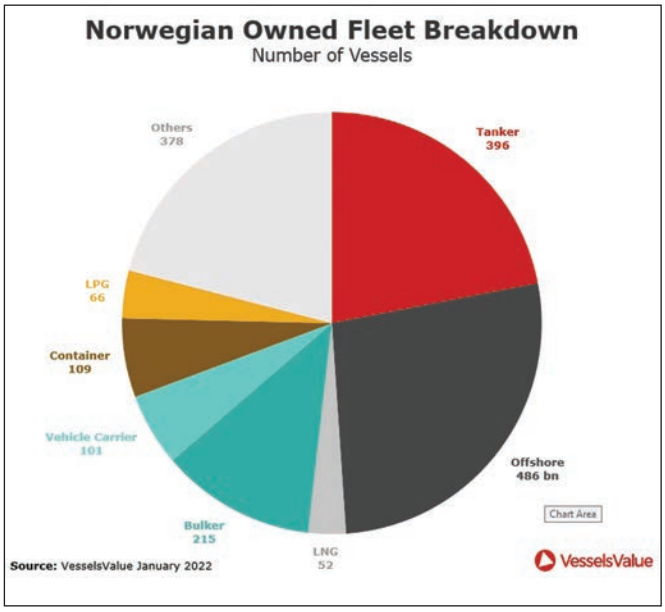
Norwegian shipowners have historically served as a bellwether for the global shipping industry, leaders in technological innovation and operation. With a population just north of 5 million, the 'maritime' is seemingly interwoven in the Norwegian DNA. Here's a breakdown of latest Norwegian fleet trends courtesy of our friends @ VesselsValue.



Norwegian Owned Fleet Breakdown

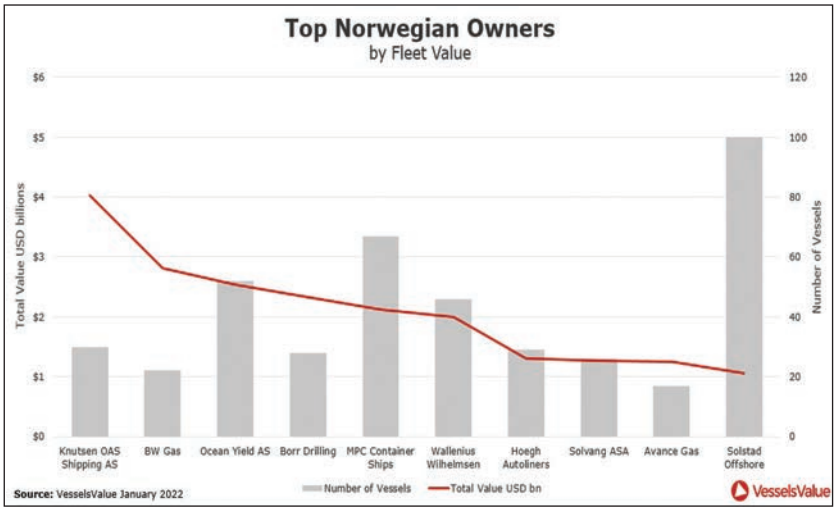
Type	Live		On Order		Total	
	# Vessels	Value $B	# Vessels	Value $B	# Vessels	Value $B
Tanker	381	$7.97	15	$1.16	396	$9.13
Offshore	469	$7.22	17	$1.07	486	$8.29
LNG	31	$3.08	21	$3.84	52	$6.92
Bulker	215	$4.98	-	-	215	$4.98
Vehicle Carrier	93	$3.55	8	$0.68	101	$4.23
Container	104	$3.63	5	$0.45	109	$4.07
LPG	61	$2.56	5	$0.47	66	$3.03
Others	368	$2.21	10	$0.15	378	$2.36
Grand Total	**1,722**	**$35.19**	**81**	**$7.81**	**1,803**	**$43.01**

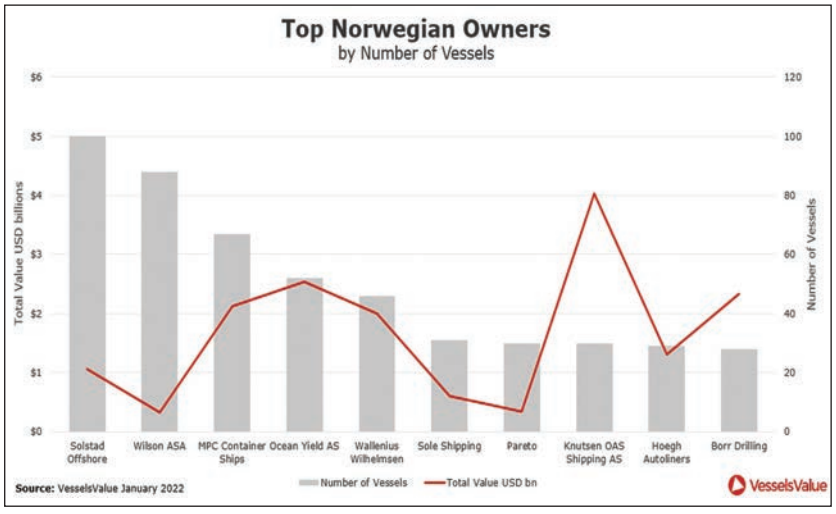




Top Owners, by Value

Owner	# Vessels	Value $B
Knutsen OAS AS	30	$4.03
BW Gas	22	$2.82
Ocean Yield AS	52	$2.53
Borr Drilling	28	$2.33
MPC Container Ships	67	$2.13
Wallenius Wilhelmsen	46	$2.00
Hoegh Autoliners	29	$1.30
Solvang ASA	26	$1.26
Avance Gas	17	$1.25
Solstad Offshore	100	$1.05



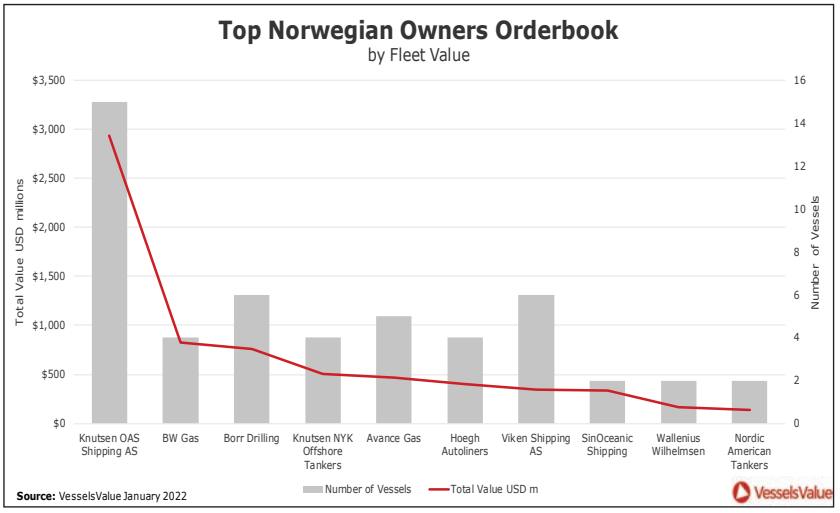


Top Owners, by # Vessels

Owner	# Vessels	Value $B
Solstad Offshore	100	$1.05
Wilson ASA	88	$0.32
MPC Container Ships	67	$2.13
Ocean Yield AS	52	$2.53
Wallenius Wilhelmsen	46	$2.00
Sole Shipping	31	$0.60
Pareto	30	$0.33
Knutsen OAS	30	$4.03
Hoegh Autoliners	29	$1.30
Borr Drilling	28	$2.33

Top Owners, by Orderbook

Owner	# Vessels	Value $B
Knutsen OAS AS	15	$2,933
BW Gas	4	$825
Borr Drilling	6	$756
Knutsen NYK O Tankers	4	$505
Avance Gas	5	$470
Hoegh Autoliners	4	$401
Viken Shipping AS	6	$347
SinOceanic Shipping	2	$338
Wallenius Wilhelmsen	2	$162
Nordic American Tankers	2	$139



The 3D Digital Process

3D digital design can save 'dollars on the deck plate' during construction while maintaining safety, says **Patrick Ryan**, SVP, Global Engineering & Technology, ABS.

By Greg Trauthwein

Last year ABS, Robert Allan, Signet and USCG collaborated on a project that would be the first commercial vessel in U.S. history to be produced using only 3D models in design and construction for all structures. While the process used to deliver this RAL-designed Advanced Rotortug (ART) is historic, it is just the start as Ryan contends that a purely 3D process reduces costs and time investment, while streamlining interaction between all stakeholders throughout the design, verification and construction phases, without compromising safety.

"ABS started focusing on this (pure digital process) in 2018 with a series of joint development R&D projects," said Ryan.

These early development projects were effectively building blocks in the digitalization production process, with the ART tug representing the completed structure; "purely and completely, stem-to-stern, all drawings replaced with 3D CAD from a plan review standpoint."

As is turns out, ABS has not simply been on the digital path, it has been on-point helping to bring together disparate parties to effectively lead the transformation.

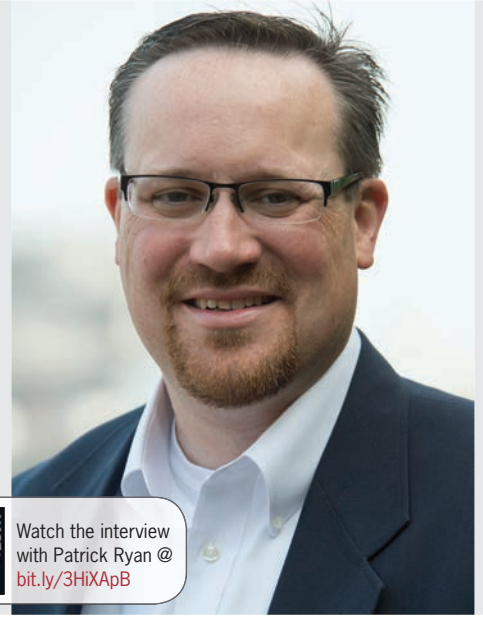
"To a large degree, it's really about enabling our clients to save dollars on the deck plate during construction while maintaining the class focus on safety," said Ryan. While savings vary greatly depending on the scale of the project and are proprietary bits of information held closely, Ryan said the savings can be substantial. "I come from shipbuilding before my time with ABS, and I really think about this in the lean manufacturing perspective of the elimination of waste."

"(I've been saying for more than a decade that) engineering drawings are a waste in the lean manufacturing sense because they are an inefficient communication method," said Ryan. "With mobility and modern technology and the advent of computers on the deck plate, it makes that drawing production an antiquated process."

"I took drafting in college and I have respect for the romance and the beauty of an engineering blueprint. But if you can communicate directly from the CAD to

"I took drafting in college and I have respect for the romance and the beauty of an engineering blueprint. ***But if you can communicate directly from the CAD to those downstream stakeholders and eliminate the drawing from the production process, you save money in engineering."***

Patrick Ryan, Senior Vice President, Global Engineering and Technology, ABS



MARITIME REPORTER TV Watch the interview with Patrick Ryan @ bit.ly/3HiXApB

those downstream stakeholders and eliminate the drawing from the production process, you save money in engineering."

3D model integration

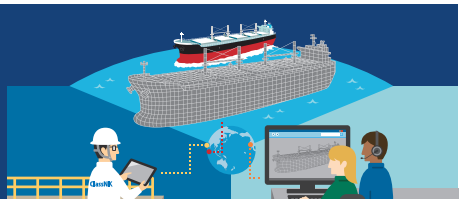
The milestone with RAL and Signet is just the latest in a succession of ABS firsts in 3D Model-based Class. According to the classification society, ABS was the first to develop a process for ingesting 3D models into class software to allow 3D model-based reviews in 2018. ABS then became the first classification organization to accept 3D models for class surveys in April 2020. "We are very focused philosophically on being flexible, regardless of file format, regardless of pure CAD or PLM involvement, effectively making it easy for everyone," said Ryan.

"ABS does not want to dictate to the shipyards what format or what file types they need to submit to us. We work with those yards, typically in a JDP first, to establish what that exchange process looks like and then we build upon their existing process to make it easy for them, rather than trying to drive the industry toward a standard."

To the Cloud

Watching the 3D process evolve from R&D to the market has been an exciting one for Ryan and his team, and it's brought along its share of surprises, too, particularly with its broad interest and acceptance. "What surprised me the most about this is this isn't a capital ship, this isn't a major vessel approach," said Ryan. "I thought the early adoption in this would be in big capital projects that were driven by the high-tier shipyards for hundred-million-dollar projects. That's not been the case. We've seen this (interest) across the spectrum, (from) big ships, to patrol craft, to tugs, and all the way down to barges."

Though still in its infancy, Ryan is looking ahead … or rather up … to 'the cloud.' "The exciting thing is that, starting last year really, we started moving it from an R&D project into the core process of ABS," said Ryan. "We're starting to move all of this approach into the cloud to really facilitate that exchange and make everything easier. We know there are security questions, and we are attacking that with great rigor to make sure that that data is well protected. The future is bright for digital class exchange."



MIT takes the lead toward Net Zero

The MIT Energy Initiative (MITEI) launched a new research consortium—the Future Energy Systems Center—to address the climate crisis and the role energy systems can play in solving it. Randall Field, Executive Director, discusses current research and the challenges ahead for the maritime sector.

By Greg Trauthwein

Photo courtesy Shutterstock/MIT

The reputation of the Massachusetts Institute of Technology (MIT) is such that it can take mammoth issues — such as driving the world to net zero — head-on, and suddenly make the impossible seem possible.

Last month the MIT Energy Initiative (MITEI) launched a new research consortium — the Future Energy Systems Center — which aims to address the role energy systems can play in solving the climate crisis, an integrated effort which will engage not only researchers from across all of MIT but a multitude of corporations and global organizations to help drive emission reductions across all industries further, faster.

"The Future Energy System Center (today) has 26 member companies in it," said Randall Field, Executive Director, Future Energy Systems Center. "We have more than 20 different projects in our research portfolio today across six focus areas, including transportation. The center lives within the MIT Energy Initiative, which has been in existence since 2007 when Ernie Moniz and Bob Armstrong started it up, and we've deployed more than $850 million in funding to date."

The Future Energy Systems Center's mission is to investigate the emerging technology, policy, demographics, and economics reshaping the landscape of energy supply and demand. The Center conducts integrative analysis of the entire energy system—a holistic approach essential to understanding the cross-sectorial impact of the energy transition.

There are, of course, many collaborations and initiatives globally that seek to draw the brightest minds and deep pockets to fund R&D. But Field said the Future Energy Systems Center is unique and collaborative.

"Our approach to the energy transition is to take a holistic look at the entire energy system and consider all the sector coupling issues, which are massive because decarbonizing the world is a very complex beast," said Field. "We think of MIT as technology, and it is, but we look at the technology, we look at the economics, and we look at the policy issues. We also engage closely with industry because industry are the ones who are going to deploy the technology. We talk about different groups working on this, I also want to commend our friends over at the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping. We have had great discussions with them and we're looking forward to collaborating with them on the decarbonization of shipping." The overarching focus of the Center is integrative analysis of the entire energy system, providing insights into the complex multi-sectorial transformations needed to alter the three major energy-consuming sectors of the economy — transportation, industry, and buildings — in conjunction with three major decarbonization-enabling technologies — electricity, energy storage and low-carbon fuels, and carbon management.

While the Future Energy System Center's remit extends far

"Even if you're not going to put hydrogen on ships, hydrogen may be involved in producing that synthetic fuel. We have a number of projects underway that are tackling the question of hydrogen, ***including a project we're starting now looking at pathways towards gigaton scale, low carbon hydrogen production."***

Randall Field, Executive Director,
MITEI Future Energy Systems Center

MARITIME REPORTER TV Watch the interview with Randall Field @ bit.ly/34iM5zO

Photo courtesy MIT

beyond the confines of the maritime industry, Field maintains that shipping offers its own set of unique and difficult hurdles.

"Shipping is a very tough sector to decarbonize, as there are no fuel options out there that address all the requirements for international shipping," said Field.

Those requirements include high energy density, the potential for that fuel to be zero carbon in the future, the ability to scale those fuels as needed for the shipping sector, and very importantly, low cost as well as health and safety.

"New ships ordered today will still be in service in the year 2050 when we're trying to get to net zero," said Field. "So it's a very difficult choice for shipping companies to make on what their ships should be, so the lock in challenge is very severe."

"No Silver Bullet"

A common refrain when discussing maritime fuels and technologies in the context of decarbonization is that there is 'no silver bullet.' "Every fuel option has its challenges and uncertainties," said Field, including challenges on scale, cost, carbon intensity, energy density, power train maturity, and emissions, with emerging alternative diesel options today including various biofuels, synthetic fuels, methanol, hydrogen, ammonia and renewable LNG. "Some of these can serve as drop in fuels, which makes the flexibility issue much more straightforward, but others require entirely different power trains," which creates many challenges, including problems centered on future modification. While there are many new and emerging technologies and techniques that offer promise to help reduce fuel consumption and reduce emissions, there is nothing today that brings it to net zero, which is the cornerstone of the Future Energy Systems Center. "Anything that delivers efficiency with existing ships is highly valuable, whether it be friction reduction by the surface coatings, design of the hulls, optimization of logistics, weather and route optimization and slow steaming (for example)," said Field. "There's a lot of opportunity there that should be done to deliver more profits for the shipping companies. But while efficiency is wonderful, necessary and profitable, it doesn't get you to net zero."

The Path Ahead

As a member-supported research consortium, the Center collaborates with industrial experts and leaders for insights to help researchers anticipate challenges and opportunities of deploying technology at the scale needed to achieve decarbonization. And while technology is an obvious focus, Field sees a bigger challenge ahead.

"The technical issues, the cost issues, those are manageable issues. The biggest challenge that I see here is the geopolitics and the policy uncertainty," said Field. "If the world could implement policies that are firm, that are long-term and eliminate leakage, then the shipping industry and the ship builders and the fuel providers would then have a clear and compelling price signal on what they need to do. The innovators and investors would be able to contribute to bringing down the costs. Sadly, we are very far from having such policies."

By "leakage" Field means that some shipping companies abide by IMO rules, others do not. Those that chose to skirt the rules will produce the CO2 emissions that could effectively undo all of the good that's being done by the shipping companies that follow the rules.

But rule makers and rule breakers are not the primary focus of Field and his team at the Future Energy Systems Center today.

"We have quite a few projects underway as I mentioned, more than 20, and all of the low carbon fuel pathways for shipping involve hydrogen at some stage in their production," said Field. "Even if you're not going to put hydrogen on ships, hydrogen may be involved in producing that synthetic fuel. We have a number of projects underway that are tackling the question of hydrogen, including a project we're starting now looking at pathways towards gigaton scale, low carbon hydrogen production.

Another project starting in February will look at large scale use of ammonia as a fuel for maritime shipping."

The Future Energy Systems Center members to date include: *AECI, Analog Devices, Chevron, ConocoPhillips, Copec, Dominion, Duke Energy, Enerjisa, Eneva, Eni, Equinor, Eversource, Exelon, ExxonMobil, Ferrovial, Iberdrola, IHI, National Grid, Raizen, Repsol, Rio Tinto, Shell, Tata Power, Toyota Research Institute, and Washington Gas.*

Let's Get One More National Multi Mission Vessel, but

Let's Add Some Grit

By Rik van Hemmen

The new maritime academy school ships being built at Philadelphia Shipyard (officially designated as National Security Multi Mission Vessels) are an exciting development and provide a significant boost to our national maritime educational system. The technology on our existing school ships has very little relevance to the present marine industry, and these new vessels will not only provide the students with a better educational setting, in their multi-role deployment, they will also provide more exposure to maritime education.

Maritime education is one of the country's educational gold standards. Maritime Academy graduates receive an education that not only strengthens our maritime readiness, but, maybe even more significantly, provides a rare educational approach that straddles practical and theoretical education and professional and technical careers. Maritime Academy graduates have been primed to work on real tasks, in real teams, in real settings, using both technical and non-technical skills (which I have referred to as STEMPHLA).

From our industry point of view, we want to get the best and brightest to enter our industry, but maritime education has a more important national benefit. Maritime education teaches grit and that is what we need both at sea and ashore.

The concept of grit was first formulated by Dr. Angela Duckworth, and she defined it as a combination of passion and perseverance for a singularly important goal. She considers it to be the magic ingredient in education, particularly in the STEM field, and there is significant evidence that today grit has become a rare ingredient in education, but it has been very difficult to study.

As far as I have been able to determine, this lack of supporting evidence is related to researchers running experiments, but not looking out of their cockpits to figure out where grit is making the difference.

In education there is a huge difference between experiments and real life. The biggest problem is that experiments in education often run into the natural resistance of the experimental subjects, which in education are not just the students, but also the parents, the teachers, the researchers themselves, and even the media.

Therefore, if an existing educational program is tasked to dial up the grit, the researchers need to design a grit setting where the teachers need to function within that setting, the parents need to buy in, and then somehow the students need to believe they are working in a real goal-oriented setting, rather than a pretend goal-oriented setting. And this is where maritime education comes in.

It is important to remember that a grit goal is only effective if it is strongly motivating and real. As a student and as a trainer, I have too often seen educational exercises fail because there was no actual motivation to achieve the goal or the goal was not real. For a teacher to say "Today we will do a scientific experiment; we will boil water and determine the boiling point temperature" will result in massive BS alarms (sorry, I cannot think of a less scatological term) firing off in the students, since it is a false goal. The students know that they are going through an exercise that has been done a billion times before. An exercise has no real goal if the goal has been achieved a billion times before.

However, even a simple experiment like this can have real educational and grit value if the teacher says "If you read your textbook, you will know that many centuries ago it was discovered that water boils at a consistent temperature. That is nice, but what nobody knows today is what the boiling temperature of your spit is. Therefore, I want everybody to spit in a test tube and measure their spit boiling point. We will then collect that data and plot it. By the way, I have no idea what the answer will be, so I am as curious as you might be."

It is interesting to note that this is a learning project, and the goal of the learning project is to engage the student in unexpected ways (catharsis) to train them to regard their world dynamically rather than passively. That educational benefit will not express itself in standardized tests and is inherently hard to measure.

Let's now transfer these concepts to maritime education. Goal setting is much easier in maritime education.

Here is a simple one: "We are going out on a boat. We will show you how to operate it and then you get to do it yourself. If you do it right, you may be somewhat miserable; if you do it wrong, you will be cold, wet, and embarrassed."

This was an incredibly common educational path until post WWII as in "Hey, you 12-year-old, please take this horse into

Photo courtesy Schulkens Communications/CRPAA

SE Louisiana middle and high school students aspiring to learn more about the local maritime industry tour the docks and terminals along the Mississippi River in St. Bernard Parish as part of the first ever Maritime Field Trip organized by Crescent River Port Pilots Association (CRPAA), the New Orleans-Baton Rouge Steamship Pilot Association (NOBRA), the St. Bernard Port Harbor and Terminal District and Associated Terminal. Pictured (L to R): **Damien Lee**, 10th grader; **Kaybre Cuhsenberry**, 8th grader; **Abrya Royal**, 10th grader; **Ben Brockhoff**, 10th grader; and **Branson Vicks**, 10th grader. "Getting young people interested in maritime careers now not only benefits the students, but it will significantly assist our riverfront partners in future job recruiting efforts as we search for new, bright and aspiring mariners," said **Captain Roy Vance,** CRPPA, who organized the event.

Read the full story here: bit.ly/32XMQyb

town to get it shoed."

However, today this has devolved into "Dear 12-year-old, please put on your coat and shoes so I can take you to soccer practice."

Remarkably, maritime education is the only remaining setting where the path between showing and having the student do it themselves with manageable risk of harm still exists and can be taught to students 12 years of age and even a little younger. This educational setting exists in the form of maritime high schools, and there are over 50 maritime high schools all over the United States. While the large new school ships can provide sophisticated professional training, it does not inherently develop grit. Grit develops on small craft and is best introduced to younger students at the high school level or even earlier. Therefore, while the academies certainly deserve their new vessels, why not also provide the maritime high schools with new training vessels?

For the cost of one additional National Security Multi Mission Vessel ($300M), it should be possible to build about a hundred 60-foot simple lower speed aluminum catamarans outfitted for light oceanographic, environmental, wildlife, and fisheries research work. These vessels would be assigned to existing and newly formed maritime high schools to function as floating classrooms where students can be trained in vessel operation and navigation and maritime research in all its forms. And there is so much left to research on the water. (Some of which could be contracted research to local state and national entities, where student participation in real research is a further grit driver.)

While the design would be standardized, they would be outfitted for local environmental conditions where some may be all electric, while others may be hybrid. They would be designed to be modified or outfitted to take advantage of emerging technologies. These vessels will provide high school students with the grit to apply to maritime academies for maritime careers or any other university level STEM programs.

A fleet of 100 of these vessels will undoubtedly provide a higher level of exposure and educational bang for its buck than one additional NSMMV.

Many years ago, my father and I took my 7-year-old son on a head boat fishing trip. My son was the only kid aboard; and when we got to the fishing ground, the mate took a spot next to my son and said "Let's see what we got here." He put his rod out and a few minutes later he said to my son "Kid, take my rod; I have to talk to the Captain." The moment my son had the rod in his hands, the reel spun out and my son got to reel in his first fish. My father was delighted; and when we got back to the dock, he handed the mate a big tip. The mate said "Thanks, but I don't need your money." Then he pointed at my son, "I just want to get them when they are young."

I have been told drug dealers use the same approach; instead, let's spend some money to get our kids some grit.

For every column I write, MREN has agreed to make a small donation to an organization of my choice. For this column I nominate the Maritime Primary and Secondary Education Coalition. *www.mpsecoalition.org*

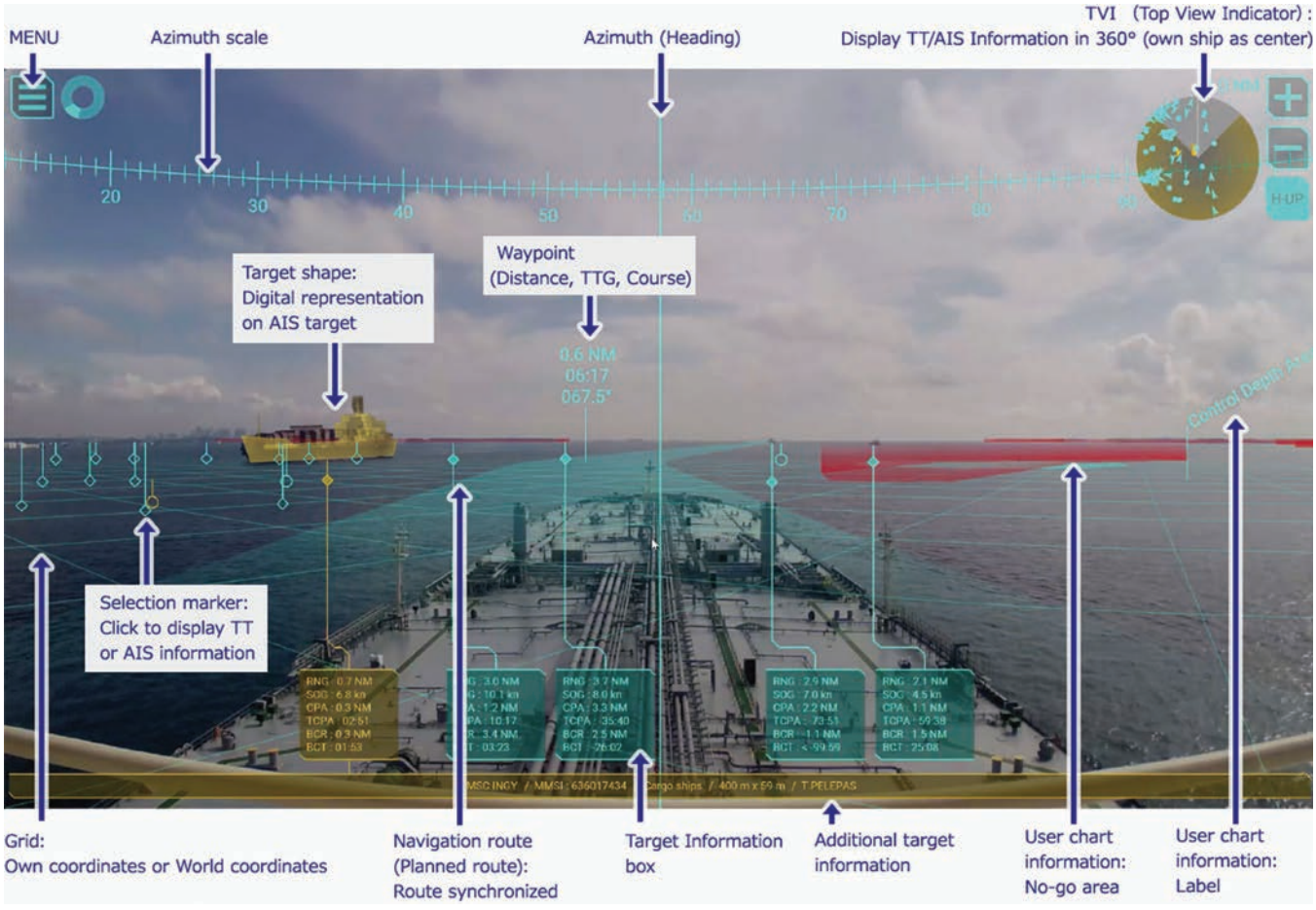
The 'Future Bridge'

With autonomous navigation and remote electronics management, Furuno is on a digital transformation journey to help revolutionize the maritime industry. Matt Wood, National Sales Manager, Furuno USA takes a deeper dive.

By Greg Trauthwein

In 1938, Kiyotaka Furuno founded Furuno Electric Shokai Ltd., the predecessor of Furuno Electric Company. Today Furuno is best known as a radar and navigation company with nearly 90 percent of its business in the maritime sector. "We are still principally a family-owned, family-oriented company, founded by two brothers that were radio engineer specialists," said Matt Wood, National Sales Manager, Furuno USA. "They parlayed the radio engineering into underwater depth sounding and fish finding, and the rest, as they say, is history."

Today, Furuno is just under 3,000 employees with annual sales (2020) of about $770 million. The company is headquartered in Japan, and in addition to the parent company there are 40 wholly owned subsidiary companies globally. "We're acknowledged as a brand in the maritime space, and marine is what we do. Research and Development (R&D) is our engine, and the majority of employees in the company are engineers," said Wood. Focused on all levels of maritime, from small recreational to the largest oceangoing commercial and government ships, the Furuno product line-up is in a word 'broad'. "It's impossible to say this and not sound a little bit arrogant, but the fact is we have the largest



Photos courtesy Furuno USA

product line of any of our contemporary manufacturers: we do everything," said Wood. "When we sit in our forecasting meeting, we are forecasting well over 400 finished goods … it's a long meeting!"

The Future is Now

As the world's waterways become increasingly congested, situational awareness and real-time, actionable intelligence is increasingly in demand to conduct safe, efficient operations. Modern vessels increasingly sport higher levels of automation and autonomy, a step-process toward reduced crews and eventually uncrewed. Case in point is Furuno's use of augmented reality technology, a key first step toward automated ships of the future.

"A product that is just starting to emerge right now is our AR100, an augmented reality device," said Wood. "It's nothing that is mandated by the market or required by regulation. You have to have a gyrocompass on board, you have to have a radar on board; but you don't have to have augmented reality technology."

Augmented Reality

According to **Matt Wood**, a product that is just starting to emerge is Furuno's AR100, an augmented reality device. AR100 merges multiple technologies: camera, ECDIS, radar, GPS, heading, satellite compass, doppler speed log and satellite doppler speed log … merged into a heads-up display. Wood admits "it's not a regulatory requirment, but there are companies that want to embrace it." Furuno has intentially started small and inexpensive. "We're looking at, ballpark, $25,000 to add it to an existing for Furuno bridge. But we envision that this kind of technology is going to continue to take off" and drive future developments in autonomy. Pictured **left** is the head-up display; **below** is 'the kit'.

Photo courtesy Furuno USA

Furuno sells a complete AR kit, merging camera, ECDIS, radar, GPS, heading, satellite compass, doppler speed log and satellite doppler speed log.

"We're merging all of those technologies into a heads-up display that today is a conventional play in the front of the bridge," said Wood. "But it could be put into a headset, an overhead or a projection."

Wood said the company has intentionally started small. "It's not particularly expensive technology; we're looking at (about) $25,000 to add to an existing for Furuno bridge. But we envision that kind of technology is going to continue to take off" and effectively serve as a gateway technology to future automation and autonomy.

Augmented reality technology has been implemented successfully in the automotive and gaming industries but has not been widely deployed in a maritime environment. Furuno developed the concept and presented it for the first time at a maritime exhibition, where it attracted the interest of Mitsui OSK Lines. Furuno and Mitsui OSK Lines embarked on a joint development project and, and after a year and a half of development, the partners launched their product in May of 2019 on 21 VLCCs, and growth has been strong ever since.

AR is just one step on the autonomous journey, as it alone cannot mitigate all accident risks.

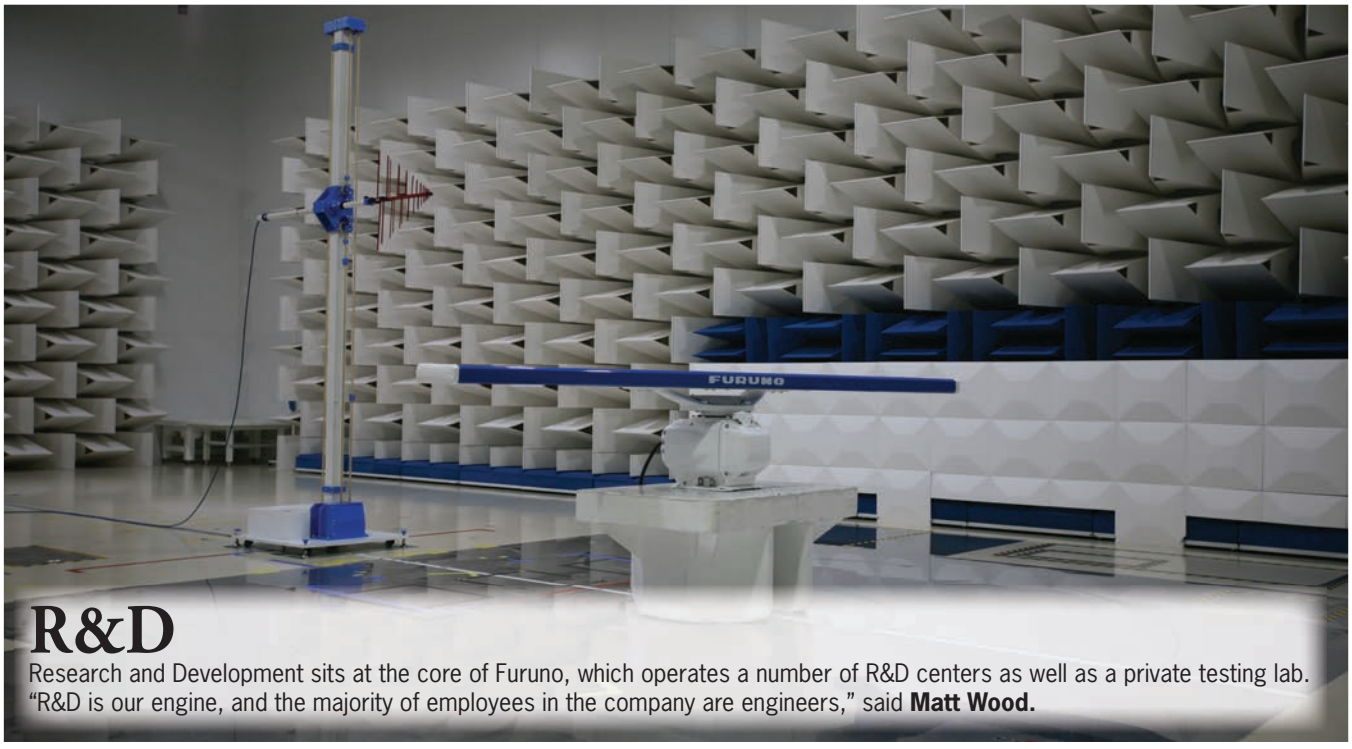
In Japan, in 2020, under the sponsorship of the Nippon Foundation, MEGURI 2040, began a joint project to develop the world's first completely crewless ship. For its part, Furuno established a special division to accelerate the development of sensors and technologies that will enable the creation of this fully automated ship by 2025, mobilizing its researchers, developers, and companies to make help bring the project to reality.

The Digital Path

As is the case with any engineered product, it is the core foundation of R&D that is critical to delivering a sound solution, and for Furuno that all starts with digital signal processing and the adaptation of other digital technologies from outside the maritime space. "For us digitization, most simplistically, initially, has meant a transition from analog technology to digital technology. While that's a bit simplistic, it's really important for us to underscore how vital that digitization has been for growing our technology in leaps and bounds. We had a really good analog radar before, we have an even better digital radar now."

This mantra runs throughout the Furuno product line, and the digital footprint extends far beyond the product, system, and even the ship.

"We are enabling a much higher and deeper level of connectivity between the shore side of operations, to better understand what's going on with the vessel. One of our subsidiaries, Furuno Hellas in Greece, have come out with a product that they call HermAce, which is full-scale, remote monitoring system that was awarded Lloyd's Register world's first Digital Twin Ready



R&D

Research and Development sits at the core of Furuno, which operates a number of R&D centers as well as a private testing lab. "R&D is our engine, and the majority of employees in the company are engineers," said **Matt Wood.**

certification.

New product and system development is the cornerstone of every electronic company, and in this regard Furuno is always on the lookout for new technologies and partnerships outside its walls, as well as seeking innovative ways to redeploy its own existing technology.

"One examples is we have leveraged our marine radar into a weather radar," said Wood. "We have a dual polymetric – either 2D or 3D radar – for weather.

Another core technology that we're really expanding on is inertial navigation units. Bringing technology from all around the globe, into our box allows us to do very high precision pitch, roll and heave for stabilization, whether we're stabilizing a recreational fish finder, a commercial fish finder or a multi beam sonar.

Another product accomplishment, which Wood believes to be unique to Furuno, is to offer "a matched pair of IMO type-approved navigation radars, in solid-state X-Band and S-band. There are other manufacturers that have one or the other, but we can actually do a matched pair."

Regardless of the market, Furuno comes loaded with a solution for most situation on the world's waterways. "We really pride ourselves in providing very sophisticated, complex answers and solutions, to really complex problems," said Wood.

Greg Lennon

VP, Global Offshore Wind, ABS

New to 'classification' as of September 2021, ABS' new head of global offshore wind delivers a powerful pedigree from the energy and offshore wind markets.

By Greg Trauthwein

MARITIME REPORTER TV Watch the interview with Greg Lennon @ bit.ly/3lXmZWa

While Greg Lennon is new to classification, ABS' new head of global offshore wind delivers a powerful one-two punch in the energy and offshore wind markets with more than 20 years of experience in wholesale power generating as well as renewables. "Specifically, I've been in the offshore wind sector for over 12 years," said Lennon in his recent interview with ***Maritime Reporter TV***. "While I was at a company called NRG, we acquired a company called Bluewater Wind and they had a lease area off of Delaware. That lease area is now Skipjack Wind Farm controlled by Ørsted. So, we had spent time developing that project 12 years ago. At that time, turbines were about just under 3MW in size, today we're talking about 15MW turbines."

Domiciled in New Jersey, Lennon also spent two years at the New York Power Authority, searching for a way to move offshore wind forward south of Long Island, a lease area that eventually went to auction and that's now controlled by Equinor BP – the Empire Wind Project.

A Booming U.S. Market

When Lennon opted to make the move to ABS, he saw a horizon filled with opportunity, premised by the Biden administration's goal of 30GW of offshore wind power in development by 2030. The last two months, in particular, have been busy. "Since you and I last met in November (2021, at the ABS Offshore Wind Conference in New Orleans), 3.2GW have been announced from Maryland and Massachusetts, making it just over 25GW of contracted certainty for the market."

In addition, the State of New York announced a $500 million commitment for further infrastructure investments, and that can also be directly related to supply chain, port infrastructure and education. Meanwhile on the west coast, Oregon announced its 3GW study to commence this year, in 2022, with California announcing that its mandate will be defined by mid-2022, a pair of moves that promises to help fast-track the concept of floating offshore wind.

"Finally, I think the most important thing is the Bureau of Ocean Energy Management announced its auction for six lease areas off of the New York-New Jersey; the Bight Area," said Lennon. "That has established a significant commitment for lease areas to be built upon that eventually could be utilized and bid into those power purchase agreements. So, it's that project certainty of process, project certainty of scale and commitment for power purchase agreements that has really led the significant market signals that this is an industry that's here, and it's (an industry) moving forward significantly."

Field of Dreams

While the offshore wind field developers continue to build, plot and plan the evolution of massive offshore wind farms, questions still surround the size, shape and origination of the fleet of vessels that will be needed to install and service the fields. In the U.S., implications of the Jones Act will play a central role, and a key concern for many years has been the ability to build out the domestic fleet and/or hire the foreign fleet of ship that will play a key part in a seamless start for the industry, from foundation install to first energy.

"These are good problems to have, and the market will respond," said Lennon. "We're going to have a number of projects that are going to be receiving their final permits in mid-2024 to 2026 or so, built based upon their progress from environmental assessments to power purchase agreement securitization. And that's going to lead to a number of projects

"More vessels are needed, and while creative financing may come around to help close the gap on challenges in vessel financing, ***the problem on larger vessels, on a simplified level, is that matching the certainty of revenue with the payback period to recover those initial investments is still a challenge."***

Greg Lennon, Vice President, Global Offshore Wind, ABS

coming and the demand for vessels to service the construction of those projects. So, we are going to see a significant increase in the number of vessels needed to install these projects in service from the various ports along the east coast here in the U.S."

While there have been sporadic orders to date for the new U.S.-built Jones Act fleet, the volume of new orders needs to ramp up significantly, and soon, to ensure that projects planned and permitted become projects under construction with timely completion. The complexity of the problem extends far past the Jones Act itself and the inherent higher costs of building in U.S. yards, a problem that really boils down to vessel and project finance.

"With all these different types of vessels, ultimately, it leads to new challenges on vessel financing," said Lennon. To that end ABS has been engaged in discussions with key stakeholders, including the federal government, including the DOE Loan Program Office, to look at helping to step in and finance some of these vessels. "ABS is bringing key stakeholders together and helping get the (DOE) Loan Program Office message out in support with the National Offshore Wind Research Development Consortium (NOWRDC). NOWRDC is directly supporting the DOE Loan Program Office. We are partnered with NOWRDC in getting that message out on the Loan Program Office capabilities, because they have the loan guarantee program and the financing capability that not only applies to vessel finance, but it also applies to offshore wind projects." Ultimately, Lennon sees natural market forces mixed with government involement and some finance creativity as well as increasing "revenue certainty" for vessels as the key to take U.S. offshore wind from a jog to a sprint.

"More vessels are needed, and while creative financing may come around to help close the gap on challenges in vessel financing, the problem on larger vessels, in a simplified level, is that matching the certainty of revenue with the payback period to recover those initial investments is still a challenge."

For example, wind turbine installation vessels (WTIVs) are usually on site for a lease contract, one to two years, dependent upon the size of the project and the scope in the operating conditions. "We're talking about $500 million vessels, and you're not going to recoup $500 million in those first two years. So, I think there's an opportunity for the investment industry to come forward," said Lennon.

He said the WTIV under construction now at Keppel AmFELS for Dominion is contracted for its first few years, and "it's a unique case where the regulated utility of Dominion Energy and Ørsted have worked together to provide certainty for that revenue for that type of vessel."

In the end, it comes down to revenue certainty premised on the project pipeline. "This contractual obligation, these projects have an underlying certainty and revenue. It's the vessels that will move from one project to the other, we have to figure out how to allocate that risk and enable the support for closing the costs."

The Path Ahead

"So, I think we're at the very start right here. We have the right people in the room. We have the right capability. The industry has responded before. And so, I think we have the opportunity here this year to solve this problem. And once we get the first vessel financed beyond what Dominion had done, and we can finance a larger scale wind turbine installation vessel, look at some of the service operating vessels, a portfolio approach perhaps. Maybe we'll look at an asset fund. There are opportunities in the financial markets that can be brought in to solve this type of challenge, given that there's revenue certainty on the projects on the whole."

Through it all, Lennon sees ABS as ideally placed to help all offshore wind stakeholders navigate some of the biggest challenges ahead. "The American Bureau of Shipping knows the vessel owners; we know the shipyards; and with our offshore wind team, we know the developers now, too," said Lennon. "We're bringing everybody together, and also, with a number of other key stakeholders, we're bringing investors, pension funds, private equity, and the government to talk about how we can look at financing these vessels to close that gap."

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OFFSHORE WIND DEVELOPMENT GAINS SPEED IN THE UNITED STATES

As of the end of January 2022, there were over 45 projects in development representing a $136 billion capital expenditure and $4.4 billion annual OPEX opportunity that are forecast to be brought on stream within this and early in the next decade.

By Philip Lewis, Intelatus Global Partners

What a difference a year makes. This time last year there was still some uncertainty around the federal offshore wind permitting process, the timing of offshore wind projects and certainty for the supply chain.

At the beginning of 2022 the situation is more positive. The final investment decision has been made for a major offshore wind project which has also reached financial close, 12 OCS projects are under final federal permitting review, 17.5 GW of project capacity has secured offtake commitments, 16.5 GW of new federal offshore leasing activity in the northeast, South Atlantic and California is underway, turbine component, foundation, and cable factories are being built in the U.S., awards for at least six Jones Act compliant wind farm support vessels were announced in the last quarter of 2021 and offshore wind port development is accelerating.

Our forecast and report accounts for 55 projects, 46 of which will install 43 GW of capacity in this and the next decade – and will require CAPEX amounting to $136 billion to bring onstream, a recurring annual OPEX of $4.9 billion once delivered, and $19 billion of decommissioning expenditure at the end of commercial operations.

These are the findings shared in a recent report on the U.S. offshore wind market in this decade by Intelatus Global Partners (IGP).

The report examines the latest developments likely to drive offshore wind project development in the U.S. within this decade, forecasts the number, CAPEX, OPEX and timing of projects, and provides a roadmap to understanding and accessing these market opportunities.

So, what has changed?

The excitement surrounding U.S. wind is founded on two power supply and demand drivers. On the supply side, federal leases containing over 20 GW of project capacity have been awarded – the last in early 2019. And more federal leasing is underway. On the demand side eight Northeast and Mid-Atlantic states have established offshore wind procurement targets and/or procured offshore wind capacity from developers operating federal offshore wind leases. Two Pacific coast states are also working through the process to establish offshore wind goals.

But those with a long memory of U.S. wind will remember the false dawn of the Cape Wind project. Initially proposed in 2001, Cape Wind secured the first commercial offshore renewable energy lease in the United States in 2010. The project's construction and operations plan (COP) was approved initially by federal authorities in 2010 and revisions further approved in 2014. However, in the face of objections to the wind farm, Cape Wind relinquished the lease in 2017.

In 2021, three things changed and have created a more solid foundation for the U.S. offshore wind industry.

Exhibit 1 *CAPEX, Annual OPEX and DECEX Forecast by Final Investment Decision Timing*

Forecast ($ billion)	GW	CAPEX	OPEX/yr	DECEX
FID made	0.8	3.0	0.1	0.4
0-18 months	0.1	0.5	0.0	0.1
18-36 months	17.5	61.1	1.8	7.9
36-60 months	11.1	34.0	1.1	5.0
Over 60 months	13.7	36.8	1.4	6.2
Total	43.2	135.5	4.4	19.4

Source: Intelatus Global Partners

The first piece of the jigsaw was the White House initiative released in March 2021 to "catalyze offshore wind energy, strengthen the domestic supply chain, and create good-paying, union jobs". The White House program included an offshore wind deployment target of 30 GW by 2030 and an aspiration to achieve 110 GW of offshore wind by 2050. The practical upshot is that developers and tier one suppliers, most with European wind industry backgrounds, have the visibility of demand needed to make domestic U.S. investments – including key component factories and port developments. This in turn will create employment opportunities for "tens of thousands of workers."

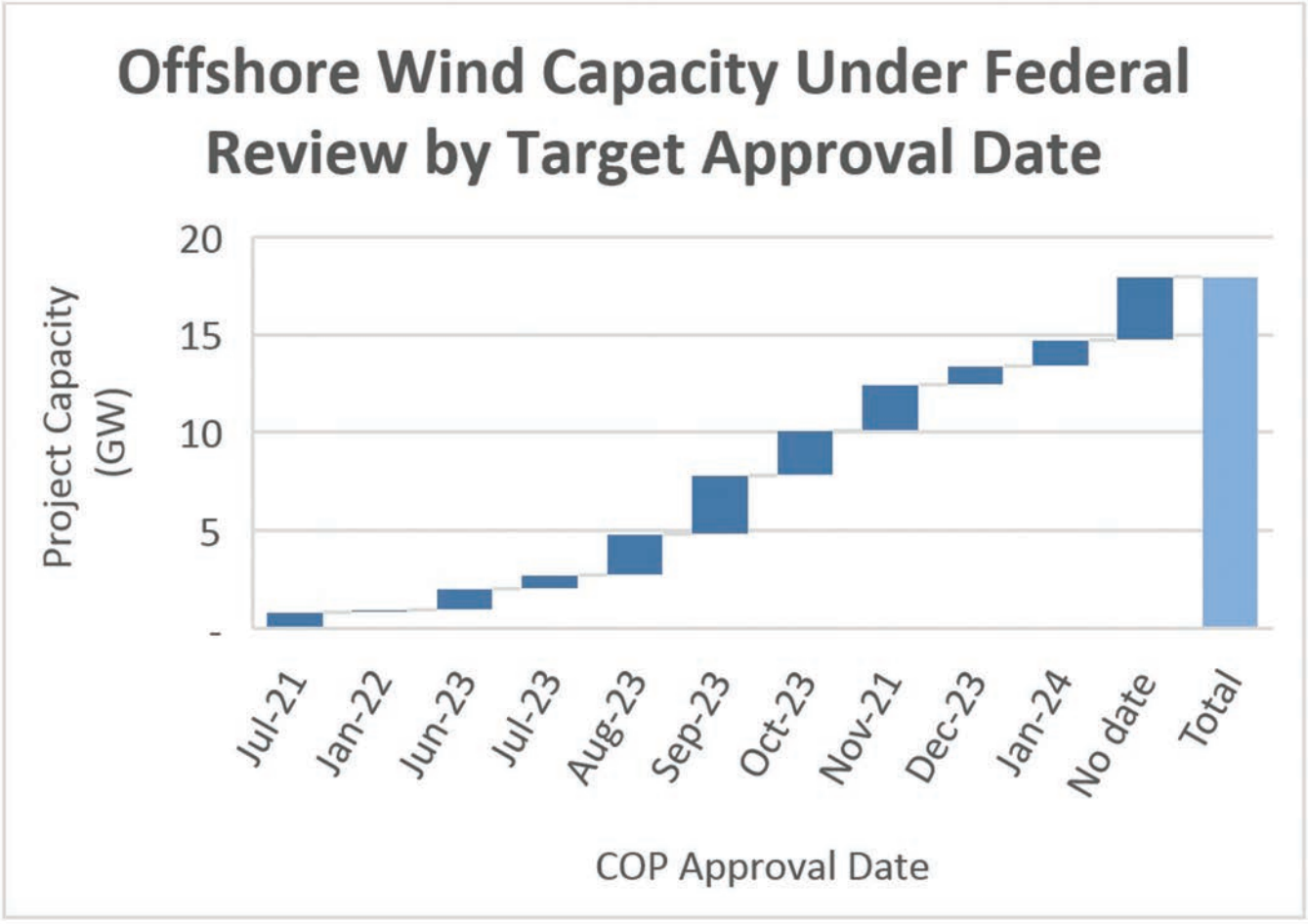
Secondly, Federal agencies, led by the Bureau of Ocean Energy Management (BOEM), have shown a renewed impetus to progress offshore wind projects.

The 800 MW Vineyard Wind project was approved in July 2021 and reached financial close in September 2021. The project has broken ground, components are being manufactured, first power is expected in 2023 and the project will be fully commissioned in 2024. BOEM has approved the environmental impact assessment of a second wind farm, the 132 MW South Fork wind project and expects to complete final permitting of the project in January of this year.

Exhibit 2 shows the clear pathway to project capacity permitting by the month and year when BOEM expects all permitting to be complete. Most project capacity will be fully commissioned three to four years after final permitting.

The Department of the Interior has confirmed that BOEM

Exhibit 2 *U.S. Offshore Wind Capacity by BOEM Permitting Target Date*



Source: Intelatus Global Partners

will potentially hold up to seven new offshore lease sales by 2025. The first auction consists of six New York Bight leases. Other leasing will be held for sites in the North and South Atlantic, the Pacific and the Gulf of Mexico. This sets a clear foundation for long-term offshore wind activity in the U.S.

The third piece of the jigsaw is linked to state procurements and new federal leasing requirements– in simple terms developers must commit to significant supply chain infrastructure investment and make good on these commitments. As a result, developers are executing investments in offshore wind manufacturing and port infrastructure that were agreed as part of the capacity awards with the states. Further, the current New York Bight federal leasing contains domestic supply chain development incentives aligned to the supply chain development activities of New York and New Jersey. In its March 2021 statement, the White House targeted "one to two new U.S. factories for each major windfarm component including wind turbine nacelles, blades, towers, foundations, and subsea cables". At the time this seemed somewhat optimistic, yet through state procurement requirements multiple key component factories are now being built and will provide ongoing opportunities to the domestic supply chain.

One piece of the jigsaw is missing – Jones Act Vessels

In the March 2021 White House statement on offshore wind, one ambition was to achieve "the construction of 4 to 6 specialized turbine installation vessels in U.S. shipyards, each representing an investment between $250 and $500 million." Achievement of this goal is currently behind plan.

Till now only one Jones Act wind turbine installation vessel has been committed and is under construction – owned by Dominion Energy and under construction at Keppel Brownsville. Without additional domestic supply, developers will need to secure installation vessels from the international market – as Vineyard Wind has done for its project. However, although international supply of wind turbine installation vessels is growing, supply will be stretched in the global market around the middle of the decade – at the same time U.S. offshore wind installation activity is expected to peak.

Recently, Great Lakes Dredge & Docks announced that it is moving ahead with the construction of the first Jones Act compliant wind farm scour protection/rock installation vessel. The Ulstein designed vessel is being built at Philly Shipyards and is due to be delivered in late 2024. Great Lakes Dredge & Dock and Philly Shipyard have agreed an option for a second vessel to be declared at a later date.

One would expect there to be a significant amount of construction of service operations vessels (SOVs) and crew transfer vessels (CTVs). Both are used in the long-term operations and maintenance phase of a wind farm and will need to be Jones Act compliant. Till now one SOV has been announced as under construction – although the indications are that others are in the pipeline. In the CTV segment, three vessels, owned by Atlantic Wind Transfers and WindServe, are already operating on the Block Island wind farm and the Coastal Virginia Demonstration project. Five CTV awards have been announced recently awarded to two yards -- Blount Boats and Gladding Hearn shipbuilding. Despite the building activity, the domestic supply and SOVs and CTVs is significantly below our forecast for demand.

Floating Wind Advances

Many eyes are attracted to the potential of California's offshore floating wind potential, with BOEM expected to auction two areas for development in 2022. But four floating wind projects are already currently being progressed in the Atlantic and Pacific – three in state waters and two in Federal waters.

Floating wind requires a different supply chain approach to the bottom-fixed of the current northeast and Mid-Atlantic pipeline.

First moves are being made on port infrastructure, but little movement has been made on the Jones Act vessels required to install floating wind projects – supply of the asset classes required in limited presenting a construction opportunity for domestic yards.

For more information about the U.S. Offshore Wind Market Forecast, please visit ***www.intelatus.com*** or contact Michael Kozlowski at +1 561-733-2477or Philip Lewis at +44 203-966-2492

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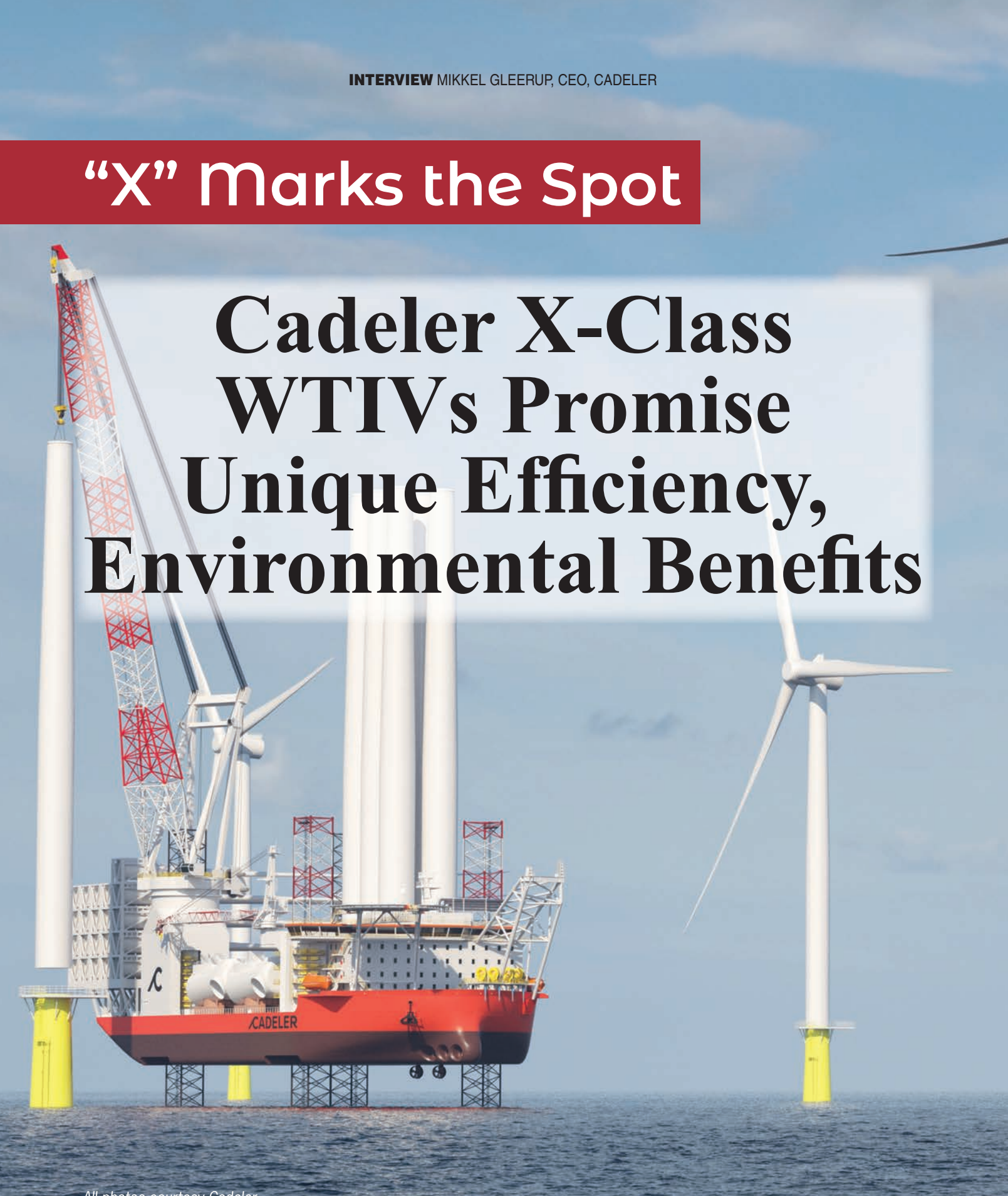
Cadeler X-Class WTIVs Promise Unique Efficiency, Environmental Benefits



All photos courtesy Cadeler


CADELER

Fresh from its name change and IPO, **Cadeler CEO Mikkel Gleerup** shares insights on the path ahead for his company in the fast-growing offshore wind sector, with details on Cadeler's new X-Class Wind Turbine Installation Vessels.

By Greg Trauthwein

The last two years were big year for your company, with a name change from Swire Blue Ocean and IPO at the end of 2020 and a rebranding through 2021. What was the rationale for these moves?

We rebranded from Swire Blue Ocean to Cadeler end of 2020 to demonstrate that this was a separation from Swire. Swire is still an integral part of us, but it was to create a standalone company with own structure, culture and goals. In terms of the going to the public market (IPO), offshore wind is growing very fast and it's also capital-intensive. We believed that going public was the best path.

In March 2021 you announced your biggest ever contract with Siemens Gamesa. Interestingly, the contract was for a vessel that hadn't been ordered, to install turbines that have yet to be made. Can you add some color on how the talks before the contract signing went?

We were on that path to ordering new vessels, and we had interacted with Siemens and other clients early on to gauge their interest and to get technical input; to ensure that what we were building what was needed. (Through these discussions plus information released during the IPO) they knew that we had been working towards this goal for a long time; they saw the path and they liked what they saw.

The X-Class series has significant benefits because of the enhanced loading, carriage and installation capability, which allows you to severely reduce the number of transits.

[**Note**: In the transport of 15MW turbines, Cadeler's existing O-Class vessels could transit with three turbines, whereas the new X-Class vessels will be able to transit with seven (7) turbines.]

In parallel with signing the contract, Cadeler ordered two giant X-Class offshore WTIVs from COSCO. Can you tell us a little bit more about the design of the ships?

They are special because they are purpose-built. We designed them towards the turbine installation market and I think that we had seen both the benefits and the downsides of having too much multi-functionality in a ship design.

In looking at our O-Class, you could say that they were de-

All photos courtesy Cadeler

"The X-Class is special because it will be more capable, for example the X-Class can load more than 70% more cargo. The cranes are much bigger, the overturning moment, which is really the number that we're looking at from an operational point of view, is significantly larger. "

– Mikkel Gleerup,
CEO, Cadeler

OETV Watch the interview with Mikkel Gleerup @ bit.ly/3s9FDDG

signed to potentially support the offshore oil and gas market; they were designed for handling foundations; they were designed for doing some subsea work. A lot of the capability we did not need nor use. So, the X-Class was about designing something for what we believe this asset will be doing for the next 20 to 25 years.

When we talked to our clients about the design, it was a conversation with management, with engineering, and also a discussion with many different parts of their organizations, from the people coming onboard, doing the actual work, to the onshore teams that plan the projects.

The X-Class is special because it will be more capable, for example the X-Class can load more than 70% more cargo. The cranes are much bigger, the overturning moment, which is really the number that we're looking at from an operational point of view, is significantly larger.

Our final design includes an upgraded jacking system and main crane. This is to better cater for the wind turbines of tomorrow taking into account the latest input provided from clients and partners.

[**NOTE**: In December 2021 Cadeler signed a contract with Huisman to design and build two >2,000 t Leg Encircling Cranes (LEC) for the two Cadeler X-class vessels scheduled to be ready by end of 2024 and beginning of 2025. These LEC cranes will have a 155 m long boom and with a reach of 180 m above deck. In addition, the boom has the option to be upgraded from 155m to 175 m, so that lifting height can be increased to 200 m, helping to 'future safe' the new X-class vessels as turbine size and weight grows.]

While you're waiting for the new vessels to be delivered, your other two vessels, Wind Orca and Wind Osprey, have been busy, as earlier this year you reported a 253% revenue increased compared to the first half of 2020. Can you talk about where the duo has worked this year and about the contract pipeline visibility going forward?

With Osprey we worked on Triton Knoll, where we helped installing ninety (90), 9.5MW Vestas turbines. Orca was on Hornsea, where we have been installing foundations on the Ørsted project Hornsea 2. This is a massive project with approximately 165 foundations going into the water.

Everything seems to be getting bigger in the offshore wind sector, and it's now at a point where it's unclear if it's the larger turbines are driving the demand for the larger vessels or vice versa. How do you see it?

I've worked in offshore wind for more than 15 years, and we don't have to go too many years back where we thought that a 6MW turbine was a huge turbine. Today we are at a point where I think that most believe that they will at least become bigger than 20MW. With that, there is a strong push for bigger machines to support these bigger turbines and bigger projects. Stand-out projects not too long ago were 300 to 500MW range. Now everything is around the gigawatt size and upwards. So it is really growing very fast, not only on equipment size, but also on project size, which obviously also drives the need for bigger, more capable and more efficient vessels.

Efficiencies are really important with these bigger projects (to expedite the installation process and the time to produce first energy and revenue), particularly as the projects move further offshore, and also with the global expansion, as we see that the U.S. and Asia is growing very fast.

When you look ahead, how do you see the vessels that serve this market evolving?

There, rightfully so, is much focus on the vessels, their efficiencies, with projections of how many in each class that we'll need. But I think it's also important to focus on people. It's not enough to invest in steel. You need to have some soft skills as well in order to be a success in this industry. So I think that if we have that right communication with the developers and the clients, then I think we will be able to continue to make this industry a success. But it has to be in a prudent way, and we have to do it sustainably.

X-CLASS MAIN PARTICULARS

Vessel Owner Cadeler

Shipyard COSCO Shipping Heavy Industry, Qidong

Type X-Class Wind Turbine Installation Vessels

Price $651m

Delivery Q3/2024 & Q1/2025

Cranes Huisman >2,000 t Leg Encircling Cranes (LEC) with a 155 m long boom and a reach of 180 m above deck. In addition, the boom has the option to be upgraded from 155m to 175 m, so that lifting height can be increased to 200 m

Deck Space 5,600 sq. m.

Payload more than 17,600 tons

Capabilities The X-Class ships will be able to transport and install seven complete 15MW turbine sets per load or five sets of 20+ MW turbines

All photos courtesy Cadeler

Photo courtesy HII

WITH ARLEIGH BURKE HULL MAXED OUT, THE NAVY IS BUILDING A NEW DDG(X) LARGE SURFACE COMBATANT WITH ROOM FOR GROWTH

By Edward Lundquist

"DDG-51 hull form is maxed out in nearly every mission area. Meanwhile, the threat marches on."

– Rear Adm. Paul Schlise, Director for surface warfare

The U.S. Navy's highly successful USS Arleigh Burke (DDG 51) surface combatant program is still going strong and growing in capability. Nearly 40 years later, new ships are still being built. But, the navy said, the ship cannot support the systems of tomorrow needed to meet the future threat.

"DDG 51 has been in production for over 40 years with basically the same hull we started with in 1985, and with and 30 years-worth of upgrades from Flight I to Flight II and IIA and now Flight III," said Rear Adm. Paul Schlise, director for surface warfare on the Navy staff. "This hull form is maxed out in nearly every mission area. Meanwhile, the threat marches on."

Speaking at the Surface Navy Association's 34th Annual Symposium. Schlise said the newest version, the Flight III, will be a quantum leap forward in the class. The first Flight III, the future USS Jack Williams (DDG 125) is nearly 75 percent complete. It brings a new radar, electronic warfare system, Aegis Baseline 10, and a new electric plant into the Arleigh Burke hull.

"DDG 125 will be the first ship with the SPY-6, the Navy's next generation radar system that will make our ships more lethal by providing power and sensitivity for long range detection, discrimination and engagement," said Schlise." "It will be the most capable and sophisticated surface combat ever built, but it also represents the bridge from the past to the future."

Flight III will assume the air defense commander role (currently carried out by a Ticonderoga-class CG-7 guided missile cruiser), with an O-6 in command (the other DDG 51 ships have an O-5 in command, while the CG-47s are commanded by O-6s). The first Flight III is USS Jack Lucas (DDG 125), which is being built at Huntington Ingalls shipyard in Pascagoula, Miss., and is expected to go to sea later this year.

By comparison, the original Flight I DDGs displaces about 8,300 tons, while the Flight III will be close to 10,200 tons. The DDG 51 program over the year has consumed all of the available space, weight and power margin. Due to the density of the DDG 51 design, the cascading effect of design changes to accommodate new capabilities impacts large portions of the ship, increases costs and takes a long time to upgrade. So, after 40 years, the Navy is beginning the DDG(X) program, formerly known as the large surface combatant (LSC). DDG(X) will have a new hull design, will be bigger than DDG 51s, and will have more power, with the for more and bigger missiles and the flexibility to support power hungry weapons such as lasers and rail guns.

Pace the threat

"DDG 51 is the most successful combatant class that we have in production. It's been going on since 1985. There are a lot of lessons learned from there, a lot of goodness that we're trying to incorporate in this program," said Katie Connelly, the deputy program manager for the DDG X program office. "The Flight III combat capability upgrade provides the best integrated air and missile defense capability that we have, and will enable us to continue the fight for the near term, and pace the threat as we go."

Based on typical service life expectancies, DDG 51 Flight III will be in service in the fleet into the 2060s. "But," Connelly said, "We took up all of the service life allowance on that platform. All of the space, weight and power has been allocated; there is not enough room on that ship to put a new combat capability that takes more power or a larger footprint within the ship," she said. "The threat will continue to evolve, and there will be new threats as well. As the Navy continues to evolve its combat systems, weapons and other technologies to deter the threat, it needs a new platform that can accommodate those new technologies. We need to upgrade to a

new hull form--hence DDG(X)."

The first ship will deliver with the new hull; the Flight III combat system; two RAM launchers and IPS.

Like the FFG 62 program, the Navy wants to avoid revolutionary technologies for the basic hull, mechanical, electrical and combat systems (having learned lessons from the DDG-1000 program, which was to be 32 ships but was truncated to three because of cost and technology issues). The Navy is reducing program risk by taking an evolutionary approach as opposed to a revolutionary approach, gaining benefits from existing systems on the Flight III and those that that are common in the fleet, including RAM launchers for improved self-defense.

"The first ship will minimize incorporation of new technologies," Connelly said. "When new technologies are fully mature and ready to actually be implemented, we will put them on the ship, but not until then. We are trying to reduce risk as much as possible."

Potential upgrades in the future include lasers; larger array; an upgraded X-band radar additional VLS cells; large missile launchers; and well as also potentially an integrated power and energy system versus the IPS.

The ship is being designed accommodate a destroyer payload module, which would be plugged into the ship during construction to increase the size and available space for new systems or capability. This is similar to the Virginia Payload Modules being inserted in new-generation Virginia Class attach submarines that significantly increase the number of weapons that can be carried.

Congress is requiring the Navy to conduct significant land-based testing for new platforms and their critical systems, which applies to DDG(X) and its hull form and IPS. Hull form model testing is being conducted at Naval Surface Warfare Center Carderock.

Connelly said the Navy is working with Huntington Ingalls Shipbuilding and General Dynamics Bath Iron Works to ensure a thoughtful and smooth transition from the DDG 51 production line to the new DDG(X).

Integrated Combat System

The Navy is seeking commonality among its various combat systems in the fleet. The Navy is necking down the variations of combat systems on its warships into what they call the Integrated Combat System, or ICS, integrating sensors and both hard and soft kill weapons into a common system, which will tie all the platforms together. ICS brings the Lockheed Aegis system on combatants and the Raytheon Ship Self-Defense System on carriers and amphibious ships, as well as the and the Combatts 21 and TACTICOS systems on the littoral combat ships, into a new system based on the Aegis Common Source Library (CSL) and combat system, the scalable SPY 6 radar and SEWIP Block 3. The new Block 3 version of the Surface Electronic Warfare Improvement Program (SEWIP) provides upgraded electronic warfare (EW) detection and countermeasures system based on the AN/SLQ-32. The SEWIP Block 3 system is a next chapter in the SLQ-32 family, and will be installed on Flight III and backfit onto the Flight IIAs, to fight threat with a virtually unlimited electronic attack magazine.

SPY-6 is the U.S. Navy's new and missile defense radar for the DDG 51 Flight III and DDG(X), as well as other surface warships.

Raytheon

According to the Chief of Naval Operations Nav Plan of January 2021, the Navy Operational Architecture (NOA) is designed to "close the kill chain faster than our rivals with a resilient web of persistent sensors, command and control nodes, platforms, and weapons." The NOA leads to the Integrated Combat System (ICS), which will "connect sensors, networks, and weapons across a distributed naval force afloat and ashore. In turn, ICS is enabled by the AEGIS Common Source Library (CSL), which "enables baseline consolidation and will form the software foundation for the future."

While Navy leadership is solidly supporting DDG(X), there may be a need to keep the DDG-51 production line going. Speaking at a U.S. Navy Memorial SITREP presentation on Jan 18, Secretary Carlos Del Toro said there is a valid need for more combat power at sea today. "Perhaps a better strategy might be to build a few more DDG Flight IIIs to ensure that we have the capacity necessary to deter China and do the other things that we need to do," before the DDG(X)s are delivered.

Congress may agree. The Senate Armed Services Committee said in a report accompanying the National Defense Authorization Act for Fiscal Year 2022 that the DDG-51 destroyers are the backbone of the surface fleet, providing multi-mission flexibility and increasing capability with introduction of Flight III and the AN/SPY-6 radar. "With plans for construction of a new class of Large Surface Combatants (LSCs) toward the end of this decade and the current multi-year procurement of DDG-51s ending in fiscal year 2022, the committee believes that it is imperative that the Navy award another DDG-51 multi-year contract beginning in fiscal year 2023. This contract is critical to ensuring that Flight III capability continues to be delivered to the fleet and the industrial base is maintained to support the LSC acquisition strategy."

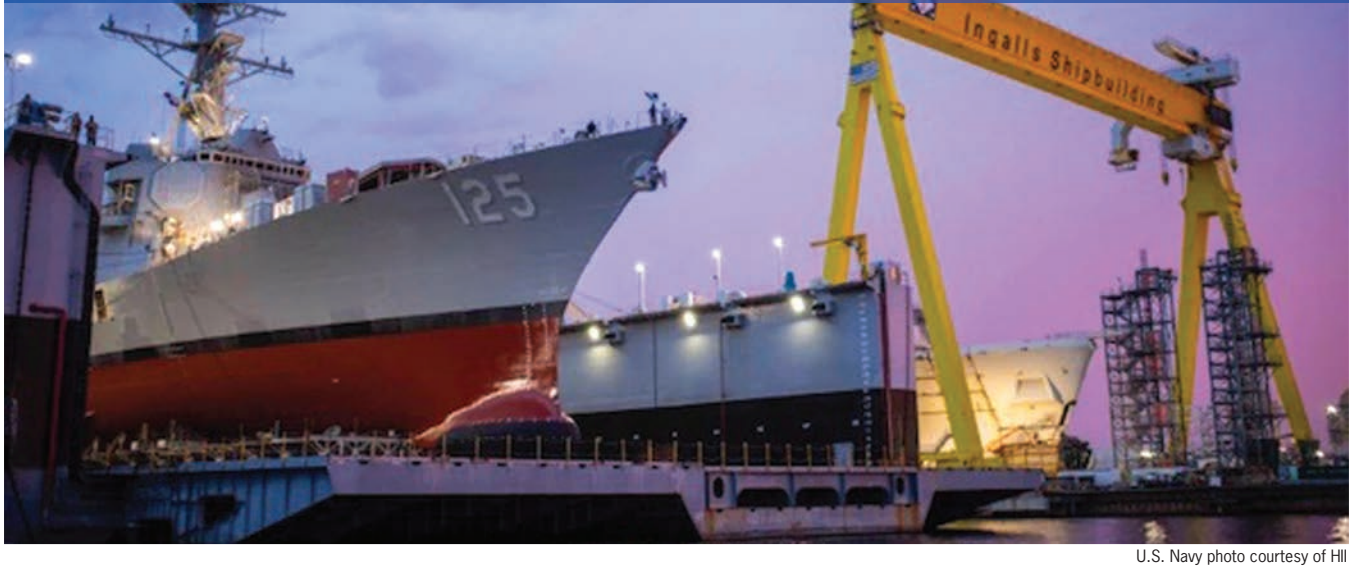
"Flight III will be an exceptional platform throughout its service life," said Schlise. "There's no doubt in my mind DDG(X) is required, and will be the next enduring large surface combatant. The Flight III is a fantastic capability, but we need to look to the future."

The Arleigh Burke-class of Guided Missile Destroyers

The first ship in the class, USS Arleigh Burke (DDG 51), was commissioned in 1991. It is currently modernized with the lasted combat system and is forward deployed. The 20 Flight I ships were followed by seven Flight IIs with improved systems. The Flight IIA was lengthened to incorporate a helicopter hanger for two aircraft. 33 Flight IIAs were built before production ended. The Arleigh Burke production was restarted, with 15 new Flight IIAs ordered, some of them with new technology insertion to smooth the transition to the Flight IIIs. Fourteen Flight IIIs are being built or approved for construction.

Flight I: 8,184 long tons (8,315 t); 505 ft (154 m)
Flight II: 8,300 long tons (8,400 t); 505 ft (154 m)
Flight IIA: 9,300 long tons (9,500 t); 509 ft (155 m)
Flight III: 9,500 long tons (9,700 t); 509 ft (155m)

The future guided-missile destroyer Jack H. Lucas (DDG 125) is launched, June 4, 2021, at Huntington Ingalls Industries, Ingalls Shipbuilding division in Pascagoula, Miss. Jack H. Lucas is the first Arleigh Burke-class guided-missile destroyer to be built in the Flight III configuration. The Flight III upgrade is centered on the AN/SPY-6(V)1 Air and Missile Defense Radar and incorporates upgrades that provide enhanced warfighting capability. The Flight III baseline begins with DDG 125 and will continue with follow on ships.



U.S. Navy photo courtesy of HII

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Shipyard Investment
A centerpiece of FMM's capital investment is the largest Syncrolift ship lift in the U.S., expected to be ready by the end of 2022. This rendering shows FFG-62 on the shiplift.

When he served as the commander of NWSC Carderock, ***Mark Vandroff*** *woke every morning knowing that his counterpart in China had just gone to bed and had spent that day trying to make China's Navy superior.* ***His job, he figured, was to "get cracking and work to make our Navy even better."*** *Now the CEO at Fincantieri Marinette Marine (FMM), Vandroff brings that passion for navy shipbuilding – and delivering on the new USN Constellation-class frigates contract – to work every day.*

By Greg Trauthwein


Fincantieri Marine Group

"**One of the things that has been useful for me is to think ahead.** When you're flying a plane, you cannot stop and say, 'Let me think where I'm going, what I'm doing.' You have to constantly think ahead. It's very much the same in shipbuilding."

Dario Deste, CEO & President,
Fincantieri Marine Group,
discussing the skill sets of being a former Navy pilot that translate into shipbuilding leadership.

Introducing a new class of warship usually comes with a heaping helping of pain, from cost overruns to technical glitches. Serving as the prime contractor on the first two Constellation-class guided missile frigates (FFGs), Fincantieri Marinette Marine (FMM), Marinette, Wisc., and its parent company Fincantieri Marine Group (FMG) are investing mightily in the shipyard – technology, people and processes – to help mitigate risk as prudently as possible in delivering for the U.S. Navy.

To reduce risk to budget and schedule, the new FFG will be built on an existing hull design and armed with well-known combat systems and weapons. The current program of record is for 20 ships, although it could be more. FMM has been awarded a detail design and construction (DD&C) for up to 10 ships in the program — the lead two ships plus eight option ships, to date.

"The program was assigned to us at the beginning of 2020," said Dario Deste, CEO & President, FMG. "The program itself is for 10 ships. We received the first one for about $800 million and we received the second one in May 2021." Deste, a former Italian Naval pilot who has been in shipbuilding for about 15 years, said his experience as a pilot taught him to always think ahead, a valuable tool in shipbuilding to help anticipate and head-off problems while they are small. "When you're flying a plane, you cannot stop the plane and say, 'Let me think where I'm going, what I'm doing.' You have to constantly think ahead."

As the prime contractor on this new class of U.S. Navy ship, Deste and his team are working relentlessly to deliver as expected. "We have a lot of challenges here, but I would say the first priority for us is to execute the program and be on schedule," said Deste. "Being on schedule is imperative, and it's something that I make clear to all of my teammates through the organization."

Risk Mitigation, by Design

While investment by FMG has been substantial and continual, arguably the first, best step to help ensure the first two contracted ships are designed and built with minimal hitches lay in the selection of an existing, lower-risk design for the ship.

FFG 62 is based upon a "parent design," the Italian-French FREMM (Fregata Europea Multi-Missione) frigate, a ship that is being been built in France and Italy for their respective navies and a few foreign customers. FMM's parent company, Fincantieri builds the ships at its Muggiano shipyard at La Spezia, Italy. Although the parent design is European, FFG 62 will have significant American content, to include a government furnished combat system centered around the new SPY 6 radar and newest baseline of the Aegis Combat System and other U.S. sensors and systems.

The American version will be about 23 feet longer and about 500 tons heavier to provide margin for growth and to accommodate future weapons such as lasers, although the bridge and propulsion plant layout is the same. It will be equipped with a 32-cell, strike-length MK 41 vertical launch system (VLS) launcher and armed with Standard Missiles, Naval Strike Missile capable and Evolved SeaSparrow Missile (ESSM) Block II; a Mk110 57mm main gun, and have the RAM close-in system for point defense. It will have a flight deck and hangar for MH-60R helicopters. It will

FFG-62 rendering

Fincantieri Marine Group

have essentially the same anti-air and anti-submarine warfare capability as the newest Flight III DDGs.

"It is a risk reducer," said Mark Vandroff, CEO, FMM, in discussing the pros and cons of the parent design, but using the European design is not without challenges. Premised on the 'Buy American Act', the new U.S. Navy FFG will have an entirely new set of equipment manufactured in the United States. With that, "you're going to have some significant level of design work in order to accommodate the difference in equipment," said Vandroff.

He points out another critical difference: getting the parent design to meet U.S. Navy damage control and survivability standards.

"Having been the CEO of Carderock, I was involved in an organization that helped develop and maintain those standards, so, I'm very familiar with them," said Vandroff. "The way we compartment ships, the way we build in redundancy and separation of vital systems is unlike any other Navy or commercial enterprise in the world."

The engineering work that goes into meeting and beating the U.S. Navy standards is no small feat, and while he knows his team is up to the challenge, the process does not come without those moments when you ask: "Well, how the heck are we going to make this work?"

Investing in the Shipyard(s)

Serving as the prime contractor on a new U.S. Navy shipbuilding contract comes with ample challenges and rewards, too. According to Deste, the three basic essentials to have an efficient shipbuilding system is to have a very high-technology products and systems; the facilities and the people. "Those are the three main pillars to good steady operations."

While the FFG is the current focus, FMG's investment in FMM started before construction began on the Littoral Combat Ship program, an investment of around $150m to "get the shipyard up to speed."

But to win the frigate contract, more investment was needed. "The Navy was very clear about our capacity. We had to produce two ships per year at least, so we redesigned the shipyard," said Deste. The end result when completed will be an ultra-modern and efficient layout, a layout that "will allow us to complete up to 92% of the ship before it's in the water."

All told, FMM will have invested $300 million in capital expansions to prepare for the U.S. Navy frigate contract, $300m invested in a contract that could be worth $5.5 billion if all options are exercised.

The major pieces of the capital investment strategy include:

- **Panel Line:** FMM is getting a new robotic panel line, module assembly facility and paint shop. Bay Shipbuilding in Sturgeon Bay, a commercial yard that will support the frigate contact, is undergoing similar upgrades. "We had a great panel line facility at Marinette for the LCS program, but for the frigate program we've invested in state-of-the-art technology," said Vandroff. "What we used to do with about 12 people will now be done with one or two operators. The robotic welding gives a more consistent, higher quality product, as well as the ability to put more panels through the line more efficiently. That new panel line is installed and going through its final testing." With the previous sys-


Fincantieri Marine Group

"Tiger Woods once said his golf swing was never standing still. He was either working to get it better or it was getting worse. **I have that same philosophy about safety. You're either working to make it better or over time, it will start to get worse.**"

Mark Vandroff, CEO,
Fincantieri Marinette Marine

tem, when panels came off of the line they were shuttled around the yard for module assembly. At the end of the new line is a new module assembly facility. "This way, we're moving more complete modules around the yard for outfitting, and that'll be a more efficient flow for the frigate throughout the yard," said Vandroff.

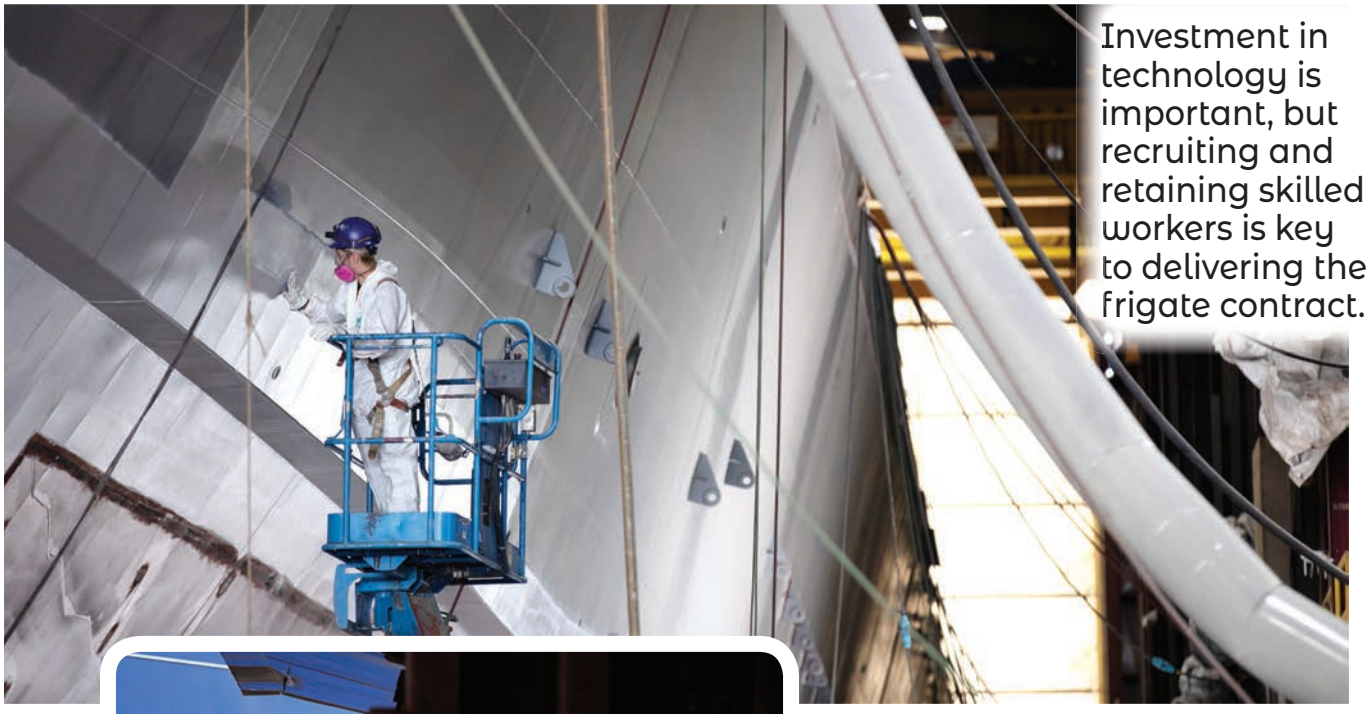
- **Building 34:** Wisconsin winters are harsh, so keeping as much construction under cover in a climate-controlled environment positively impacts efficiency. To this end Building 34 will accommodate the construction and erection of two full-size frigates simultaneously under cover. The frigate is both longer, taller and heavier than the littoral combat ships that FMM is now building, and it needed a larger facility. FMM broke ground on the building at the beginning of 2020, and "I would describe it as dangerously near completion," said Vandroff, noting that the contractor should be done with a few final items, in time for a ribbon-cutting in March/April 2022.

- **Ship Lift:** The other major investment is the installation of a Syncrolift, which will allow FMM to lower ships into the water more gently and effectively than the traditional side launch into the Menominee River. "Ships have been side launched for a long time: it's simple, it's not a lot of infrastructure. You just need a set of incline weights and you let gravity take its natural course," said Vandroff. "But there are some drawbacks." First, the yard can complete more of the ship on land using the ship lift. "And there are some things that are on the frigate that we don't want a side launch, parts of the combat system that require very high precision alignment. We want to do that in the building, and then we don't want do it again after we put it in the water." With most of the ship lift's civil works done, it is expected to be up and operational by the end of 2022, in time to launch the first of four multi-mission surface combatant hulls, similar to the LCS design, for the Royal Saudi Navy. When completed, the new ship lift system will be approximately 500 ft. long and 82 ft. wide, and will be capable of handling vessels of nearly 10,000 tons, making it the largest in the U.S.

- **Blast and Paint Facility:** In moving the panel line, FMM freed up a production building which will be converted to an additional blast and paint facility. "We have excellent blast and paint facilities in the yard," said Vandroff. "But if we're going to do two frigates a year, which is the Navy's goal for us, we needed additional blast and paint capacity. That conversion project is scheduled for completion in 2023.

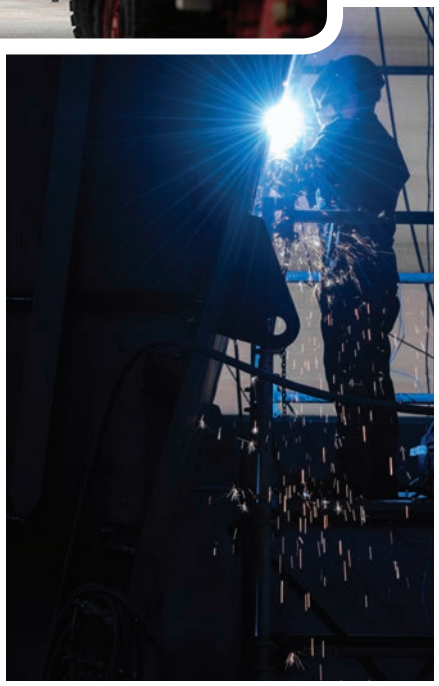
While much of the focus, rightfully so, is on FMM, two additional FMG shipyards in the area – Fincantieri Bay Shipbuilding in Sturgeon Bay, which is a commercial yard; and Fincantieri Ace Marine in Green Bay, which builds aluminum boats up to 25m long, as well as aluminum modules – complete Fincantieri's 'system of yards' that provide flexible manpower and facilities to help facilitate the building of the Frigates.

"For the frigate, Bay is going to be critical for us," said Vandroff. "We've invested significantly in Bay: a new panel line, a new blast and paint facility, and a new erection bay. Roughly one-fourth of the frigate will be built in Bay and completely erected and outfitted and then barged over for those super modules to be erected onto the ship. And that



Investment in technology is important, but recruiting and retaining skilled workers is key to delivering the frigate contract.

All images courtesy Fincantieri Marine Group



Once the new ship lift is operational in late 2022, the side launch will be a thing of the past @ Fincantieri Marinette Marine.

All images courtesy Fincantieri Marine Group

gives us a lot of advantages, particularly in terms of workforce flexibility."

"Shipyards are most efficient when they are busy, working at capacity," added Deste. And while each of the three yards will contribute to the Navy program, he was quick to emphasize: "Let me be crystal clear here; commercial shipbuilding and repair will remain the core business at Bay Shipbuilding."

People, too

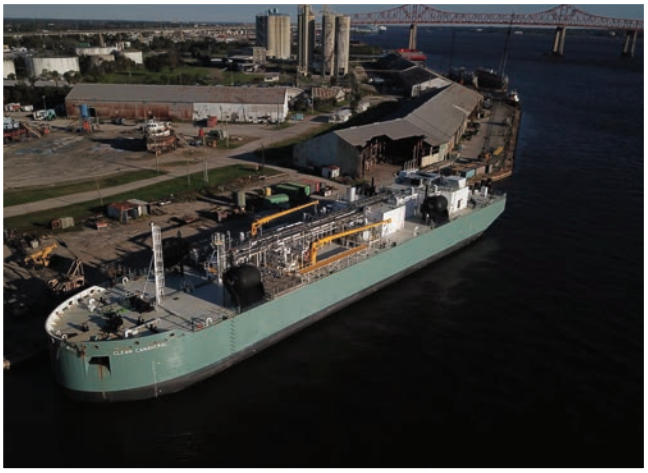
In addition to the physical facilities, FMM is laser focused on growing its employee base to deliver on its military contracts. "The biggest long-term risk for our ability to execute this program is manpower," said Vandroff. "Right now, we're roughly 1,000 trade workers in the yard, and I need to grow that to about 1,400 over the next two years. And I probably need to add around 100 additional white-collar employees between additional engineers and additional business professionals."

To address the need FMM is attacking the issue on multiple fronts. "We are engaged in national recruiting efforts for both blue collar and white collar employees," said Vandroff, as well as leveraging partnerships with the State of Wisconsin, as well as educational institutions from the local high schools to the local technical and community colleges, as well as the local four-year college, the University of Wisconsin-Green Bay. "Their Dean of Engineering and their Dean of their Business School have both visited the yard," said Vandroff, and both have tailored curriculum so that their engineers and business professionals both have the skills that FMM needs. If all else fails, there is outsourcing. "On previous programs we've given chunks of ship construction to an outsource partner," said Vandroff. "We are exploring options to do that, additionally, on the frigate in order (if needed) to make sure that we have the right resources to build the ships at the rate the Navy needs us to build them.

New Fincantieri Florida Ship Repair Business is 'Open'

Prompted by the Navy's request to expand its ship repair capacity and help enable a better record of uptime for navy ships, particularly the ones built by Fincantieri Marinette Marine, Fincantieri Marine Repair, a division of Fincantieri Marine Systems North America (FMSNA), expanded to Northeast Florida late in 2021, and in early January 2022 welcomed its first commercial customer to Commodores Point in downtown Jacksonville, effectively marking the start of operations in northeast Florida.

"The U.S. Navy wanted additional maintenance and sustainment support for Fincantieri-built military ships homeported in nearby Mayport, and that's what we've done," said **Dario Deste**, CEO & President, Fincantieri Marine Group. "But there are other military, government and commercial customers who need sustainment help as well, especially in the southeastern U.S."



According to Deste, the move to open the new facility and bring it up to 'Fincantieri standards' represents an investment of nearly $30 million – with the new 16,000-ton capacity drydock expected to open in early 2023, serving as the biggest ticket time – with additional investment to come.

Fincantieri Marine Group already has a well- and long-established repair hub in Wisconsin in the form or Bay Shipbuilding, but the Florida facility is well situated to handle both Littoral Combat Ships built by Fincantieri Marinette Marine as well as similarly sized military and commercial craft.

The ship repair practice is seen throughout the Fincantieri brand globally, particularly in the cruise and foreign military sectors, and as Deste reasons "we obviously know best what we build. To the navy, maintenance and sustainment is a serious issue," said Deste. "We talk about increased number of ships, and that is obviously very important. But we also have to talk about how to keep those ships at sea as long as possible (with an efficient repair cycle). We don't want to waste time (in the shipyard), we want to keep ships sailing; so it is important to have more quality facilities where the ships can be maintained and repaired as quickly as possible."

For the navy, keeping ships in shape and sailing is a mission imperative for national security; for the commercial market, it's a business imperative to keep cash flowing.

The first customer for the new repair yard is a commercial vessel, and one that has special meaning: it is the recently-competed liquefied natural gas (LNG) barge Clean Canaveral **(pictured)**, which was built by Fincantieri Bay Shipbuilding in Sturgeon Bay, WI, and is in the yard for testing and trials.

Tech Files

Innovative Products, Systems & Concepts

Photo © BOURBON

smartPAL

MariApps Marine Solutions will provide its flagship product smartPAL to Bourbon Marine & Logistics in support of its digitalization efforts to optimize its fleet management processes, including day-to-day operations in crewing, maintenance, QHSE and finance. smartPAL is designed to allow users to retrieve real-time finance, performance and operational data.

mariapps.com

mobile!

A difficult and time-consuming task when carrying out inspections or maintenance jobs on vessels is recording information on the job. Crews work on machinery, take notes and go back to their computers in the office and type in all the information. Now MESPAS has solved the problem: the first maritime app for QHSE and maintenance tasks.

mespas.com

Alfa Laval broadens LPG offering

As the marine industry focuses on decarbonization, Alfa Laval is experiencing increased demand for solutions related to LPG as fuel. Recent months have seen notable orders for the Alfa Laval FCM LPG, a low-flashpoint fuel supply system (LFSS) that can work seamlessly with LPG cargo handling systems.

LPG is a logical step in decarbonizing the vessels that transport it. The FCM LPG can be a key enabler in moving to LPG as fuel, combining Alfa Laval's experience in fuel conditioning and engine-related applications with a high degree of flexibility. The system's LFSS core is surrounded by an adaptable framework, allowing it to be tightly integrated with the cargo handling system.

The success of this approach can be seen in orders from prominent actors in the LPG market. TGE Marine Gas Engineering included the FCM LPG in its delivery scope for three LPG carriers – one of 40,000 cu. m. and two of 93,000 cu. m. – to be built in China in 2022. More recently, Alfa Laval received an FCM LPG order from one Japanese customer, to be integrated in the cargo handling system of newly designed 87,000 m3 VLGCs under construction in Japan.

Photo courtesy Alfa Laval

Alfa Laval FCM LPG, a low-flashpoint fuel supply system (LFSS).

For the full story: bit.ly/3HuLppM

Michelin tests inflatable sails

Michelin and Compagnie Maritime Nantaise will test a 100 sq. m. Michelin inflatable wing sail in 2022 on a merchant container ship. The Wing Sail Mobility (WISAMO) project is centered on an inflatable, retractable and automated wing that can be fitted on commercial vessels and pleasure boats.

Photo courtesy Michelin


Posidonia
6 -10 June 2022
Metropolitan Expo, Athens Greece
www.posidonia-events.com

Tech Files

Innovative Products, Systems & Concepts

Photo courtesy Nippon Paint/COSCO

Fastar

COSCO Shipping intends to coat its entire fleet of VLCCs with Nippon Paint Marine's new antifouling system FASTAR once initial applications have been evaluated. The hulls of the passenger ferry COSCO Star and the 56,000dwt bulk carrier Xin Liu Lin Hai will each be coated with the antifouling at drydockings scheduled later this year. The shipowner selected the nano resin containing paint – introduced to the market early last year – to help vessels meet the Energy Efficiency Existing Ship Index (EEXI) requirements.

FASTAR is a self-polishing antifouling paint that incorporates a unique nano-domain resin structure designed to minimise the effect that seawater temperatures, vessel speeds and other external factors have on coating performance.

According to Nippon Paint Marine, despite some market retraction last year, orders for the new coating increased steadily with the 135,000 litres of the coating having been applied to hulls totalling 4.2Mdwt.

Techcross: Record Start to 2022

Despite the prolonged COVID-19, Techcross reports that it has kicked off the new year with a new record in amount of order, FAT and shipments in January 2022. As of the third week of January, Techcross sold Ballast Water Management Systems (BWMS) for 81 ships, representing already its largest January amount of order, $23m, expected to exceed $26m, which was the largest monthly order in 2021.

In addition, Techcross finished Factory Acceptance Test (FATs) for 93 ships also set a new monthly record for the company, and 83 ships already have reserved FATs in February with more expected, potentially pushing over the100 mark.

Finally, in terms of the delivery of post-inspected products, Techcross also set new company records. As of the third week of January, shipping products for 72 ships were confirmed. This is the largest figure in the company history, but there is still one week to go until the month end and more sales revenue is expected. A department in charge is currently coordinating a shipment schedule before the Lunar New Year Holidays.

Photo courtesy Techcross

Alfa Laval FCM LPG, a low-flashpoint fuel supply system (LFSS).

"Techcross has the largest production factory in the world and is capable of producing more than 3,300 sets of BWMS," said a company representative, noting that the company to date has installed more than 4,200 systems.

For the full story: bit.ly/3HuLppM

SHI: Onboard Carbon Capture

SHI developed with PANASIA an 'Onboard Carbon Capture' system which it says can be applicable to LNG fueled vessels. It received AIP from KR. The tech separates and collects carbon dioxide among exhaust gas of LNG which is burned in a ship engine or generator, using an Amine based liquid absorbent. The plan is to commercialize the tech by 2024. Last year, SHI also signed an agreement with BASF's OASE Gas Treatment team to expand its technological cooperation based on BASF's OASE blue CO2 capture process technology, which allows the possibility to capture CO2 from flue gas onboard vessels.

Photo courtesy Samsung Heavy Industries

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In the Shipyard

Latest Deliveries, Contracts and Designs

Photo courtesy HII/Ingalls Shipbuilding Division

LPD 29

Huntington Ingalls Industries' Ingalls Shipbuilding division launched the amphibious transport dock Richard M. McCool Jr. (LPD 29), the 13th LPD in the San Antonio class of amphibious assault force ships. Ingalls Shipbuilding is building the entire San Antonio class of ships, and each measures 684 x 105 ft., displacing 25,000 tons.

AET

AET took delivery of Eagle Campos, the first of three Suezmax Dynamic Positioning (DP2) Shuttle Tankers purpose built for long-term charter to Brazil Shipping I Limited, a wholly owned indirect subsidiary of Shell. Eagle Campos was built at Hyundai Heavy Industries (HHI) and delivered to AET on January 5, 2022. It will commence operations in Brazil joining Eagle Pilar.

Vane Bros takes 3,000-hp Tug

Photo courtesy Vane Brothers

Vane Brother (Baltimore, MD) took delivery this month of the final boat in a series of four 3,000-hp Salisbury Class push tugs. Named the Charles Hughes, Vane's newest addition is the 20th Maryland-built towing vessel to join Vane Brothers' fleet since 2008.

Designed and constructed by Chesapeake Shipbuilding Shipbuilders and Naval Architects of Salisbury, MD, Vane's Salisbury Class push tugs have a molded depth of only 10.5 ft., making them well suited for working in confined, shallow-draft waterways. The Charles Hughes' operational area is the Northeast U.S.

The Charles Hughes' three sister tugs, the Salisbury, Annapolis and Rock Hall, were delivered in 2019, 2020 and 2021, respectively. Along with providing exceptional crew comfort, reliability and operational efficiency, all four Salisbury Class push tugs comply with federally mandated, U.S Coast Guard-enforced Subchapter M safety standards.

To create the Salisbury Class design, Chesapeake Naval Architect John Womack worked in collaboration with Vane Brothers Port Captain Jim Demske, who has overseen construction of 48 tugboats for Vane over the last two decades. "Chesapeake has such a talented group of shipbuilders right in our backyard," says Demske. "Each tug capitalizes on safety, comfort and productivity."

Along with the four push tugs, Chesapeake Shipbuilding has supplied sixteen 3,000-horsepower, model-bow tugs.

The tug Charles Hughes is named in honor of the late Charles F. Hughes, former Vane Brothers Chairman of the Board and the father of Vane's current President, C. Duff Hughes. Charles Hughes was a U.S. Navy veteran, Johns Hopkins University graduate, and Vane Brothers executive from 1951 to 2004.

A previous push tug Charles Hughes, built in 1975 and rated at 1,800 horsepower, was acquired by Vane Brothers in 1991 and sold in 2019. The classic-looking nameboards from the first Charles Hughes were refinished and are now mounted on the new Charles Hughes.

In the Shipyard

Latest Deliveries, Contracts and Designs

Austal USA delivers USS Canberra

The U.S. Navy took delivery of the future USS Canberra (LCS 30) at Austal USA on December 21, 2022. This is the second Independence-variant Littoral Combat Ship (LCS) Austal has delivered to the Navy in 2021.

"With two ship launches, two christenings, and now the successful completion of sea trials and delivery for LCS 30, it has been a busy last couple of months at Austal USA," Austal USA President Rusty Murdaugh said. "All of these milestones require extensive coordination between Austal, our vendors, and our Navy teammates and I'm proud to say that these partnerships grow stronger with each milestone achievement."

Acceptance Trials for LCS 30 were completed in early November demonstrating to the Navy the successful operation of the ship's major systems and equipment. Delivery documents were signed onboard the future USS Canberra and the crew will now begin preparing the ship for her commissioning into the fleet. Four LCSs are currently under construction including the future USS Santa Barbara (LCS 32). Final assembly is underway on the future USS Augusta (LCS 34) and modules are under construction on the future USS Kingsville (LCS 36) and the future USS Pierre (LCS 38).

Photo courtesy HII/Ingalls Shipbuilding Division

Two Expeditionary Fast Transports are also under construction at the shipyard, with a third under contract. In October, Austal USA was awarded a contract for the detailed design and construction of two U.S. Navy Towing, Salvage, and Rescue Ships (T-ATS), the first contract for Austal's new steel construction facility.

Methanol Fueled Chem Tanker Delivered

The methanol-fueled chemical tanker Seymour Sun, owned by NYK Bulkship (Asia) Pte. Ltd., an NYK Group company based in Singapore, was delivered on January 27, 2022. The ship was built at Hyundai Mipo Dockyard in Korea.

Seymour Sun is equipped with a dual-fuel engine that can use both heavy fuel oil and also methanol. In addition, when navigating using methanol as fuel, the vessel has a new technology that suppresses the production of NOx (nitrogen oxides) by adding water to methanol to lower its temperature during combustion. As a result, the vessel can comply with the IMO's stringent Tier III NOx emission standard and contribute to environment-friendly transportation without the need for an exhaust gas recirculation (EGR) system and a selective catalytic reduction (SCR) device.

Photo courtesy NYK

Under the management of NYK Shipmanagement Pte. Ltd., an NYK Group company, the vessel will be engaged in a long-term charter contract with Waterfront Shipping Limited, which is a subsidiary company of Methanex Corporation, the world's largest methanol producer.

Seymour Sun Main Particulars

Length, o.a.:	about 186 m
Breadth:	about 32.2 m
Gross tonnage:	30,873 tons
Shipbuilder:	Hyundai Mipo Dockyard
Flag:	Singapore

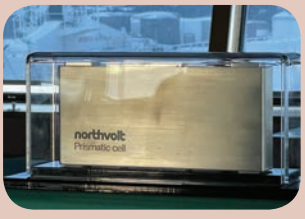
Nabucco

Photo courtesy Wallenius Wilhelmsen

Wallenius Wilhelmsen celebrated the naming ceremony of the RoRo vessel MV Nabucco at the Port of Gothenburg. The ship is the last in a line of four HERO class sister ships.

To signify the vessel's sustainable features, and the company's ambitious sustainability agenda, a **bottle-shaped ice sculpture** was smashed against the hull, the company added.

The godparents, sustainable battery company, and Wallenius Wilhemsen customer, Northvolt, **presented Captain Fredrik Krysén with a battery** to keep onboard as a reminder that both companies are committed to a decarbonized world.



Handsome and Versatile: New Crab Boat from Gaspé

With the regulated catch quotas of contemporary fisheries, design versatility for a fishing boat can be important. A new 19.81 by 7.31-meter (65X24-foot) combination crab trap and groundfish trawler designed by NAVANEX for building by Chantier Naval Forillon, both of Gaspé, Quebec, Canada is a fine example of this. Owners, Listuguj Mi'gmaq Government, anticipate accepting delivery in April of 2022.

Photo courtesy Cummins

The steel-hulled vessel will have a raised fo'c'sle design with an aluminum pilot house. When crab fishing, the clear, aft deck will be capable of carrying up to 150 collapsible, 100-pound crab pots. When rigged for trawling, a gantry will be mounted over the stern with two net drums. A pair to trawl winches can be mounted on a platform aft of the raised fo'c'sle. The designers have included features to make the vessel more comfortable for a crew of up to seven people. A bulbous bow, in addition to improving fuel efficiency, will help reduce pitching when working gear into a swell. A pair of stabilizers will be mounted, following a design first installed by Chantier Naval Forillon on the trawler Fundy Leader that they built in 2006. A number of these systems have since been fitted to other vessels. The stabilizer is a simple steel plate, hinged at the bottom on the bilge chine. It can be hydraulically raised flat against the hull or lowered to a horizontal position. The boat's designer, Jean-Nil Morissette, explains that they function very well to dampen motion both when travelling or when working gear. Propulsion power will be an IMO-compliant tier III, Cummins QSK19 producing 750 hp at 1800 RPM. To meet the IMO tier III emissions, the QSK19 main engine is fitted with a proven SCR catalyst. The transmission is a Twin Disc MGX-5222 gear with 5.04:1 reduction. This will turn a four-blade Rice Kaplan Skewed propeller with a 57-inch diameter and a 67-inch pitch. The prop's trust is enhanced with a Rice Speed nozzle. This system will give the vessel a cruising speed of nine knots and a bollard pull of 8.2 metric tons. A comprehensive set of deck equipment will include a Heila HLM 3-2S deck crane. For crabbing there will be a crab hauler, crab table, crab boom and crab block. For trawling, in addition to the two trawl winches and net drums, there will be a bag winch. The anchor winch is mounted so that the anchor will lower to the side of the bulbous bow.

Auxiliary power includes a Cummins QSB7-DM genset producing 65 kW and an additional QSM11-DM engine producing 355 hp at 1800 RPM. This engine will drive the vessel's hydraulic pumps and a back-up 65 kW genset. Main and auxiliary engines were supplied by Cummins Sales and Service, Quebec East, Cummins Canada ULC.

Kenneth Walland, CEO, Edda Wind

Photo Courtesy Gondan / inset photo © Edda Wind

Edda Wind Orders More CSOVs

Norwegian offshore wind services company Edda Wind has ordered three more Commissioning Service Operation Vessels (CSOV) in addition to the six vessels the company has under construction.

The vessels are designed for service operations during the commissioning and operation of offshore wind farms. The three vessels will be prepared for the installation of zero-emission technology in the same way as the first six vessels, based on funding from Enova, according to Edda Wind.

"Including the three latest newbuildings, the company will have a fleet of eleven purpose-built vessels, of which six are contracted on mid- to long term contracts with key clients like Ørsted, Vestas, Ocean Breeze, SSE, and Siemens Gamesa," Haugesund-based Edda Wind said.

When it comes to the three newly ordered vessels, one vessel will be built at Astilleros Gondan (Gondan), Spain and two vessels to be built at Colombo Dockyard PLC (Colombo), Sri Lanka. In addition, the company has options with the yards to build more vessels. Kenneth Walland, CEO of Edda Wind: "Ordering another three purpose-built CSOVs will further strengthen Edda Wind's leading position within offshore wind. By building a series of vessels like this, and with the experience and knowledge we have from the vessels currently under construction, we are able to acquire these vessels at competitive prices. Tremendous growth is expected in the offshore wind market over the next decades, and the move is a clear signal on Edda Wind's ambition to be a world-leading provider in this segment." In the fourth quarter of 2021 Edda Wind was listed at Oslo Stock exchange through an IPO, raising almost $113 million in new capital.

The vessels

The newbuild, to be built at Gondan shipyard, is a Salt 0217 design and a planned delivery in July 2024. The vessel will be a sister vessel of the four vessels already under construction at Gondan. "The vessel will be number eighteen ordered by companies with relation to the Østensjø Group, including seven Edda Wind vessels. With this track record, it is needless to say that we consider Gondan to be an excellent shipbuilder. We know their capabilities very well, and the yard has proven to deliver the quality we require and are very happy to enter into a new contract with them," said Walland.

Edda Wind Lands Dogger Bank Contract

The two newbuilds at Colombo will be of Salt 0425 design, which is a further development of the Salt 0217 design. The first vessel will be delivered in January 2024 and the second vessel in July 2024.

"The 89.3 meters long vessels will function as mother ships for wind turbine technicians as they perform commissioning and maintenance work on the wind turbines. Comfortable cabins and high standard common areas can accommodate up to 97 technicians and 23 marine crew onboard. Anti-heeling and roll reduction systems will provide good working conditions onboard.

The motion-compensated gangway system with an adjustable pedestal will ensure safe and optimal connections to the turbines, even in harsh weather conditions. The design is optimized for an efficient logistical operation for the turbine technicians," Edda Wind said of its new vessels, which will be delivered under the Norwegian flag.

Photo courtesy Stolt-Nielsen

Niels G. Stolt-Nielsen Resigns

Photo courtesy Ingram

Roberts takes the helm at Ingram

Photo courtesy Stolt-Nielsen Ltd.

Augusteijn Named STC President

Niels G. Stolt-Nielsen Resigns

Niels G. Stolt-Nielsen has decided to step down from his role as CEO of chemical tanker operator Stolt-Nielsen Ltd. He will continue until the appointment process for a successor is completed. He has served as CEO of Stolt-Nielsen since November 2000 and has been a Director since 1996.

Roberts takes the helm at Ingram

Ingram Marine Group announced that David O'Loughlin will retire from his role as CEO of the company effective February 1, 2022. John Roberts, the company's current Chief Operating Officer will take the helm as the new President and CEO at that time.

Augusteijn Named STC President

Stolt-Nielsen Limited appointed Hans Augusteijn as President, Stolt Tank Containers (STC), effective February 1, 2022. Augusteijn succeeds Michael W. Kramer, who will assume the role of Executive Vice President, Marketing and Business Development at Stolt-Nielsen Limited.

McCreary to Lead Gulf Marine Repair

Hendry Marine Industries appointed Richard McCreary as President of Gulf Marine Repair effective January 31, 2022. McCreary succeeds the retiring John Gallagher, who had served as President since 2019.

Wilhelmsen takes a stake in Ahrenkiel

Wilhelmsen Ship Management acquired a majority stake in Hamburg-based Ahrenkiel Tankers. The transaction will result in Wilhelmsen Ship Management taking over the management of five tankers, and Wilhelmsen Ship Management will gain 80% ownership of Ahrenkiel Tankers under the deal, with the remaining 20% to be held by existing owners MPC Capital Group. Ahrenkiel Tankers will be re-branded as Barber Ship Management.

McLean Acquires Shugart

McLean Contracting acquired Shugart Manufacturing. Shugart is engaged in the business of designing and manufacturing sectional barges, barge propulsion units and accessories, screeds, barge ramps, bridge steel, concrete forms, and other miscellaneous equipment and materials for Marine and Construction use. Shugart's principal place of business is located in Chester County, South Carolina. Donnie Wilks, prior Owner and President will stay on with McLean to direct the Division. Shugart has been in operation for over 60 years serving the Construction and Marine sectors.

Photo courtesy hendry Marine

McCreary to Lead Gulf Marine Repair

Photo courtesy Wilhelmsen Ship Management

Carl Schou, CEO & President, WSM

TSGI Promotes Sebastian, Brann
The Shearer Group, Inc. (TSGI) promoted Joshua S. Sebastian, P.E. to Vice President – Operations; and Harrison C. Brann, P.E. to Senior Naval Architect.

Uz tapped as MD for Schottel Turkey
Effective January 1, 2022, Seçkin Uz has been appointed Managing Director for Schottel Turkey.

Pruzek Namd EVP @ Reconcraft
Reconcraft named Josh Pruzek Executive Vice President, effective January 1, 2022.

Nautilus names Wilhelmsson CCO
Nautilus Labs is expanding to the UK, opening an office in London to be led by Jan Wilhelmsson, an experienced shipping executive and Nautilus Labs' new Chief Commercial Officer (CCO).

Foley Named Wozair MD
Wozair appointed John Foley as Group Managing Director to the Board on January 1, 2022.

Hundested Propeller Names Juel CEO
Hundested Propeller January 2022
Hundested Propeller A/S appointed Henrik Hamann Juel as CEO. Juel brings a wealth of experience from his prior work within the manufacturing of marine generators, aquaculture, and wind energy. In 2021 Hundested Propeller reached 100 years of producing and supplying controllable pitch propulsion systems and thrusters for commercial marine applications and superyachts.

Photo courtesy Hundested Propeller

Hundested Propeller Names Juel CEO

Photo courtesy McLean Contracting

L to R: Michael Hart, CEO of McLean Contracting, and Donnie Wilks, Owner of Shugart Manufacturing.

Photo courtesy Schottel

Uz tapped as MD for Schottel Turkey

Photo courtesy The Shearer Group

TSGI promotes Harrison C. Brann

Photo courtesy The Shearer Group

TSGI promotes Joshua S. Sebastian

Floating Nuclear Power

An interesting past and a promising future in the Net-Zero Energy Transition

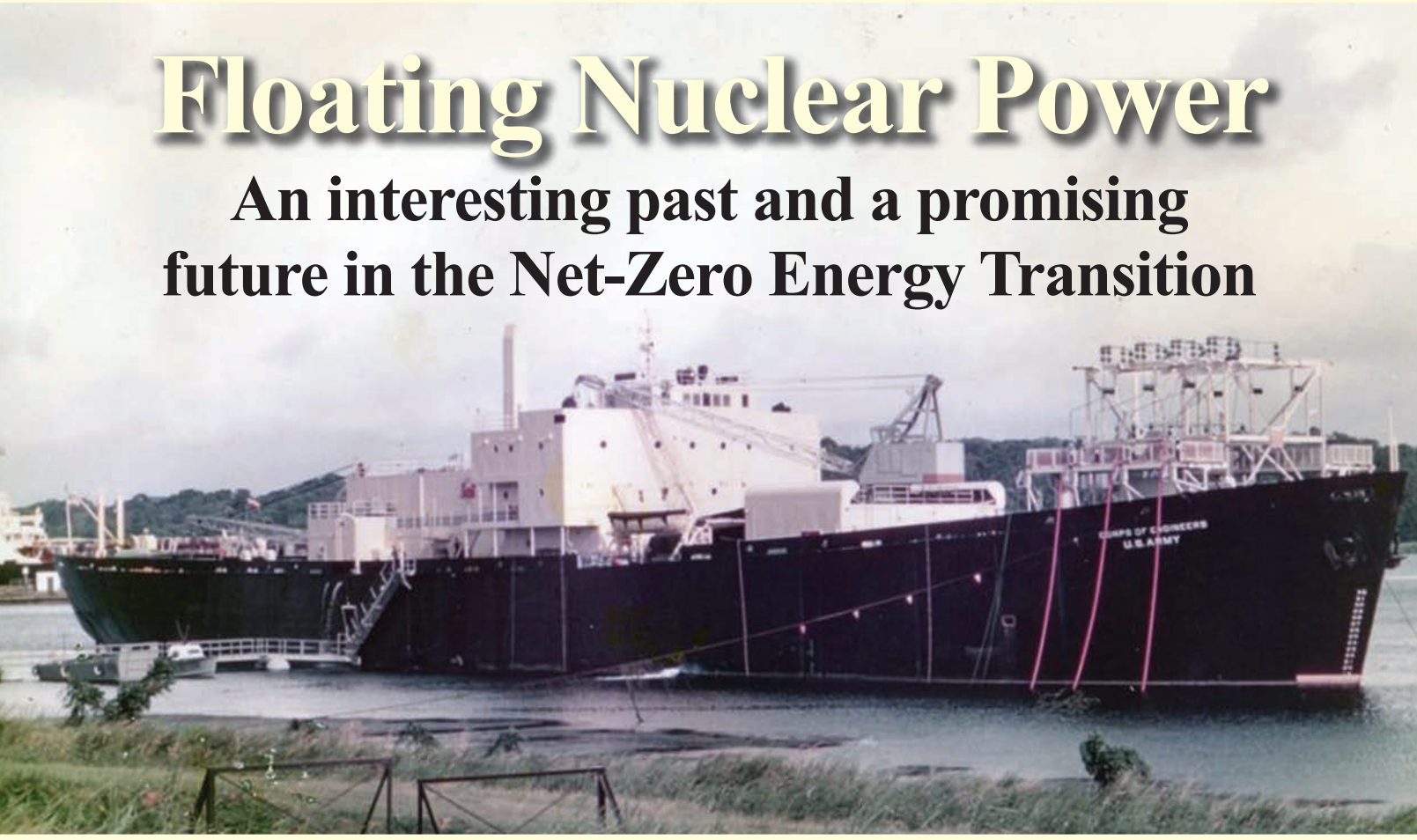


Photo courtesy U.S. Army Corp of Engineers

By Philip Lewis, Director of Research, Intelatus Global Partners

Floating nuclear power plants (FNPPs) may not immediately spring to mind as providing a solution to several of today's key global challenges – but FNPP development is emerging as a means of decentralized stand-alone production of cost competitive hydrogen-based fuels and clean electricity and water, according to a new report by Intelatus Global Partners.

The commercial case for deployment of FNPPs featuring small modular reactors is founded in the growing demand for hydrogen and hydrogen-based fuels.

Around 90 million tonnes of hydrogen is currently produced annually – almost exclusively produced from fossil fuels. Non-fossil fuel hydrogen production currently stands at around 0.5 million tonnes of annual capacity. The International Energy Agency calls for 80 million tonnes of clean hydrogen production by 2030. If this clean hydrogen target is to be met, green hydrogen produced by renewable solar and wind energy projects cannot meet all the energy requirements. Nuclear power will also be needed to produce low and zero carbon transition fuels.

The high temperatures generated by some reactor technologies are particularly well suited to clean hydrogen production, splitting water into component hydrogen and oxygen elements. Hydrogen produced by nuclear power is referred to as pink hydrogen – and sometime alternatively as purple, red or yellow hydrogen.

Given the storage challenges associated with hydrogen, FNPPs producing hydrogen from desalinated seawater can also produce more easily storable transition fuels, such as ammonia and methanol.

In a similar concept to floating oil production, storage and offloading units and floating natural gas liquefaction and regassification systems, a floating nuclear ammonia or methanol production, storage and offloading unit will process seawater to produce hydrogen which is then combined with nitrogen separated from the air to produce ammonia or captured carbon to produce methanol. The produced ammonia or methanol are stored in tanks in the hull

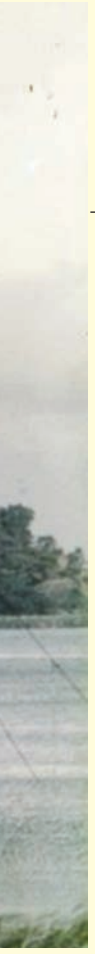


Photo Left: Undated image of STURGIS operating in the Panama Canal Zone. The STURGIS, a former World War II Liberty Ship, was converted into the first floating nuclear power plant in the 1960s. Before being shutdown in 1976, the STURGIS' nuclear reactor, MH-1A, was used to generate electricity for military and civilian use in the Panama Canal.

spaces of the floating units and then later offloaded to shuttle tankers. These low and zero carbon fuels can be used in the maritime and aviation sectors amongst others.

The need for FNPPs for decentralized power and water production

Global population is forecast to grow to 9.7 billion by 2050 from around 7.8 billion people today – of which over 770 million have no access to electricity. Further, over 60 million people live in small developing island states, which face unique challenges for power and water supply.

Until now, those in remote and island locations have often relied on diesel generators to generate power, which is relatively costly and has negative impacts on the environment. Decentralized stand-alone power and mini grids, such as FNPPs, are one potential solution to deliver clean electricity to millions.

One advantage of nuclear power plants is that they produce large amounts of heat – which can be used for water desalination. Almost a third of the world's population is estimated to have poor access to clean water and UNESCO forecasts that up to 5.7 billion people could be facing "some level of water scarcity" by 2050. The electricity and heat cogeneration capabilities of FNPPs make them ideal for providing decentralized water production from seawater, whether by thermal distillation or reverse osmosis.

FNPPs: Not a New Solution

Conventional floating power plants have been widely deployed as a source of flexible decentralized power for decades to remote and difficult to reach areas. There are currently more than 75 floating power plants operational today.

The world's first nuclear powership used in a commercial application was the Sturgis. Operating between 1968 and 1976, the Sturgis supplied electricity to the Panama Canal Zone grid.

Building on its experience in building and operating nuclear powered icebreakers and cargo ships, FNPP pioneer Rosatom commenced operations of the world's newest commercial floating nuclear power plant, the FNPP Akademik Lomosov, in 2020. The company is currently building four more next generation FNPPs.

China, South Korea, Denmark, UK and the U.S. are all home to companies developing FNPP concepts.

New technologies aim to address some of the key concerns on nuclear power

Traditional site built nuclear power plants have a reputation for high costs and long construction schedules. A new generation of small and micro modular reactors seek to address these barriers.

Small in physical size, with an electrical output of less than 300 MW, the smaller footprints of these new generation reactors make them suited to decentralized marine based applications.

The modularized approach allows for economies of scale as these reactors will be built in series in controlled factory environments and be moved by road, rail or barge. Putting the nuclear plant on a floating structure allows power and heat to be deployed where it is needed. In the case of FNPPs, the reactor modules are moved to large and experienced shipyards.

In these offshore and marine yards, quality, safety, schedule and cost are

Decarb Core

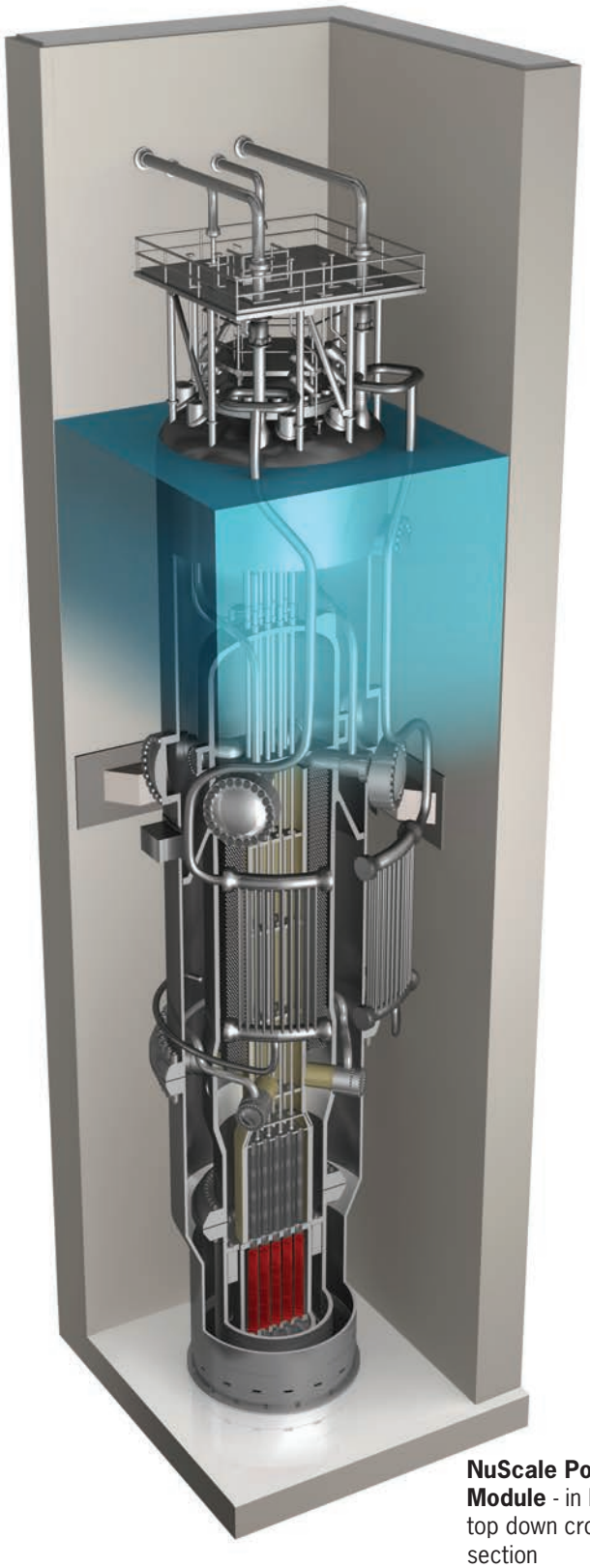
Core Power is working on a concept for an offshore facility that combines nuclear power with an offshore ammonia production facility, which would enable **affordable production of green ammonia for shipping**.

"The production of green ammonia is a key component of the decarbonization plans for international shipping. While the largest 17,000 ships are unlikely to find economic value in using hydrogen-derived green fuels, a very significant portion of the world fleet may find green ammonia to be a viable pathway to zero emissions," Core Power said in a release. "Our concept design is for an offshore facility partnering advanced nuclear power with an offshore ammonia production facility, which will create green ammonia from abundant seawater and air," said Dr. Rory Megginson, Core Power's Director of Analytics.

Core Power said its modeling showed that with current technology it is possible to produce one million tons of ammonia per year using 1.2 GW of electric power, on each floating production platform, reducing to 0.9 GW by 2050. This is the equivalent of 440,000 tons of VLFSO, the company said.

The flexible nature of these systems will mean it will also be possible to provide a mixture of electricity, hydrogen, and ammonia for other applications,.

Moving the reactors to sea allows for a substantial reduction in costs due to the lack of a need for civil engineering as well as opening the possibility of shipyard construction. "The production of Molten Salt Reactor technology is modular by design rather than the historical 'first of a kind reactor,' that has kept nuclear generation prices elevated up until now. Offshore advanced atomic power shows the best results at the lowest cost for large scale, secure, and truly green ammonia production," the company said.



NuScale Power Module - in bay top down cross section

Image courtesy NuScale Power, LLC

readily controlled given that the plant's construction and a large proportion of commissioning are performed using standardized equipment under strictly controlled conditions. This approach minimizes the risk of labor availability in remote areas and unforeseen ground conditions, two key risks for site-built power plants. At a high-level, the concept is similar to floating oil and natural gas production and storage units – another example where a mature technology, in this case oil & gas processing, has been coupled with mature offshore and marine supply chains and where there are more than 400 floating production and storage systems globally today.

High profile nuclear accidents from the past, such the 2011 Fukushima Daichi reactor meltdown in Japan, the 1986 Chernobyl accident in the Ukraine, and the 1979 Three Mile Island accident in the USA, fuel public concerns on nuclear power. Because of these risks, licensing of technology of projects is a long process.

The latest generation of reactors known as Gen-IV systems are designed to have very low likelihood and degree of reactor core damage and will eliminate the need for offshore emergency response. Gen-IV principles promote safety, reliability, sustainability, economics, and proliferation resistance – which support the licencing of technology.

One challenge of deploying conventional reactor technology, as used in the majority of existing onshore and naval nuclear power plants, is the need to refuel every 2-4 years. This will result in handling spent nuclear fuel in ports. Some of the developing small modular reactors feature technology that eliminate the need to fuel during the 20-30 year lifetime of the FNPP – mitigating many of the concerns and challenges to nuclear power.

The FNPP Market Report.

Intelatus Global Partners has developed a toolbox that identifies and assesses future business opportunities in designing, building, operating, and financing FNPPs, specific locations that are prime targets for using an FNPP, barriers and hurdles to market entry and development, the players and competitive landscape and optional strategies and paths for entering and positioning in this emerging market.

For more information about the FNPP Market Report, please contact Philip Lewis at +44 203-966-2492

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2022 Editorial Calendar

January 2022

The Ship Repair & Conversion Edition

- Hull, Deck and Tank Coatings
- Engine Conversion & Repower
- Fuels and Lubricants
- Emission Scrubbers
- Waste Water Treatment Systems

February 2022

Government Shipbuilding

- Autonomous Ship Systems
- Bridge Technology: Satellite Communications, Navigation & Controls
- Seafarer Training & Education
- Health, Safety & Sanitization

Event Distribution:
Sea, Air, Space: April 4-6, National Harbor, MD

March 2022 E-Magazine Edition

Dredging

April 2022

Offshore Energy

- Wind Turbine Installation Vessel Technology
- Cruise & Ferries
- Marine Gears & Transmissions
- Fluid Handling Pumps and Filtration
- Heavy Lifters: Deck Machinery & Cranes

Event Distribution:
OTC: May 2-5, Houston, TX
IPF: April 26-28, Atlantic City, NJ
Seatrade Cruise Global: April 26 - 28, Miami, FL

May 2022

Green Ship Technologies

- LNG / Hybrid Propulsion: Marine Batteries & Fuel Cells
- Classification Societies
- Marine Coatings & Corrosion Control
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Event Distribution:
Posidonia: June 6 - 10, Athens, Greece
Inland Marine Expo: May 23 - 25, St Louis, MO

June 2022

USCG Fleet Modernization Annual

- Fast Attack and Patrol Craft Builders
- Ride Stabilization: Pitch and Roll Control Solutions
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Event Distribution:
MACC: Jul 2022, National Arbor, MD

July 2022 E-Magazine Edition

Navy & Coast Guard Shipbuilding

August 2022

The Shipyard Annual

- Bearings, Seals and Couplings
- Pipes, Pumps & Valves
- Ballast Water Management
- Welding & Cutting Equipment
- Marine Batteries & Fuel Cells

Event Distribution:
SMM: September 6-9 Hamburg, Germany

September 2022

The Marine Design Edition

- Naval Architecture/Marine Engineering
- Dredging: Port Expansion and Deepening
- Material Handling Equipment
- Performance Coatings
- Shipping & Port Logistics

Event Distribution:
CMA Shipping: October, Stamford, CT
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October 2022 E-Magazine Edition

Offshore Wind

November 2022

Workboat Edition

- Autonomous Workboats
- Workboat Propulsion
- Deck Equipment: Winches & Cranes
- Emissions: Exhaust Systems and Scrubbers
- Training and Simulation

Event Distribution:
Clean Gulf: December 2022
Int'l Workboat Show: December 2022

December 2022

Great Ships of 2022

- Naval Architecture/Marine From Sails to Bubbles: Alternative Ship Propulsion Assist Technologies
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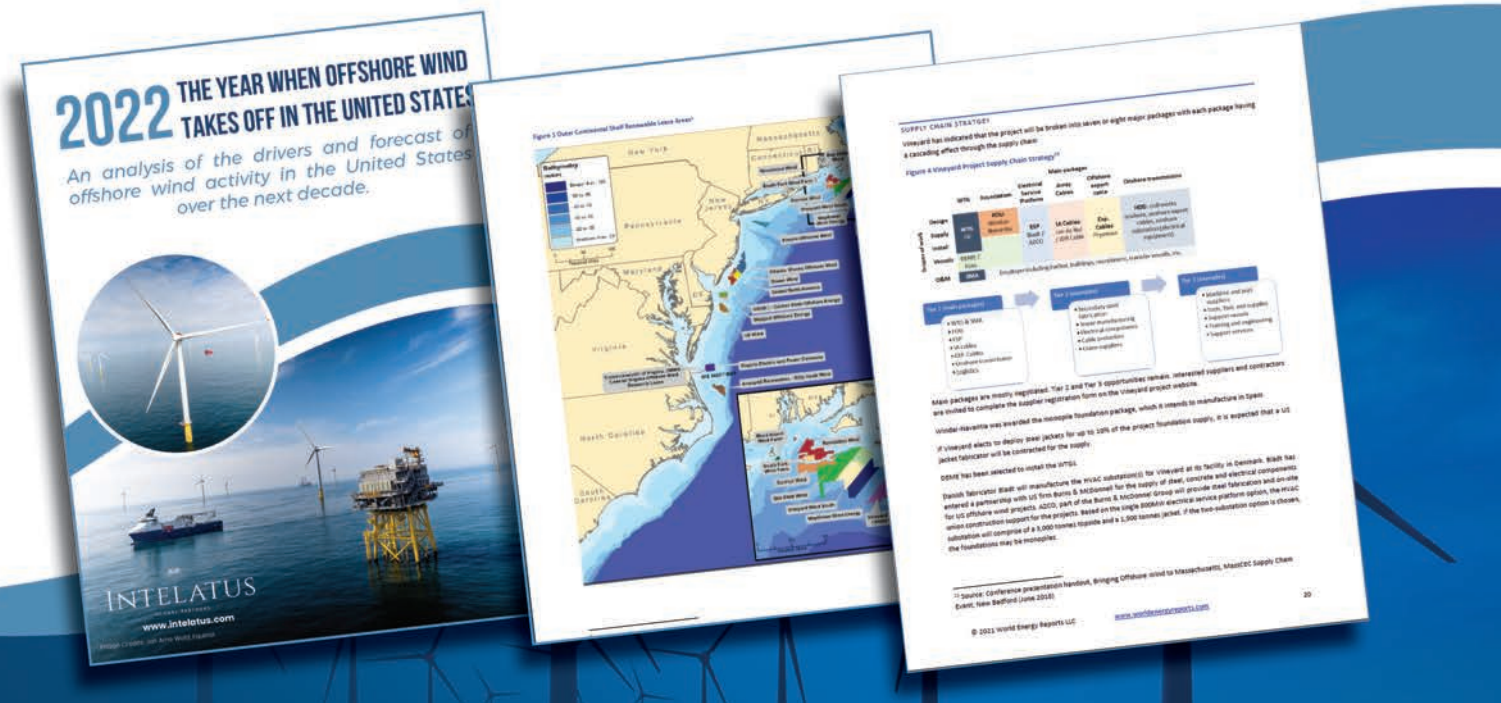

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