April 2022

MARITIME REPORTER AND ENGINEERING NEWS

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OFFSHORE WIND

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ADMIRAL KARL SCHULTZ

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Having written this page, amazingly, for almost 30 years now, I know better than to use the words 'market boom' quickly, as history suggests, on more occasions than one, soon thereafter that market boom goes 'bust' in spectacular fashion due to some unforeseen global event, the latest being the global cruise industry and COVID-19.

With that encouraging note as a backdrop, please read on as we discuss the booming U.S. offshore wind industry in the round in this issue, our offshore energy edition. As most of you know all too well, the promise of offshore wind in the U.S. has come with a decades-long bout of fits and starts, always endlessly good editorial fodder focused on the dual evolution of government regulation and technological advancement. On the latter, we've written often about Europe's generations plus leadership in the space, but in regards to the industry's evolution off the shores of the U.S., this is in fact a positive as we now have 20 or more years of trial and error from which to learn. Add to that the U.S.' own long history offshore in the oil and gas sector, and what you see today is an amazing collection of technological know how getting a generous boost up the mountain from political will, with the final shove over the peak from financial support.

As of this writing there is a historic changing of the guard brewing at the United States Coast Guard, with the President nominating **Admiral Linda L. Fagan** to serve as the 27th Commandant of the U.S. Coast Guard. Upon confirmation, Adm. Fagan would be the first woman to serve as Commandant of the Coast Guard.

Last month I had the opportunity to sit personally for the third and last time during his tenure with USCG Commandant **Admiral Karl Schultz**.

The USCG today is engaged in a historic shipbuilding program across multiple classes of vessels, the largest of its kind since WWII, which is good news for shipyards, design support and equipment supply companies across the country. Admiral Schultz and his leadership have worked relentlessly to ensure that the Coast Guard was adequately funded for its multiple-missions following years of underfunding, and that included a long list of physical assets on the shore, at sea and in the air, as well as the technology backbone to keep the Coast Guard on the leading edge as the first in line to protect and estimated $5.4 trillion in U.S. maritime commerce. But attracting and retaining quality people – challenge and lament for everyone reading these pages, including the author – is a never-ending battle for the Coast Guard today. I thank the Coast Guard for allowing us amazing access to their operations across the country, on the ships, the planes and at USCG headquarters, too, for some interesting insights on the priorities and projects that are driving the Coast Guard of tomorrow.

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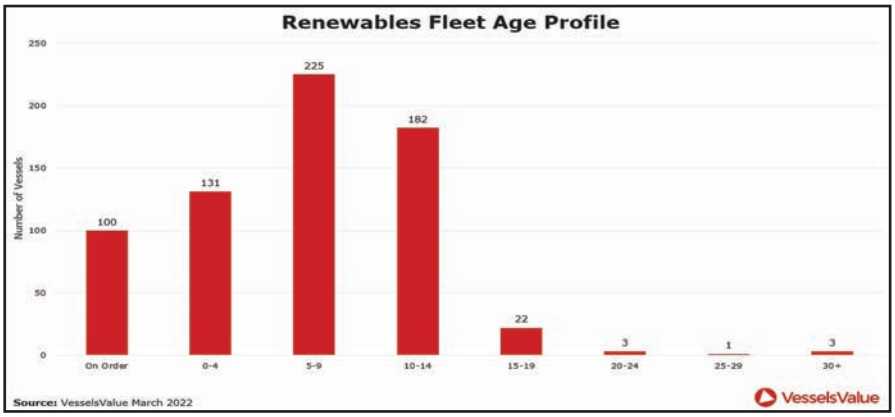
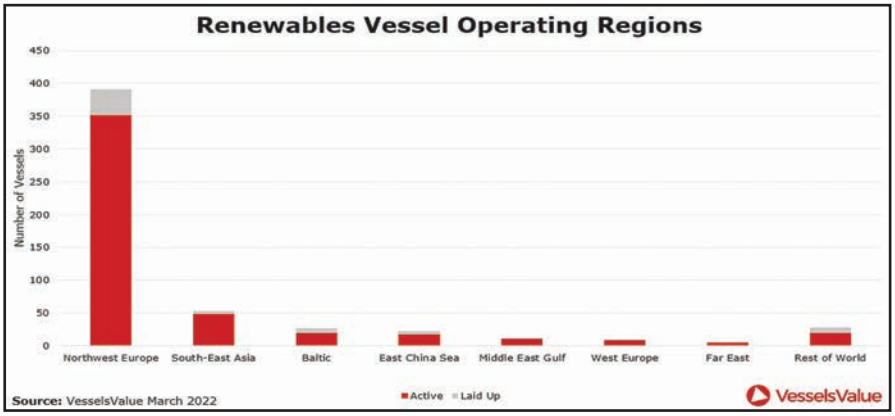
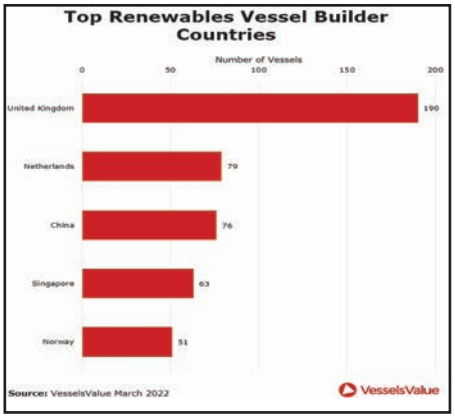
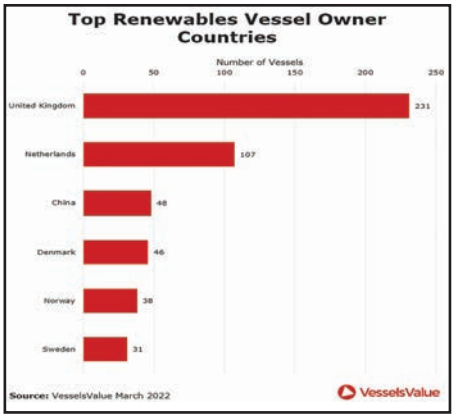
Windfarm Vessels

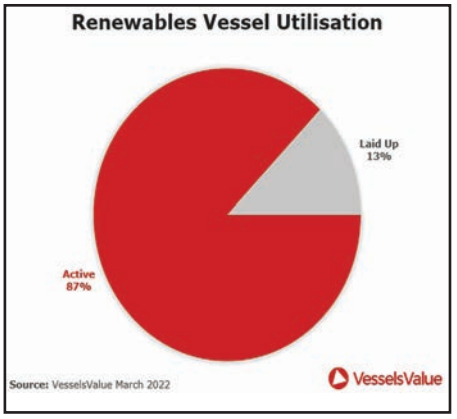
This month, courtesy of statistics from our friends at Vessels Value, we take a look at the growing fleet of offshore wind vessels globally.

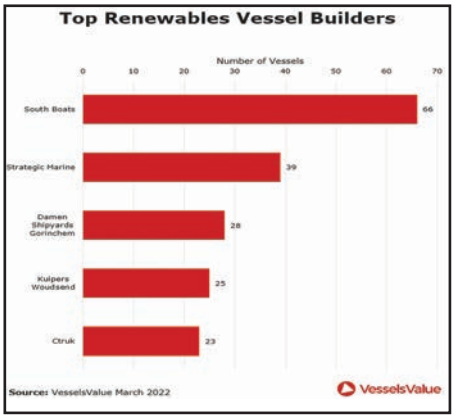


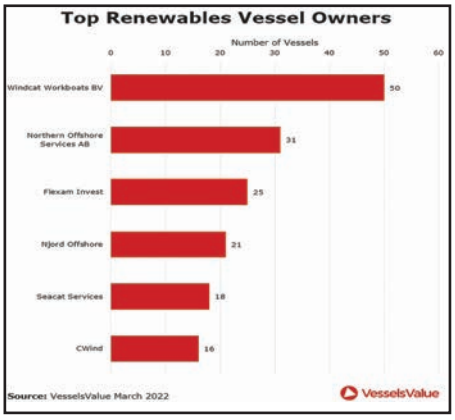


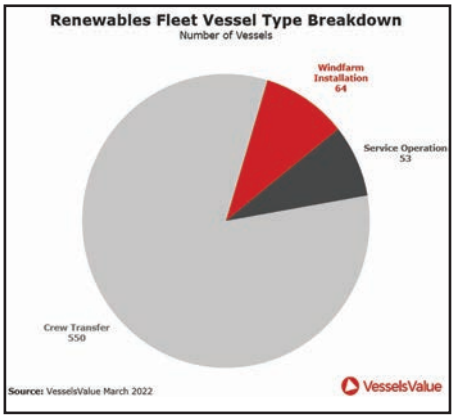












"Looking further out, we anticipate that a commercial launch of an autonomous vessel that can resolve all the aforementioned concerns and problems to a satisfactory level while being designated to MASS Level 3 and 4, will most likely happen post 2030."

Sungjoon Kim
Sr. Executive Vice President, Korea Shipbuilding & Offshore Engineering (KSOE)

"At Reintjes we also want to ride the wave of decarbonization, and currently, 80% of the inquiries we get from our customers – shipyards and owners – are regarding hybrid."

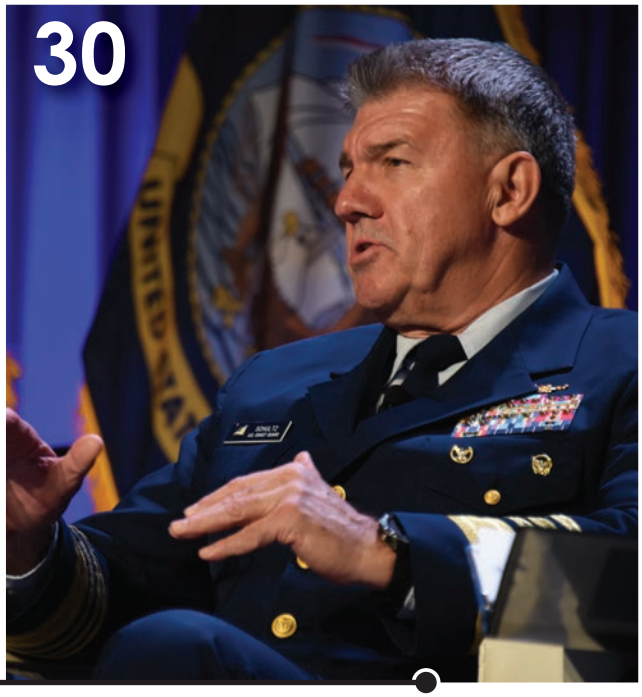
– Klaus Deleroi, Managing Director, Reintjes

"We forecast 27 GW of capacity to be grid connected by 2030 and around 50 GW by 2035. Longer-term we anticipate that 110 GW of installed capacity by 2050 is achievable. Our forecast is based on developer plans, BOEM leasing and permitting activity and state committed and planned offtakes.

Philip Lewis, Director of Research, Intelatus Global Partners

"I think it has been a uniquely, persistently challenging period from external factors. We had a plan, and a lot of things have been trying to take us off the plan. I didn't think I'd stand in front of some portion of 60,000 people explaining they weren't going to be paid, but they still need to stand the watch. **And here we are today with post-WWII rules-based order being threatened with an egregiously acting Russia.** Through it all, we've always tried to go back to the plan."

Admiral Karl Schultz
Commandant, United States Coast Guard, discussing challenges during his tenure.



(U.S. Coast Guard photo by Petty Officer 1st Class Adam Stanton)

Tip #34

What's Most Effective? Text, Video, Simulations? Debunking the Myths

What is the optimal media for learning? The answer may seem obvious, but is it?

The Cone of Learning

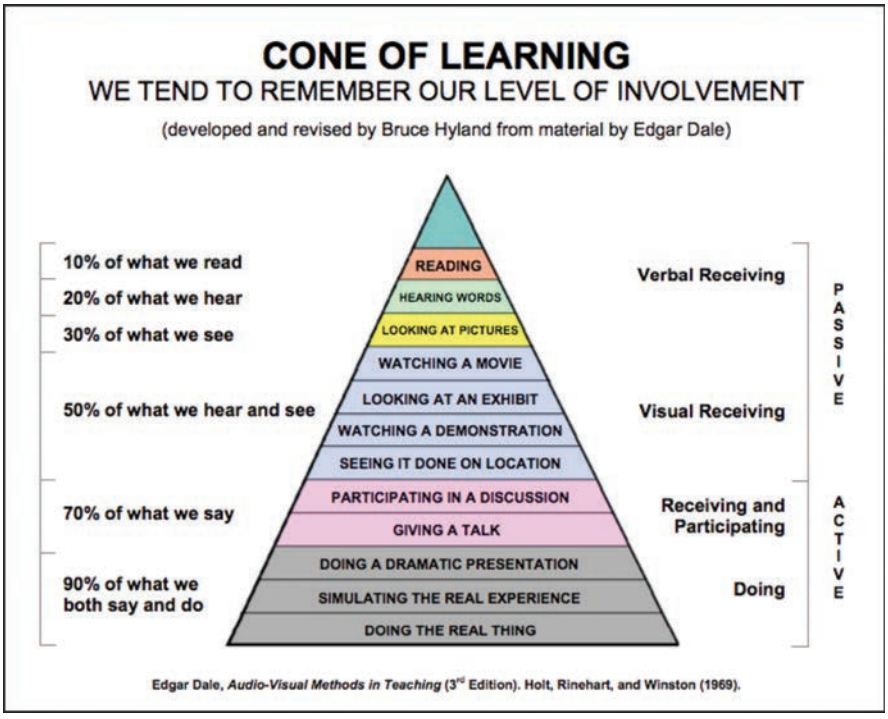
As maritime trainers we've probably seen, and possibly even quoted, something similar to the following information on the effectiveness of learning media. It is referred to as the Cone of Learning. The "Cone" is one of the most repeated graphics in learning conversations and exists in tens or even hundreds of forms scattered over the internet and elsewhere. A representative example is presented below (Credit Cisco: "Multimodal Learning Through Media: What the Research Says").

It appears to be great information.

Or … does it? Should we believe this? Well, it turns out that we should not! Despite how commonly this or similar information is presented and how authentic it may appear, it's simply not true. Not only that, but it is damaging because people routinely make media decisions based on this information and other information like it.

This is very important, so let's look at what the Cisco paper actually says about this cone of learning. To quote the Cisco paper about the graphic to the left (I have underlined the last two sentences for emphasis):

"The person(s) who [incorrectly] added percentages to the cone of learning were looking for a silver bullet, a simplistic approach to a complex issue. A closer look now reveals that one size does not fit all learners. As it turns out, doing is not always more efficient than seeing, and seeing is not always more effective than reading. Informed educators understand that the optimum design depends on the content, context, and the learner. For example, the bogus percentages on the cone would suggest that engaging students in collaborative learning in general would result in higher levels of learning than would a lesson where a student listens to narration or reads text about the topic. <u>The reality is that, for the novice student engaged in basic skill building ... individual learn-</u>



Credit Cisco: "Multimodal Learning Through Media: What the Research Says"

ing through reading or simple drill and practice might be the optimal learning design. Yet, for a different learning objective – for instance, understanding cause and effect ... a simulation might be the most effective learning approach."

On reflection, this is not surprising. If you examine the cone a little more closely, the troubling signs become apparent. First - the data is simply too convenient. Real research rarely yields percentages as results that are almost all conveniently multiples of 10. Likewise - how could such numbers even exist when we know that different people learn differently?

The truth is that every media has its place. And there is no shortage of choice when it comes to eLearning media types. We are all familiar with the use of text, audio, images and video in eLearning implementations. But to make the conversation even more interesting, there are other more esoteric media types such as web-based simulations, gaming and immersive environments. And just as there is no shortage of media types to choose from, there is no shortage of opinions on what constitutes the best choice. It is common to run into the opinion that the more sophisticated media types are automatically better at delivering a quality learning experience. I disagree. Each media type has advantages and limitations and the best choice requires careful consideration of your learning goals, the knowledge and skills you are training, how much training you have to do, the nature of your audience (trainees), how big your budget is, and (very importantly) how frequently the training content changes. Typically, you will find that combining media types provides the best results - taking advantage of the strengths of each while minimizing the limitations of any one. So there is much to consider. And we will do so in upcoming editions of *Training Tips for Ships*. For now, I hopefully leave you with a healthy desire to be critical (in a positive sense) of the notion that fancy, expensive media is necessarily superior. There is much more coming on this topic.

Until then, sail safely and keep well.

The Author

Goldberg

Murray Goldberg is CEO of Marine Learning Systems which provides software and services to optimize knowledge, skills and behavior in maritime operators. Murray@MarineLS.com

A Clear Path to Lower Emissions through Autonomous Robotics

It's not a stretch to say that the underwater body of a ship is the most important of all the myriad systems that make up a ship. Yet, it's often near the bottom in terms of routine maintenance and monitoring. The hull receives a visual inspection once or twice a year and a more thorough inspection in dry dock every 5 years (or so). Its allowed to get fouled, reducing its hydrodynamic performance and the methods employed to remove the fouling can shorten the life of the protective coating. This is in stark contrast to how other systems, like the propulsion engines, on board are managed in terms of inspection and maintenance.

Why is this? Simply put, underwater maintenance falls into the nebulous "too hard" bucket. Being underwater, it's out of sight (out of mind?) and unless something catastrophic happens, its condition is "good enough." Inspections need to be completed by divers or robots, both of which are expensive and include varying degrees of complexity, risk and interruption to the ship's routine. The result is these evolutions typically only get completed when dictated by external factors, such as regulatory requirements or (potential) severe performance degradation of the hull. In other words, it is reactive maintenance.

Armach Robotics is setting out to change the paradigm and turn underwater maintenance into a proactive endeavor through the use of small autonomous robots. This will be the first in a series of three articles discussing Armach's approach and vision for proactive hull maintenance, and will provide an overview of the technical approach being taken for the robot, with follow-on articles delving into proactive in-water cleaning (aka grooming) and the concept of hull intelligence.

First a bit of background and introduction. Greensea Systems, creator of OPENSEA, spun Armach Robotics off in the fall of 2021 to be the exclusive provider of its recently developed "hullographic" (meaning hull relative) navigation and autonomy technology for ship maintenance and inspection. Greensea will continue to advance the software as Armach advances the hardware and delivers the capability to the marine industry through Robot-as-a-Service.

Through a Small Business Technology Transfer Program (STTR) with the Office of Naval Research, Greensea Systems set out to develop a means of establishing position and navigating on a ship's hull without the use of external sensors or preloaded drawings of the ship. Over the past 4 years, Greensea leveraged OPENSEA, its open architecture platform for marine robotics, to serve as the backbone of a novel positioning and navigation system.

Recognizing the need for a custom hardware solution, Greensea designed a crawler assembly to integrate with the commercially available Videoray MSS Defender ROV to create a vehicle capable of flying into position alongside a ship, then inverting itself and attaching to the hull to commence on hull activities. The crawler was designed specifically to support on-hull navigation, incorporating precision track encoders for odometry and velocimetry, a fiber optic gyrocompass for heading and orientation, a Doppler Velocity Logger for relative motion tracking, and tracks specifically optimized for use on approved U.S. Navy coating systems. A low pressure vortex generator provides the necessary adhesion to the hull without the use of magnets. Built on OPENSEA, Greensea's EOD Workspace was easily modified to incorporate crawler control, enabling manual piloted operation of the robot on a ship's hull. With the concept proven, Armach Robotics will continue to evolve the hardware design to improve operation.

To establish navigation capability, the robot creates a new coordinate system, transforming the ship's hull into a 2-D plane. With the new coordinate plane established, odometry and heading data can provide basic navigation capability, but ultimately this is simple dead reckoning, and error can easily grow to an unacceptable level. To combat the error growth, the features of the hull can be used as reference points much like water towers, steeples or points of land on a nautical chart. For

this application a forward looking multibeam sonar is used to create a sonar mosaic image of the hull in real time. The robot is then able to identify dozens of uniquely identifiable features that can be referenced and compared against each other as the robot completes multiple passes through the same area. The robot then applies the information learned from these comparisons to eliminate any navigation error and update its position on the ship hull.

The forward looking sonar also enables obstacle detection and avoidance capabilities, critical to autonomous navigation on a surface that will have occasional obstructions and non-navigable regions. Ultimately, machine learning will allow for cataloging of these obstacles and obstructions, improving the detail of the collected data product, but simple feature detection is sufficient to allow for avoidance algorithms to operate.

Upon completion of the evolution, the robot's path can be overlaid onto the complete sonar mosaic of the hull showing the area covered, providing proof of coverage as well as showing any items of interest that were identified and flagged through the course of the evolution.

Armach Robotics is currently using this autonomous capability to simplify proactive in-water cleaning operations by enabling use of multiple robots by one small on-site crew, flipping the current paradigm of a large crew for each cleaning tool in use. Armach will be adding sensors to the robot in the future. As that occurs, significantly more data will be collected by the robot over the course of the evolution, and when combined with the precision positioning, will enable provision of valuable information to vessel operators, managers and maintainers, but that will be the topic of a follow-on article.

The Author

Lander

Following a 25+ year career in the marine industry, including 20 years in the US Coast Guard, Karl Lander joined Armach Robotics as a Senior Program Manager.

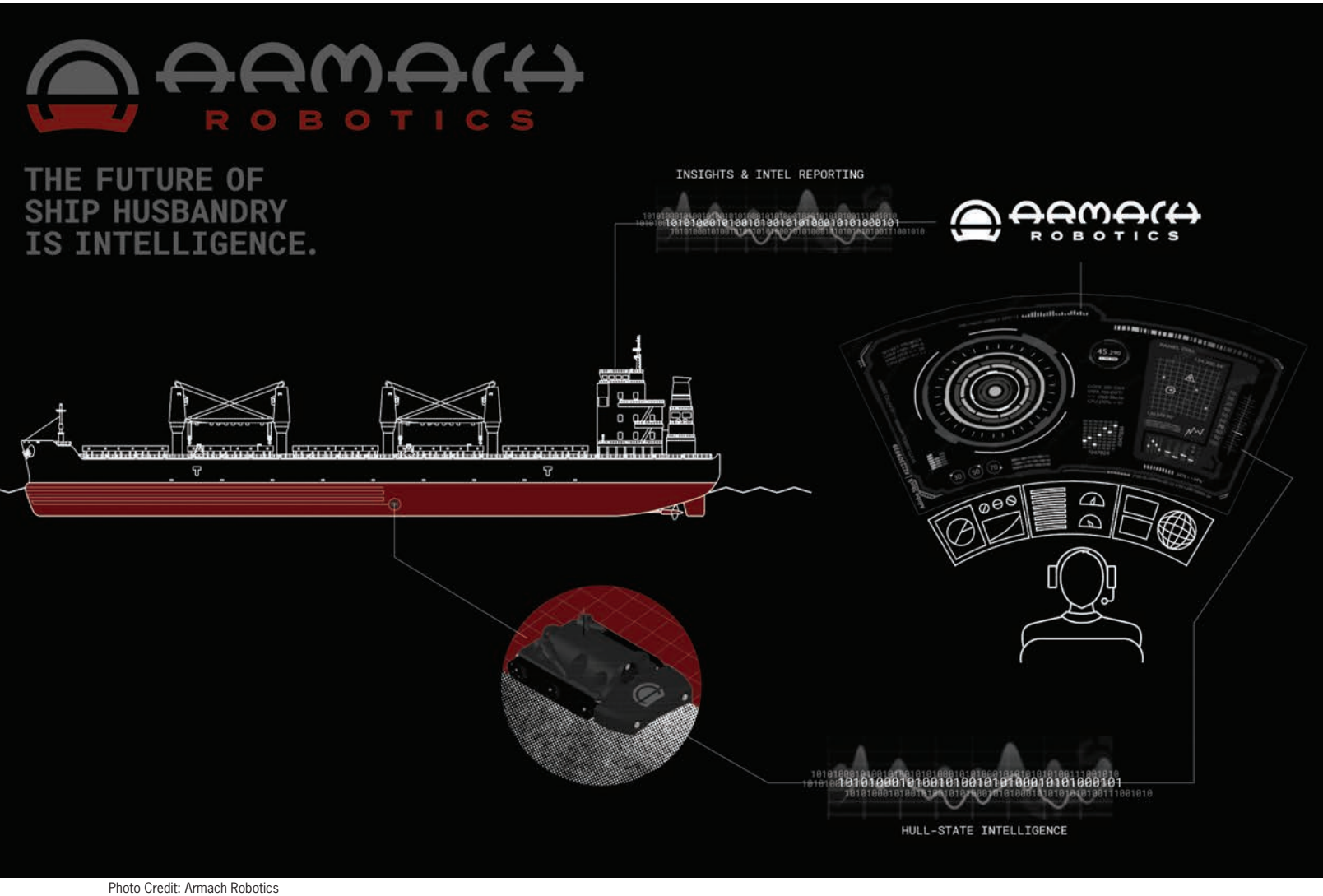
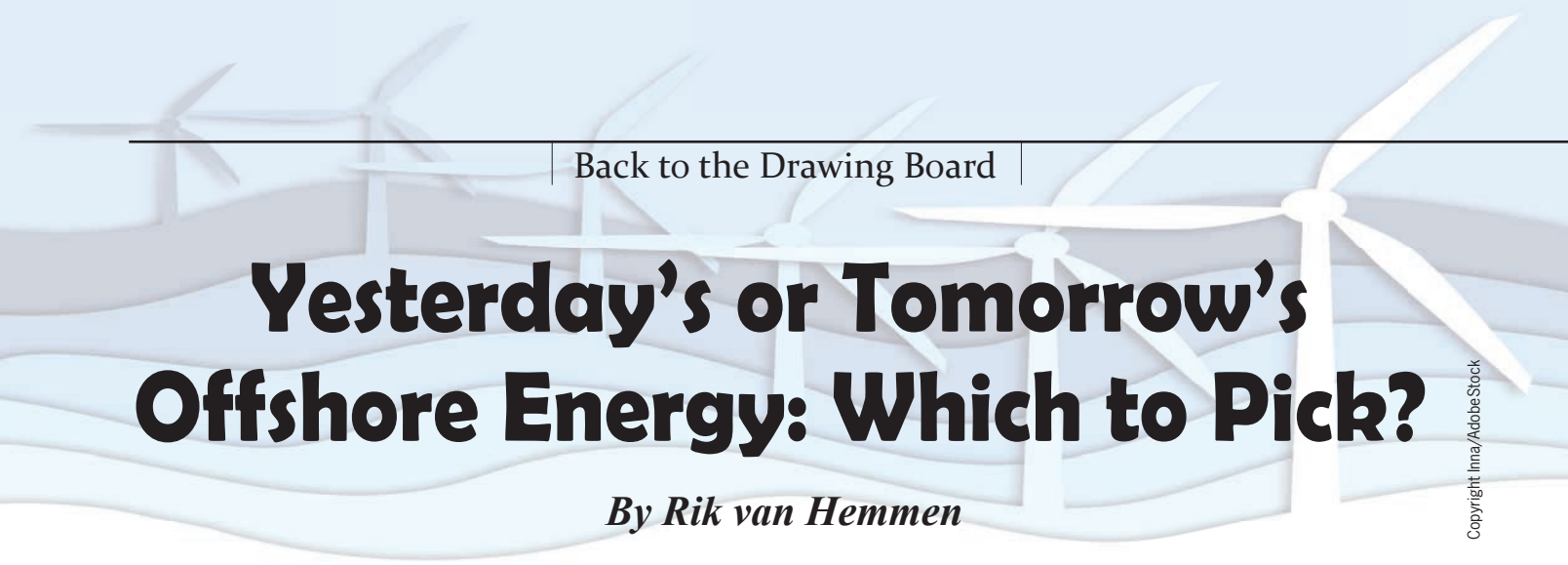


Photo Credit: Armach Robotics

Yesterday's or Tomorrow's Offshore Energy: Which to Pick?



By Rik van Hemmen

Looking back, it is easy to wonder if one could have done better by taking the other fork in the road. I grew up in Holland in a maritime family and am pretty sure I would have stuck with maritime there. In 1968, when I was 8 years old, my father left Holland America Line and joined the United States Salvage Association. At the same time, their main customer, the U.S. marine insurance industry, became heavily involved in the development of North Sea offshore oil and gas, and it resulted in an economic boom that made USSA's Rotterdam office wildly profitable. My father had become the Rotterdam office manager; and, in 1976, somehow U.S. headquarters thought that his transfer would bring the boom to New York. So, my family moved to the United States and, after a one-year U.S. high school career, I went to Virginia Tech and became embroiled in U.S. maritime rather than Dutch maritime.

Would I have done better in Holland? Possibly, but I doubt it. Dumb luck has very much driven my life since arriving on these shores, but offshore energy got me here.

Offshore energy has been a wild ride.

Back in Holland my father would occasionally take me on offshore drill rigs on weekend survey jobs, and I loved it because the roughnecks would always show me the soft ice cream machine and told me to help myself. Man, those rig workers were cool!

In my actual career, I would always hum the James Bond theme (*Dum da dum dum dum Da dum dum Dum da dum dum dum*) when the helicopter started to descend to some offshore rig. I even thought taking a trip on the basket or using the swing rope was super cool. Every time I had a job in Fourchon, I could not help but be blown away by the sheer muscle and technological boldness of it all.

It will all be gone in a few decades.

Fortunately, that does not bother me at all because the future is bright and exciting. The latest James Bond is dead, but I am sure the new Jane Bond will end up in some fight on an offshore wind farm or offshore wave energy converter. Just imagine that blade swinging by within inches of her head until she manages to put the villain in the path of the next blade. And then she will inflate a life raft with champagne and … Sorry, got distracted there.

Let's get real.

Offshore oil will not disappear overnight, but it is reasonable to expect offshore oil exploration and development to decline to a fraction of its present size. Gradually declining oil exploration will result in the loss of specialized equipment, but a very significant part of the technology and its workers will find employment in sustainable offshore energy development.

At the moment, the ability to enter sustainable offshore energy development is still wide open, particularly Wave Energy Conversion (WEC). Initially, WEC is technically more challenging to achieve commercial viability, but recent developments have shown that it can potentially be more cost effective than offshore wind.

It is troubling to note that oil companies with offshore development experience have not been more aggressive in WEC. There have been some attempts that were supported by oil companies, but these efforts were technically and economically misguided and timid from an investment point of view. If offshore oil companies do not join the game soon, they will be left out and will have little opportunity to transition and will have to initiate corporate endgame (liquidation) strategies.

Offshore wind is a given, but at this time it is still quite expensive compared to other sustainable technologies. To some extent the offshore oil industry is at fault for the increased cost and limited rate of progress on offshore wind, especially in the United States. At the genesis of offshore oil in the 1960s, there were very few regulations and very little oversight; but due to environmental mishaps, the level of review, public review, and regulation has increased tremendously. This process transferred to offshore sustainable energy projects and is cumbersome and expensive.

While offshore wind is relatively expensive, the co-location of offshore wind and WEC is an excellent efficiency multiplier, reducing the cost fractions of leasing, permitting, and shore infrastructure costs, and extending the availability window of offshore sustainable energy generation when the wind does not blow.

The single most significant obstacle to offshore wind is public resistance to visual pollution. None of the large offshore wind projects in the United States have fully made it past the public acceptance point. If and when there is public acceptance for the first major project, the entire process will accelerate with

rapidly reducing costs and rapidly increasing capacity.

WEC is not as sensitive to public resistance, since it is virtually invisible from shore. It will inherently reduce wave impact on shores, which is actually a benefit with rising sea levels. This may be resisted by surfers, but there are excellent alternatives.

The SurfWEC concept uses a breaking wave generator. If an offshore wave farm dedicates a small percentage of its breaking wave generators to surfers, it could result in an entire offshore surfing industry with much larger optimal wave condition windows and improved surfing on many coasts without harassment from private or limited access beach interests.

There will be some wildlife impact, particularly with regard to offshore wind. I have not seen any studies that would indicate the effect would be devastating, but offshore oil impacts wildlife too.

There may not be a large amount of resistance from recreational fisherman to sustainable offshore wind. They are familiar with the productivity of artificial marine structures. Commercial fishermen will resist offshore wind and WEC simply because they have not yet developed a personal vision of their future. Sustainable fishery practices are still in their infancy as far as commercial fisheries are concerned and to alter the traditional hunter gatherer mindset to a mindset that more closely resembles a sustainable ranching mentality will take time. However, if I were a betting man, I would bet on the overall benefit of harvest free zones in littoral waters that can function as nurseries to increase overall yields.

In the end, the central question should be "How will offshore sustainable energy benefit us all?" There are many encouraging indications.

1. Much reduced risk of pollution compared to offshore oil
2. Carbon free energy instead of continuously increasing atmospheric carbon levels due to offshore oil
3. Very similar (if not larger) overall employment levels when compared to offshore oil energy production
4. A reduction in boom-and-bust cycles in coastal areas as compared to coastal oil since offshore sustainable energy does not run out
5. More ethically rewarding employment for the best and brightest in engineering
6. No change in maritime "can do" spirit as compared to offshore oil
7. No significant loss of James Bond excitement

Offshore oil was a great ride, but I am picking sustainable offshore energy this time around.

For each column I write, *MREN* has agreed to make a small donation to an organization of my choice. For this column I nominate the Sierra Club **www.sierraclub.org**. It fights for realistic tradeoffs between clean energy and nature preservation.

NFPA Certificated Marine Chemists – A Century of Fire Protection and Life Safety

By Lawrence B. Russell and Guy R. Colonna, P.E.

Courtesy NFPA

As the National Fire Protection Association (NFPA) Technical Committee on Gas Hazards votes on the First Draft of the next edition of NFPA 306, Standard for the Control of Gas Hazards on Vessels, the NFPA Certificated Marine Chemist Program will mark 100 years of fire protection and life safety on marine vessels, in shipyards, marine terminals and waterfront facilities.

What started a century ago as an industry effort to prevent fires on vessels under repair has never been more important. According to a 2007 report of the U.S. Bureau of Labor Statistics, approximately 25 percent of fatalities in shipyards result from fires and explosions caused by hot work (welding, cutting, burning, abrasive blasting, and other heat-producing operations).

Following the First World War, numerous fires and explosions occurred when ships were being converted from troop transport vessels to their original purpose as bulk carriers and cargo vessels. Vessel owners, shipyards and marine insurers all recognized that something had to change. Marine industry representatives including the American Bureau of Shipping (ABS) asked NFPA for assistance in the development of a fire prevention standard specific to the hazards found on marine vessels while being repaired in shipyards. In 1922 the Regulations Governing Marine Fire Hazards, Appendix "A", Having to Do with the Freeing of Tanks of Flammable and Explosive Vapors Previous to Making Repairs, was adopted by the NFPA.

From the beginning the unique feature of the Regulations was the requirement for the tanks that were the subject of hot work to be tested and inspected by a certified competent chemist whose ability and reliability was attested to by the ABS. These chemists were for the most part employed in the laboratories of petroleum refineries. So, they understood the properties and characteristics of the petroleum products that were carried as fuel and cargo on marine vessels.

The ABS certified the "gas chemists", until 1963 when the NFPA agreed to assume full responsibility for marine chemist training and certification. To accomplish this mission the NFPA established the Marine Chemist Qualification Board (MCQB). The Board is comprised of representatives from the marine insurance industry; tank vessel operators; shipbuilding or vessel repair industry; Marine Chemist Association; a practicing Marine Chemist; Occupational Safety and Health Administration (OSHA); U.S. Coast Guard and U.S. Navy.

The MCQB is responsible for establishing the NFPA Rules for the Certification and Recertification of Marine Chemists. The Board acts on applications for certification and recertification of marine chemists and the registration of trainees. It also reviews accident reports that involve marine chemists and when necessary, takes disciplinary action which can include the suspension, cancellation or the revocation of a marine chemist's qualification documents.

Marine chemists have a combination of academic knowledge and professional expertise. The marine chemist is required to quantitatively and qualitatively determine the severity of the hazards that are present in the tanks or compartments where work is to occur and the adjacent spaces. These hazards include oxygen deficiency, flammable gas or toxic vapor associated with cargo or fuel products, or combustible materials that may be present at the time of the inspection.

NFPA 306 is the document that a marine chemist is required to use when he or she performs this job-site hazard analysis (JHA). This standard provides minimum requirements and conditions that are necessary before a space can be entered or before work can be started, continued, or started and continued on any vessel under construction, alteration, or repair, or on any vessel awaiting shipbreaking. The requirements of the current edition of NFPA 306 can be traced back to 1922 and Appendix A of the Regulations Governing Marine Fire Hazards.

Upon completion of the JHA the marine chemist will issue a Marine Chemist's Certificate documenting the results of the survey. Both OSHA and the U.S. Coast Guard require a Marine Chemist's Certificate is posted for hot work in, on or adjacent to tanks, spaces or compartments that contain or previously contained combustible or flammable liquids or flammable gas. Presently there are 93 NFPA Certificated Marine Chemists located in ports throughout the continental U.S., Hawaii, Alaska and Guam. Together these marine chemists write about 31,000 Marine Chemist's Certificates each year.

It's fitting that NFPA 306 has entered the revision cycle for the 2024 edition just as the marine chemist program enters its second century. The first draft of the next edition of NFPA 306 will be available on the NFPA website for public review and comment on March 22, 2022.

What began as an experiment in 1922 continues today and serves as a testament to a successful industry-and-government partnership. For 100 years the NFPA Certificated Marine Chemist has been the professional who the marine transportation industry and shipyard industry has relied upon for confined space safety and fire prevention on marine vessels, in marine terminals and in shipyards. As the NFPA Certificated Marine Chemist program enters a new century of service to its stakeholders, marine chemists will continue to apply NFPA 306 to assure the safety of workers and to protect shipyards, marine terminals, and waterfront facilities from fire.

If you would like more information about the NFPA Certificated Marine Chemist Program or NFPA 306, Standard for the Control of Gas Hazards on Vessels, please go to the NFPA website: ***www.nfpa.org***

WHAT TO EXPECT FROM THE U.S. OFFSHORE WIND MARKET THIS YEAR

After many false starts, **the U.S. offshore wind market is building strong roots** *for a solid future. But as the market develops from its current northeast and mid-Atlantic niche new opportunities and challenges arise.*

By Philip Lewis, Intelatus Global Partners

The U.S. offshore wind market has long been seen as not delivering on its significant potential. With an offshore wind technical potential of more than double that of the country's total annual electricity sales, the U.S. has long been seen as having the potential to be a major player in the global offshore wind market. However, until recently, the promise was not translating into reality.

But the last 12 months have changed this view, and there is reason to be much more optimistic.

Two major OCS projects with around 940 MW of capacity have reached FID and have commenced onshore construction, more than 15 GW of projects are undergoing federal permitting review, 17.5 GW of project capacity has secured offtake commitments from states, auctions containing 12-to-16 GW of potential will be concluded before the end of this year, longer term leasing plans for the Gulf of Mexico, the Central Atlantic, Oregon and the Gulf of Maine are being developed for auctions before the end of 2024, turbine component, foundation, and cable factories and Jones Act wind farm vessels are being built in the U.S. and offshore wind port development is accelerating.

In this article we discuss some of the key themes, opportunities and challenges for U.S. wind going forward. These themes are addressed in detail in our monthly U.S. offshore wind report and online project database.

$167B Spend to Deliver 51+ GW

There is a range of views on how much offshore wind will be deployed in the coming decades, from as low as 23 GW by 2050 to 110 GW by 2050.

The bullish view – The White House is targeting the deployment of 30 GW of offshore wind by 2030. Further, the administration plans to "unlock a pathway" to reach around 110 GW of capacity by 2050 or around 9% of total U.S. electricity generation in 2050.

A year ago, there were doubts raised on this target. But much has changed in a year to create the conditions to advance offshore wind in the U.S.:

- Two major projects with around 940 MW of capacity have reached FID and have commenced onshore construction.
- To date, federal leases with a potential to support an estimated 40 GW of offshore wind have been awarded. Federal agencies plan additional leases supporting at least 6 GW to be awarded this year and further lease sales encompassing multi-gigawatt potential are planned in the Gulf of Mexico, the Central Atlantic, the Pacific and the Gulf of Maine by 2024.
- 10 large developments with a potential for more than 15 GW are undergoing federal permitting review. Further, the government has committed to completing the permitting review of at least six more projects by 2025, amounting to at least 4 GW of capacity.

- 17.5 GW of project capacity has secured offtake commitments from states, and more than 18 GW of future requirements have been identified.
- Developers have recently been selected for at least 11 GW of new Mid-Atlantic offshore lease capacity.

A conservative view – The U.S. EIA forecast assumes 10 GW of offshore wind connected to the grid by 2030 and 23 GW by 2035. Thereafter, the EIA forecasts no growth of the offshore wind base. Based on the EIA figures, offshore wind will account for around 2% of electricity generation in the U.S. in 2050.

Based on current developments, this appears to be somewhat conservative.

Our view – We forecast 27 GW of capacity to be grid connected by 2030 and around 50 GW by 2035. Longer-term we anticipate that 110 GW of installed capacity by 2050 is achievable. Our forecast is based on developer plans, BOEM leasing and permitting activity and state committed and planned offtakes, details of which can be found in our latest U.S. offshore wind monthly report.

Forecast of CAPEX, Annual OPEX and DECEX by FID Timing

Forecast ($ billion)	GW	CAPEX	OPEX/yr	DECEX
FID made	0.9	3.5	0.1	0.4
0-18 months	1.82	14.4	0.2	0.8
18-36 months	15.7	56.5	1.6	7.1
36-60 months	11.1	34.0	1.1	5.0
Over 60 months	21.8	58.8	2.2	9.8
Total	51.3	167.3	5.2	23.1

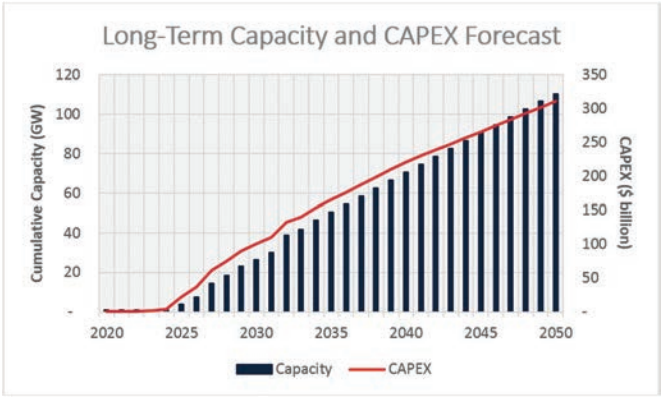
Source: Intelatus Global Partners

Our forecast of capital expenditure, annual operations and maintenance expenditure and end of life decommissioning costs by timing of final investment decision through the middle of the next decade is shown on the table above.

We forecast that final investment decisions for close to 30 GW of offshore wind capacity will be made within the next five years.

Our current forecast for longer term FIDs amounts to close to 22 GW of projects – but this number is growing on an almost monthly basis as new capacity potential is opened up

Forecast of Offshore Wind Capacity Development



Source: Intelatus Global Partners

for development. In the long-term we anticipate a further 60 GW of potential to be developed taking the capital investment required by 2050 beyond $300 billion.

Confidence Grows

2022 has already shown market confidence in the U.S. wind segment, and we anticipate the trend to continue witnessed by three factors:

FIDs made for close to 1 GW of offshore wind potential – After many false starts for commercial wind farms, the first two commercial scale offshore wind projects have been permitted, reached financial close and have broken ground. We do not anticipate further FIDs in 2022 due to the project permitting process, but the foundations are in place for multiple FIDs next year and after.

Lease price inflation – Developers committed to pay a record $4.4 billion for six leases in February's New York Bight auction. The price effectively signifies an option payment to secure the rights to assess and then develop a wind farm on the lease. The prices paid per MW of potential capacity were roughly six times more than the average paid for three Atlantic leases in 2019, the last federal offshore wind lease sale. One developer's bid was nine time more than it paid for a lease in 2019.

Developers are committing to significant supply chain infrastructure investment and are making good on these commitments – 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 and support multiple key component factories are now being built and will provide ongoing opportunities to the domestic supply chain. Investment plans in construction and O&M ports is also translating to ground being broken and projects advancing.

Activity to Peak from 2023 to 2026

Achieving the goals of 27 GW by 2030 and 110 GW by 2050 will make the U.S. a significant global offshore wind market. However, developers of projects in the U.S. will need to account for a significant upswing in global offshore wind capacity and supply chain competition in the same period.

U.S. project activity will see an initial peak from 2023 to 2026. This will coincide with a spike in bottom-fixed project activity in Europe and East Asia – and an increase competition for limited supply chain resources.

- To date, over 28 GW of offshore wind has been installed in the U.K. and Europe since the first commercial turbines were commissioned in the early 1990s. The U.K. aims to achieve 40 GW by 2030, and the European Union targets at least 60 GW by 2030 and 300 GW by 2050.
- China, the current world's largest offshore wind market, commissioned over 10 GW alone in 2021. Provincial plans indicate a further 75 GW of capacity will be added by 2025.
- Elsewhere in Asia, Japan, South Korea and Taiwan aim to deploy over 33 GW of capacity by 2030.
- Outside of Europe and Asia, we anticipate new market entrants in Australia and South America.

Whereas global supply and demand of offshore construction vessels is currently in balance or in some cases over-supplied, we anticipate tight to under supply of wind turbine and foundation vessels, heavy lift vessels and cable layers from around the middle of the decade. Without new vessels, we anticipate some impact to project costs and/or schedules.

Details of our analysis of U.S. wind farm construction schedules can be found in our monthly U.S. offshore wind report.

Jones Act Vessels: Investment Needed

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 is under construction. Without additional domestic supply, developers will need to secure installation vessels from the international market –- as one developer has already done for its project. However, although international supply of wind turbine installation vessels is growing, the growth the of suitable large vessels remains relatively slow and 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.

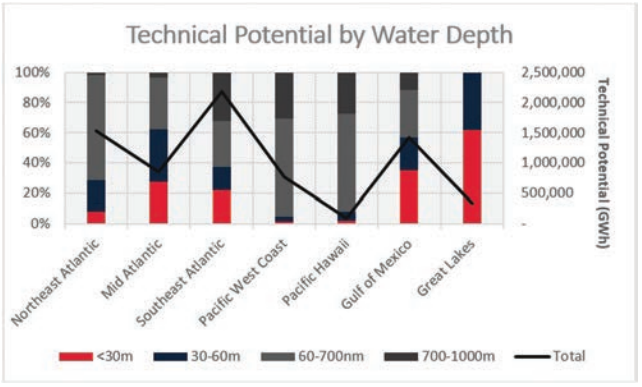
The only other Jones Act compliant construction vessel committed to date is a wind farm scour protection/rock installation vessel. One would expect there to be a significant amount of construction of service operations vessels (SOVs) and crew transfer vessels (CTVs). Both are used in the long-term operations 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 are already operating, and five CTV construction contracts have been announced recently. Despite the building activity, the domestic supply and SOVs and CTVs is significantly below our forecast for demand.

Floating wind

Close to 60% of the technical potential for the U.S. is in waters best developed with floating wind technology.

Federal agencies are advancing offshore leasing in California, Oregon, the Gulf of Maine and several other locations that will feature floating offshore wind solutions. The first leases are expected to be auctioned this year.

However, few realize that five floating wind projects are already currently being progressed in the Atlantic and Pacific – three in state waters and two in federal waters. These projects



Source: Intelatus Global Partners, NREL

will demonstrate the opportunities and challenges for the supply chain – which require a different supply chain approach to the bottom-fixed projects of the current Northeast and Mid-Atlantic pipeline. The key differences are summarized in the table above. 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 is limited, presenting a risk to developers and an opportunity for vessel owners and shipyards.

Offshore Transmission Solutions

Till now, U.S. offshore wind projects have deployed the same single line or radial connection solution that is common in much of the world's offshore wind capacity. In this concept, a developer is responsible for building the connection between the offshore wind farm and the onshore grid interconnection point. However, various state and federal agencies are studying a range of options to deal with accommodating a large number of offshore wind farm grid interconnections in the coming years. One approach being studied is similar to that employed in several North Sea markets – offshore integrated transmission networks, where an independent transmission system operator collects power generated by individual windfarms offshore and injects the capacity to the onshore grid through a network of high-capacity offshore transmission cables. We anticipate some decisions on new approaches to be firmed up within the year.

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

GEOTECHNICAL, MARINE AND COASTAL DESIGN SOLUTIONS

FOR MARSHALING PORTS TO MEET U.S. OFFSHORE WIND POWER POLICY TARGETS FOR 2030 & 2050

*By **Wayne Cobleigh, CPSM**, Vice President – Client Services, GZA Geoenvironmental, Inc., and **David R. Carchedi, Ph.D., P.E.**, Senior Principal, GZA GeoEnvironmental, Inc*

As reported in a ***Maritime Reporter and Engineering News*** February 2022 article, "Offshore Wind Development Gains Speed in the United States", the offshore wind (OSW) market is beginning to heat up. The White House policy target of 30 GW of offshore wind power by 2030, increasing the Bureau of Ocean Energy Management's (BOEM's) leasing awards, and permitting target approval dates, together with more state energy procurement awards, are creating demand for more port infrastructure, Jones Act compliant vessels, and manufacturing facilities for wind farm components. Recently a study (Parkison, Sara B. and Willett Kempton, "Marshalling Ports Required to Meet US Offshore Wind Power Policy Targets" Energy Policy, Volume 163, April 2022), concluded that supply (and storage area) of U.S. marshalling port infrastructure for offshore wind projects is insufficient to meet the immediate demand by 2023 and far short of that needed for projected policy targets through 2050.

The challenge ahead for the U.S. market is to develop enough marshalling area for long-term, large-scale, and economically efficient use by the OSW industry. The demand for investing in redeveloping port infrastructure that can enable the logistics of lifting and moving heavy offshore wind power components by specialty vessels is at an all-time high. Federal, state and private funding is becoming available for redeveloping our ports.

GZA has been working on engineering design teams providing geotechnical, marine and coastal engineering services for port owners, contractors and OSW developers on several offshore wind ports on the east coast. The geotechnical, marine and coastal engineering solutions that are available to improve the load capacity of ports and waterfront properties for the OSW industry are discussed.

OFFSHORE WIND PORT DEVELOPMENT

Offshore wind port facilities consist of two areas of concern: a waterfront ship servicing berth with heavy loadout capacity; and an upland area for transport, storage, marshalling and/or manufacturing of OSW components. The waterfront berth must provide a deep enough dredge elevation to accommodate the transport vessels close to the loadout equipment. Such equipment may include roll-on/roll-off ramps or high-capacity fixed position or mobile cranes. The transport vessels may also require a prepared bottom or submarine structure to allow spud jacking for hydrodynamic stability. The upland areas must support movement storage, and assembly of the OSW components prior to loadout and transport to the offshore wind farm.

The first OSW terminal in the United States, the New Bedford (Massachusetts) Marine Commerce Terminal, was a completely new, purpose-built facility. It included a cellular bulkhead, a deep dredged berth, a waterside relieving platform for crane support and an extensive gravel surfaced upland area. It is not likely that there will be many more newly built port facilities. More commonly, the future OSW terminals will be rehabilitated

Images Courtesy of Connecticut Port Authority. Rendering Artist: Jennifer Gottlieb, AIA NCARB ENV SP at AECOM

under-used or functionally obsolete existing port facilities.

Because of the anticipated high demand and short time frame, numerous existing waterfront facilities are under consideration, in design or currently under construction (Port of Providence, South Quay-East Providence and Quonset Point, R.I.; New London and Bridgeport, Conn.; Salem and Brayton Point, Mass.; and Paulsboro, N.J.). Reuse and repurposing of existing properties can present challenges.

As stated above, the OSW industry has certain requirements that many aging ports currently do not meet. Limited dredge depth, deteriorated bulkheads and quay walls and limited surface load capacities of pier and wharf structures and adjacent upland areas need to be addressed. Because the large-scale development needs of the OSW industry is for a limited time frame (10 to 20 years) within a particular local, short to medium term fixes may be in order. A new relieving platform may be able to span over an old bulkhead, seawall or rip-rap slope to reach deeper water. Relatively inexpensive isolated mooring dolphins might accomplish the same goal. An isolated pile supported crane platform may allow loading and off-loading without requiring heavy surface capacity adjacent to existing waterfront structures. Every existing marine facility has a combination of structural, geotechnical and coastal issues that need to be holistically assessed.

Upland areas also have concerns with storage capacity, topography, elevation and most importantly subsurface conditions. Limited storage space may be able to be increased by procuring additional adjacent parcels. Adjusting surface elevation and topography is easy to accomplish if the subsurface soil conditions are adequate. Poor subsurface soil conditions can often be improved, at reasonable costs, using standard earthwork or the right ground improvement techniques. Designing for actual component and vehicle ground load pressures rather than unrealistically high "developer requested" uniform ground pressures can result in substantial cost savings to a project.

Every existing port facility has its own set of positive and negative conditions. As the song goes: *"You got to accentuate the positive, eliminate the negative, latch on to the affirmative, and don't (ever, ever, ever) mess with Mr. In-between."*

Images Courtesy of Connecticut Port Authority. Rendering Artist: Jennifer Gottlieb, AIA NCARB ENV SP at AECOM

Taking Autonomous Strides

Earlier this year, a unique pairing to advance autonomous and remote-control functions into commercial maritime vessels was announced. The project brings together ABS, Hyundai Heavy Industries' Korea Shipbuilding and Offshore Engineering (KSOE) and its autonomous navigation subsidiary, Avikus. *Maritime Reporter & Engineering News* was afforded the unique opportunity to interview all sides for insights on the substance, pace and direction of the project.

By Greg Trauthwein

While the reality of fully autonomous oceangoing ships freely sailing the world is a generation of more away, the groundwork is being laid today with increased levels of automation and autonomy on commercial vessels, large and small.

"A recent study released by a Japanese shipping company found that more than four out of 10 of its seaworkers were 60 or older," said Sungjoon Kim, Sr. Executive Vice President, Korea Shipbuilding & Offshore Engineering (KSOE). "As we see fewer people drawn to seafaring jobs, we anticipate that autonomous vessels will help solve the issue of a severe lack of seafarers in the future."

"Separately, we see autonomous vehicles to be the solution to decreasing maritime accidents as eight or nine out of 10 are caused by human error and other crew related factors, such as the obstruction of the Suez Canal last year," said Dohyeong Lim, CEO, Avikus

ABS will work with Hyundai Heavy Industries' (HHI) KSOE and Avikus to integrate autonomous and remote-control functions into vessels, premised on the signing of a Strategic Framework Agreement at the Consumer Electronics Show in Las Vegas earlier this year. The agreement is intended to lead to a series of Joint Development Projects (JDP).

"ABS is putting the full technical capabilities of the organization behind these projects," said Patrick Ryan, SVP, Global Engineering and Technology, ABS. "Our 2021 Guide for Autonomous and Remote Control Functions, will be the technical foundation upon which the work will be performed." Ryan said there may be up to five companies participating in these projects, as discussions are underway for multiple projects with up to four vessel tests: LNG carrier, a RoRo vessel, a whale watching vessel and one more to be determined.

From its side, HHI Group has more than 500 researchers and 3,000 engineers in the field of maritime and shipbuilding, according to Sungjoon Kim, KSOE.

"Leveraging this resource, HHI has roughly 200 specialists dedicated to develop and commercialize our autonomous vessels. Furthermore, we are willing to comprehensively collaborate with academia and research institutes, especially in the field of AI and digital technology."

"Looking further out, we anticipate that a commercial launch of an autonomous vessel that can resolve all the aforementioned concerns and problems to a satisfactory level while being designated to MASS Level 3 and 4, will most likely happen post 2030."

Sungjoon Kim, Sr. Executive Vice President, Korea Shipbuilding & Offshore Engineering (KSOE)

Image Courtesy KSOE

Opportunities and Challenges

While the advent of automation and autonomous operations comes with plentiful opportunities to create new levels of efficiencies and safety for the maritime sector, there are an even longer list of challenges ahead, as the partners agree.

From the KSOE and Avikus side, there are three main concerns:

- **Reliability of the solutions:** All solutions for autonomous vessels need to enhance reliability and need to draw up sufficient countermeasures within the limited time frame to deal with inevitable system failures. HHI Group plans to verify the reliability to make sure that our solutions are robust enough to have no fatal consequences. This verification process is going to be done not through in-house tests, but through the partnership with ABS, which is a main goal of this collaboration.
- **Cyber security:** It is imperative to preemptively avert any detrimental issues that may arise through malware and other cyber-attacks. HHI Group is aware of how crucial cyber security is to autonomous vessels and is the first shipbuilder who has received approvals on vessels' cyber security from the world's major five classification organizations. The group said it will continue to attain the highest level of authentication and standards on cyber security from all classification organizations.
- **Machinery automation:** The large commercial autonomous vessels that HHI Group is developing not only have automated navigation systems, but also have automated intelligent machinery systems. Since a commercial vessel, especially in the form of an autonomous vessel, is made up of numerous complex systems while also having fewer crew members on board, it is important to monitor machinery, cargo and other related equipment for the purpose of predicting optimal timing in advance for appropriate maintenance. HHI Group is pioneering a condition-based maintenance system that is based on Big Data and AI technology, which is a major distinctive point on HHI Group's autonomous vessels.

Ryan's first experience with autonomy came via autonomous underwater vehicles about 20 years ago, and the technology has advanced exponentially since then. "When I walked into the Hyundai booth at CES2022 and saw the AVIKUS simulator, I knew we had come a long way. I had the opportunity to test drive the AVIKUS simulator, and the sensor fusion capabilities they showed are absolutely amazing."

From the side of class, Ryan categorizes what he sees as the top three technical challenges, which all revolve around safety:

- **Vessel interactions:** The ability of conventional vessels to interact or understand the intentions of an autonomous vessel and vice versa;
- **System reliability:** Network connectivity resiliency between vessel and shore control/monitoring station, as well as onboard systems, as examples; and
- **Infrastructure:** readiness of ports to accommodate autonomous operations

While the technology matures, many non-technical hurdles need to be crossed, from governmental and international regulation, to legal, financial and insurance.

"We see autonomous vehicles to be the solution to decreasing maritime accidents as eight or nine out of 10 are caused by human error and other crew related factors, such as the obstruction of the Suez Canal last year."

Dohyeong Lim, CEO, Avikus, a start-up company spun off from HHI Group in 2020 specialized in developing autonomous navigation solutions.

Image Courtesy AVIKUS

Taking the 'Next Step'

While the ink has just dried on the agreement, all partners are busy plotting the path ahead.

"We will be starting work on the first project this month. It is very exciting – it will be a sea trial of autonomous navigation and collision detection and avoidance (CDCA) technology on an actual voyage of an LNG carrier across the Pacific that will take place in late Q1 or early Q2," said Ryan. "The second will be the incorporation of autonomous technology including navigation, CDCA and engine room functions on a vessel currently being constructed and that will happen later in the year."

"The agreement with ABS at CES 2022 is important not just for HHI Group to develop and demonstrate a suite of world-class technologies, but also for ABS to lead the way for setting the grounds and international standards on future autonomous vessels," said Sungjoon Kim. "HHI Group and Avikus plan to showcase the highest level of autonomous navigation technology based on HiNAS (Hyundai Intelligent Navigation Assistant System) on a commercial LNG carrier this spring."

"We also plan to hold a demonstration for the autonomous functions, as categorized by ABS, for the 2,300 GT whale-watching vessel," said Dohyeong Lim, CEO, Avikus. "Various solutions related to navigations solutions, machinery diagnostics, safety management and remote control will be exhibited during the demonstration in the second half of this year."

While the focus is squarely on the technology, there remain myriad missing pieces to putting together the full autonomy puzzle. "ABS does not believe the timeline is going to be driven by technology pace – that has proven to be rapid enough and accelerating," said Ryan. "The timeline is going to be driven by the industry's, and society's, ability to answer tough questions. Tough regulatory, legal, and safety questions.

"In order to answer those questions, we need experience and knowledge on real commercial vessels. That is why this framework agreement between KSOE, HHI, Avikus and ABS is so important."

"Recently, some autonomous solutions that satisfy Maritime Autonomous Surface Ships (MASS) Level 1 defined by IMO have already started to make an appearance in the market," said Dohyeong Lim, CEO, Avikus. "One of HHI Group's solution, HiNAS, presented by Avikus during last month's CES, meets MASS Level 1 fully and 2 partially. It has been applied to small vessels such as leisure boats and is also installed in HHI Group's all standard-type ships starting this year."

"HHI Group is preparing the commercial launch of MASS Level 2 autonomous navigation vessels and relevant solutions by 2024," said Sungjoon Kim, KSOE. "Looking further out, we anticipate that a commercial launch of an autonomous vessel that can resolve all the aforementioned concerns and problems to a satisfactory level while being designated to MASS Level 3 and 4, will most likely happen post 2030."

"When I walked into the Hyundai booth at CES2022 and saw the AVIKUS simulator, I knew we had come a long way. I had the opportunity to test drive the AVIKUS simulator, and the sensor fusion capabilities they showed are absolutely amazing."

Patrick Ryan, SVP, Global Engineering and Technology, ABS

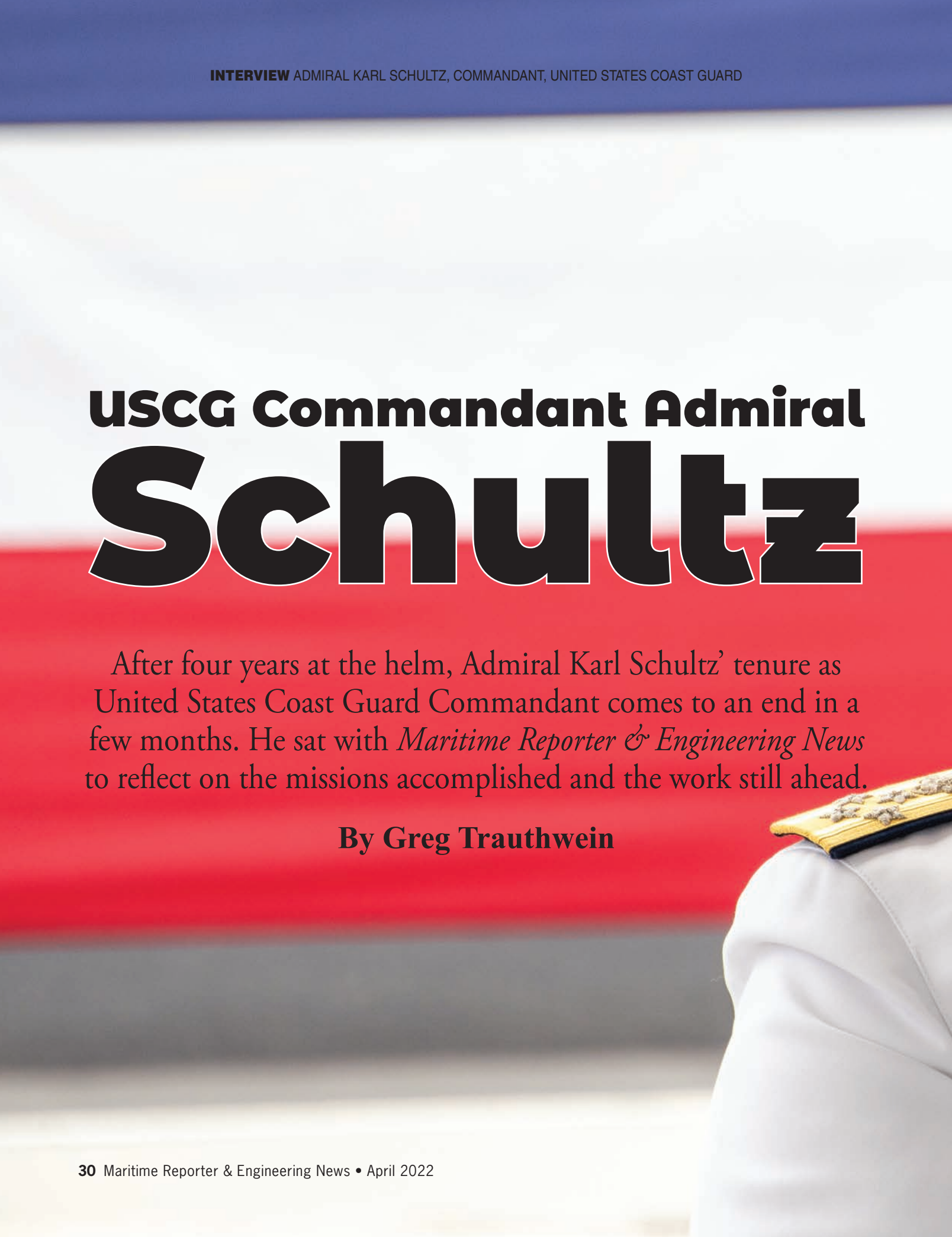
Image Courtesy ABS

Image Courtesy KSOE

USCG Commandant Admiral Schultz

After four years at the helm, Admiral Karl Schultz' tenure as United States Coast Guard Commandant comes to an end in a few months. He sat with *Maritime Reporter & Engineering News* to reflect on the missions accomplished and the work still ahead.

By Greg Trauthwein



(U.S. Coast Guard photo by Petty Officer 1st Class Travis Magee/Released)

Today's U.S. Coast Guard is tasked to perform multiple missions domestic and abroad, working as a law enforcement agency, an armed force and a named member of national intelligence, among many others. While much of the attention is focused on the technology … the air, land and sea assets … that enable the Coast Guard to carry out its missions, since the first day – and in fact even before – Admiral Karl Schultz took the top seat as Commandant at the United States Coast Guard, his focus and that of his command has been squarely on people, the entirety of the people of the Coast Guard from the top command through the new reservist, the people that are essential to execute the USCG's multiple missions.

That message rang clear at Admiral Schultz' fourth and final *"State of the Coast Guard"* speech in 2022, with the manta "United in Service" serving as an ode to ensuring today's Coast Guard is adequately funded and staffed to carry out its multiple missions.

"United in Service is really about stitching together the people, the Coast Guard missions, our roles and authorities, reminding folks that we connect a lot of things," said Admiral Schultz. "We're finding an increasing demand signal from the National Security Council," with growing national security concerns with China, and more recently with "Russia pressing into Ukraine."

"United in Service is really about the demand signal for the Coast Guard, reminding folks that we bring agility, we bring the ability to be adaptable and roll in packages," said Admiral Schultz. It stems from a four-year theme about people, ensuring that it the Coast Guard is well-funded, and "tooled up to do all the things the nation's asking for its Coast Guard right now" In fact, when asked what his number one piece of advice will be to the next Commandant, 'people' again was the answer.

Talent management is imperative to build and maintain a strong Coast Guard) and is the focus of Workforce 2030, said Admiral Schultz. "That's a little bit of an aspirational concept document about thinking through recruiting, retaining, training the workforce of the future. My successor and their team are going to have to build out the implementation of the plan. The biggest bogey facing us is talent management. We've got to get the bright young men and women in sufficient numbers, and we've got to treat them well."

One Challenge at a Time

Through his four years tenure of command, Admiral Schultz has faced arguably the most challenging time in the last half century, with increasing frequency and severity of natural disasters, led by historically busy hurricane activity in the Atlantic basin; ever active drug smuggling opertions bringing illegal drugs to U.S. shores; fast-evolving and aggressive threats to U.S. security and interests, including but not limited to cyber threats; and, of course, COVID-19.

"I think it has been a uniquely, persistently challenging period from external factors," said Admiral Schultz. "We had a plan, and I think the biggest challenge has been a lot of things trying to take us off the plan. I didn't think I'd stand in front of some portion of 60,000 people explaining they weren't going to be paid, but they still need to stand the watch. We had the extended period, and it's still ongoing, about what kind of America we want to be on social justice issues. That affects the men and women in the services ranks. The two-year global pandemic. And here we are today with post-Second World War rules-based order being threatened with an egregiously acting Russia. Through it all, we've always tried to go back to the plan."

"Ready, Relevant and Responsive" was the catch-phrase when Admiral Schultz took command in 2018, a means to focus attention on the broad scope of the Coast Guard mission and the need to fund it accordingly, because when he took over in 2018 this was immediately following the Budget Control Act of 2011 and sequestration in 2013. "We had lost about

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(U.S. Coast Guard photo by Petty Officer 1st Class Adam Stanton)

10% purchasing power over an eight-year period," a budget dent which left many fences to mend. During his tenure, between 2018 and 2022, "we've actually grown our ONS budget, it looks like 23% with this recent budget here. So that is a key enabler to being a more ready Coast Guard."

"I think this 23% of ONS uptick over the last few budget cycles really starts to signal that the readiness scenario has been heard," but that's sort of the down payment, said Admiral Schultz. "My narrative has been 3 to 5% predictable ONS budget growth going forward so we can be that Coast Guard the nation needs. We have a lot of backlog (spending on) infrastructure, and the good news is we're starting to bite into that."

One area of particular concern has been the technology backbone and IT infrastructure by which the Coast Guard operate. "We kicked off the tech revolution during my tenure, right around 2019 we started to talk about our aging backbone for all our C5IR computer systems, all of our enabling functionalities. Congress is now asking us, 'What's that next chunk of funds you need for the tech revolution?' So we've turned that conversation around, and we now have a plan to recapitalize our technical information on a battle rhythm like they do outside the military service," said Admiral Schulz. "So we were just piecing things together, gum and baling wire. And now we're treating tech like an acquisition program. We got about $120 million of CARES Act funding that enabled us to get a lot more mobility. We got some new computers, the ability to work virtually."

Ultimately, the 'tech piece' is multi-faceted: it's about attracting and retaining young, capable professionals that see the Coast Guard as a viable career; it's about increasing efficiencies across the organization, including helping to speed the process of ship inspection; and perhaps most importantly, it's a point of national security and helping to protect the portion of the economy that is directly connected to the waterways, ports and harbors, a sector increasingly threatened by cyber hacks. "We are the sector risk management agency for the maritime industry," said Admiral Schultz. "95% of the goods we consume in this country enter through the maritime ports and waterways. "That's a big deal. Plus we're a dot mil organization so we ride on the DoD information network. We have to be compliant, and you have to make investments to stay compliant." So that's tens of thousands of vessels coming in, through 360 ports, via 25,000 miles of waterways. "We've got to make sure the Marine Transportation System and its $5.4 trillion of annual activity is efficient and safe."

Turning the Page

While Admiral Shultz draws closer to the end of his tenure, legacy is not on his mind. "I'm not a guy that thinks about legacy, but I hope that the people in the Coast Guard would feel like they were priority number one. Overall, I would say we are an increasingly more ready Coast Guard because of the past four years' efforts. We came in with a readiness conversation to be the Coast Guard that can roll into whatever the threat, whether it's disasters, whether it be the agile roll up to help our allies. We have been agile, we have been adaptive, and I think we've been increasingly relevant. [No matter what was thrown at us], I think we stood the watch, and I'm most proud of our resilience and our increased readiness to be the Coast Guard the nation needs."

Personally, Admiral Schultz is looking forward to spending more time focused on his family. "What's next for me is we're going to sprint through June 1, and then I told my family I'll take four to six months to step back. I've got five kids, there is work in my future."

"I like to work, but I don't know if there's work that ever will feel as a part of me as being in the Coast Guard, but I hope to find something that's value-oriented. The Schultz's are pretty modest folks, so it's not about making a lot of money, it's about making a difference; but probably not on this level of demand and commitment that every day."


Small Unmanned Aircraft System for National Security Cutter
Medium Range Surveillance HC-27J Spartan
Long Range Surveillance HC-130J Super Hercules
Medium Range Recovery MH-60T Jayhawk
Short Range Recover MH-65D/E Dolphin
Medium Range Surveillance HC-144A/B Ocean Sentry
Ongoing Acquisitions
Recently Completed Acquisitions
Legacy Craft
Ongoing Upgrades or Major Maintenance
Completed Upgrades or Major Maintenance
Major C5ISR System Upgrades/Additi
UNITED STATES COAST GUARD
READY, RELEVANT, RESPONSIVE
Training Barque 295-Ft Eagle
WATERWAYS COMMERCE CUTTER
The Coast Guard's inland cutter fleet protects vital infrastructure and enables the free flow of commerce along the nation's marine highways, protecting American jobs and contributing to America's economic and energy security. The Coast Guard will recapitalize the capabilities of the service's current fleet of inland tenders and barges commissioned between 1944 and 1990 with three classes of Waterways Commerce Cutters. The WCC program plans to reach initial operational capability by fiscal year 2025 and full operational capability by fiscal year 2030.
Seagoing Buoy Tend 225-Ft Juniper Class
Coastal Buoy Tender 175-Ft Keeper Class
Medium Endurance Cutter 270-Ft Famous Class
Response Boat 45-Ft Response Boat-Medium
Response Boat 29-Ft Response Boat-S
Cutter Boat 22-Ft Cutter Boat Large
Offshore Patrol Cutter 360-Ft Heritage Class Artist rendering of the lead OPC
Cutter Boat 26-Ft Over the Horizon IV Acquisition of next generation planned
Fast Response Cutter 154-Ft Sentinel Class Patrol Boat
National Security Cutter 418-Ft Legend Class
Cutter Boat 35-Ft Long Range Interceptor II Acquisition of next generation planned
Boat 47-Ft Motor Lifeboat
Icebreaker 399-Ft Polar Class
Icebreaking Tug 140-Ft Bay Class
Icebreaker 420-Ft Healy
Icebreaker 460-Ft Polar Security Cutter Artist rendering of the lead PSC
For more details about Coast Guard assets scan here, or use the web address below.
https://www.dcms.uscg.mil/Acquis
ACQUISITION DIRECTORATE
MISSION EXECUTION BEGINS HERE.
SUMMER 2021

Inside the "Largest Coast Guard Shipbuilding Effort Since WWII"

At his fourth, and last "State of the Coast Guard" speech held earlier this year at USCG Air Station Clearwater, Admiral Karl Schultz gave a rundown of the physical maritime assets being built to power the United States Coast Guard for the genertation to come.

The U.S. Coast Guard is engaged in its largest shipbuilding effort since the World War II, building a fleet that will serve the U.S. for decades to come. Milestones include the 10th National Security Cutter, to be named for the first Master Chief Petty Officer of the Coast Guard - Charles Calhoun, to be christened in June.

While there have been delays, currently there is detail design work underway in preparation for construction of the first Polar Security Cutter, to be named Polar Sentinel.

The Coast Guard's first Offshore Patrol Cutter, Argus, is more than 60% complete, while OPC hull number two, Chase, is well on its way. These first units are being built at Eastern Shipbuilding, and in the coming month(s) the Coast Guard will award the largest acquisition contract in the history of its service for the next 11 Offshore Patrol Cutter hulls in "Stage Two" of the OPC program. The OPC program of record is 25 cutters, and delivery of this full fleet is aimed to recapitalize the capability and capacity provided by 28 Median Endurance Cutters, many of which are 50+ years old. "This legacy fleet loses nearly 500 patrol days annually due to unplanned maintenance and repairs," said Admiral Schultz.

Also on the board is progress on the acquisition of 30 Waterways Commerce Cutters. "These new tenders will have greater endurance, speed and deck load capacity to efficiently maintain 28,000 aids that mark over 12,000 miles of navigable inland waterways. These aids to navigation are a critical component of our Marine Transportation System on which cargoes and commodities comprising 25% of our nation's gross domestic product moves. And, for the first time in history, our entire inland fleet will be able to accommodate mixed-gender crews, providing all junior enlisted members these unique afloat experiences. We have this 35-ship fleet ... construction tenders, river tenders ... where the oldest is almost 75-years-old. The award should be here in the coming months hopefully before the end of my tenure."

And last but not least, the continuation of the Fast Response Cutters. "We're building out to 64, and this '22 budget added two more FRCs to the conversation. So now we're 64 plus two. Six are in Bahrain, four of the six are standing the watch, we'll send the next two over this summer. So we are in a pretty prolific shipbuilding phase. And we're on schedule, other than the Polar Security Cutter."

GEARING UP for Hybrid Drives

*Seven years ago we visited **Klaus Deleroi**, managing director, Reintjes, at the company's headquarters in Hameln, Germany, shortly after he took the top spot at this storied maritime drive manufacturer which dates back to 1879. This month we caught up with Deleroi via Zoom for insight on the company's recent developments and direction.*

By Greg Trauthwein

Photo courtesy Reintjes

"At Reintjes we also want to ride **the wave of decarbonization,** *and currently, 80% of the inquiries we get from our customers – shipyards and owners – are regarding hybrid."*

– Klaus Deleroi, Managing Director, Reintjes

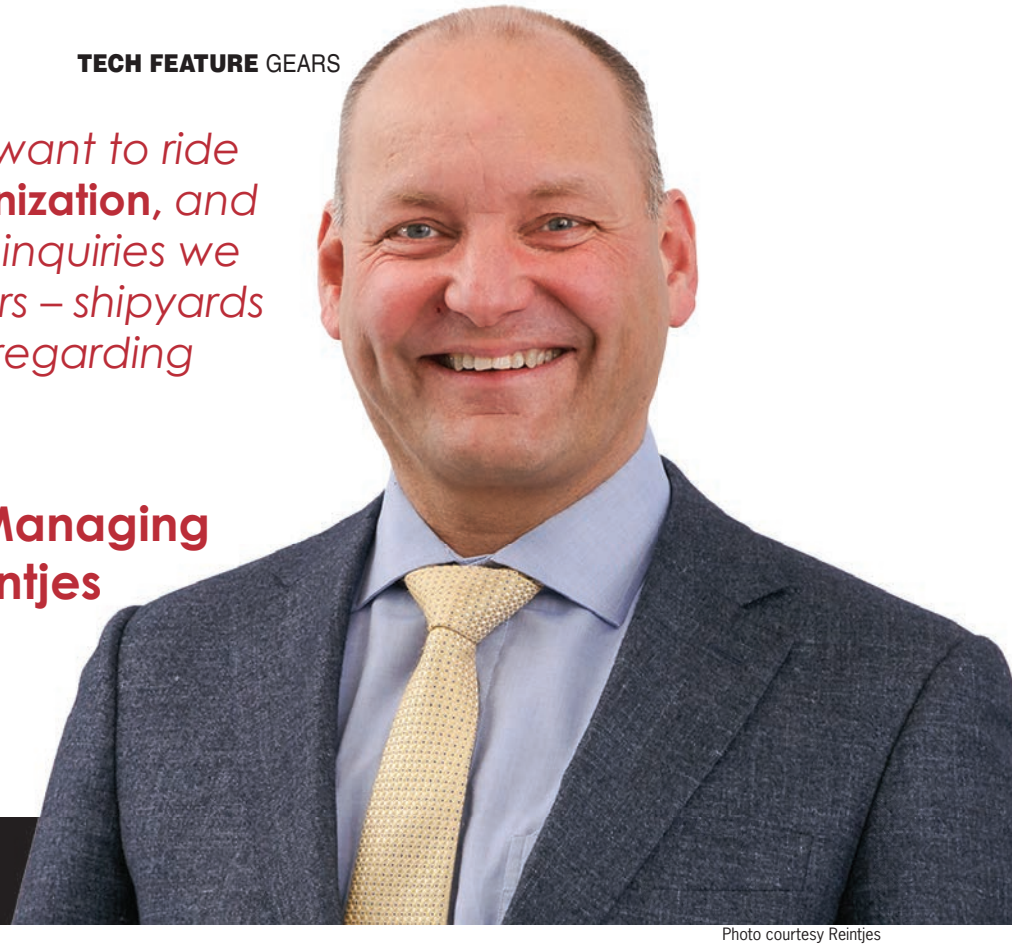

Photo courtesy Reintjes

Reintjes needs no introduction to this audience, but can you give us a 'by the numbers' look at the company today?

Thanks, Greg, for this opportunity. A rough 'by the numbers' ... today we are around 500 people, 400 here in Hameln with 100 around the world, manufacturing about 750 gears which translates into a turnover of $20 million.

Obviously the last two years have been defined by COVID. Can you give us an overview of how Reintjes has navigated these challenging times?

Luckily COVID has not really impacted Reintjes (significantly). The worst challenge was the travel restrictions for our sales people and our service technicians. One silver lining was a boost to Reintjes' in digitalization, particularly to hold meetings. We always had the tools, but the mentality was not there.

Another challenge, particularly here in the U.S., has been the supply chain snarls. Can you give an overview of how these supply chain issues have impacted Reintjes?

Focusing on the U.S. market, we have a very good partner and distributor, Karl Senner LLC in New Orleans (which houses a) healthy stock (of products and parts).We are glad to have such a partner with all the necessary parts in stock. Looking worldwide, we have some supply issues with raw material, which is increasing with this current Russia/ Ukraine crisis.

When we met at your factory in Germany seven years ago, you said, "A weakness is the organization structure, which is focused too much on production and product related. We have to open our business to become more flexible and to adapt to customer needs, even on a per order basis." My question to you: have you achieved this transformation?

I underestimated the change in the organization, because it's not the organization structure, it's the mentality of the people. To change the mentality, to be more customer driven, to understand what the customer really wants, is a really big challenge. This is made more difficult (today) with the challenge to find and retain our people. We have to be more flexible and more customer attentive, and I would say we're about a third of the way there.

All photos courtesy Reintjes

Fair enough. As the maritime industry is pressed to reduce its emissions, this includes emerging variety of fuel choices, power sources, and hybrid drives. How has this impacted Reintjes?

At Reintjes we also want to ride the wave of decarbonization, and currently, 80% of the inquiries we get from our customers – shipyards and owners – are regarding hybrid. The actual contracts tell a different story, but the inquiries are there. We are putting a lot of money in R&D to develop a compact hybrid system, if not a complete all electric system.

(So there may be a time when) there is no diesel engine, instead a big electric motor driving a shaft; or we have a splitter gear box with two, three or even four electric motors driving the shaft, which gives a bit more redundancy, (and is lighter while consuming less space).

We are working closely with the engine manufacturers, because as they move from heavy fuels, the torque and the revolutions of the engines will change. We, as a gearbox manufacturer, must adapt.

Reading the news, some people seem to think the decarbonization process is simple and quick.

If it would be quick and easy, we would have done it already.

Can you discuss how Reintjes is investing in its manufacturing, its product and its people?

We have come through some rough times since I took the helm. But during the last two years we were in the position to invest big time into machines, into people and also into IT. IT security is (increasingly) taking a big portion of our investment budget.

But our focus, of course, is our machines; [our future is dependent on having] state-of-the-art machines in our factory shop.

Can you give a quick overview of how the Reintjes family of products has changed most during your seven years at the helm?

Over the last seven years, the markets [continue to change, for example there is growing] demand for aluminum lightweight gearboxes, so if you look at our gearboxes the share of aluminum [units] is growing.

We have invested into R&D and we have now a new small gearbox family; lighter, tougher, and more compact. And, as I said before, hybrid drive [solutions] are everywhere, so you'll see gear boxes with PTI PTO, many more than seven years ago.

Reintjes serves a variety of markets from commercial to military, to pleasure boats in the form of large yachts. When you look at the market today by geographic region, by market sector or both, where do you see opportunity?

We serve everything apart from Russia; this we don't do anymore. The biggest growth area that I see is Navy and Coast Guard; due to the Russia/Ukraine crisis, everybody is spending a lot of money also in the Navy and the Coast Guard area. But we see also some smaller cargo vessels and also ferries, passenger ferries coming up and building new. [From talking to shipowners regularly,] I can say with certainty there will be increased investment in retrofits and newbuilds. I'm completely convinced we will see a lot of feeder ships in the near future.

[Also, government regulation on emissions] will continue to drive retrofits and newbuilds to make ships greener.

Arc Flash in Marine Installations

By Will Ayers, P.E., *Chief Electrical Engineer, Elliott Bay Design Group &*
Taylor Herinckx, P.E., *Electrical Engineer/Naval Architect, Elliott Bay Design Group*

The use of electrical energy aboard ships and marine structures has increased in recent decades and is anticipated to grow further. With the increase in energy and power levels, the hazards associated with electrical installations also grows. One of the major hazards is an arc flash event. Knowing about arc flash can protect your employees and your firm from a tragic accident.

An arc flash is a rapid release of energy due to an arcing fault between a bus bar and another bus bar, neutral or a ground, during which the air is the conductor. While arc flashes can be precipitated at any time, they are much more likely, and the consequences much more severe, while maintenance and repair operations on energized equipment are under way. These operations introduce the compounding effects of bringing personnel into proximity with energized conductors, and the removal of covers from electrical components. In the majority of cases, it is human error rather than equipment failure that leads to the arc flash event. Unintentional arcing in power equipment can inflict several different types of hazards:

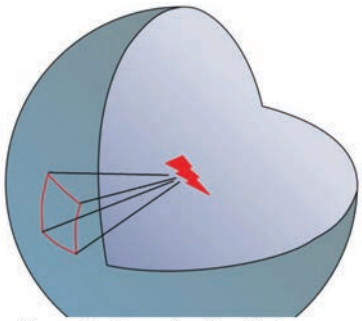

Figure 1: Example of incident energy projected onto a 1 cm² surface

- Heat from an arc can cause severe flash burns many feet away (temperatures can reach 19,500°C, four times the temperature at the surface of the sun) [1].
- This massive energy discharge burns the bus bars, vaporizing the copper, causing an explosive volumetric expansion conservatively estimated to have an expansion ratio of 67,000 to 1 [1]. Byproducts from the arc, such as molten metal spatter, can cause severe injury.
- Pressure waves caused by the rapid expansion of air and vaporization of metal can distort enclosures and cause doors and cover panels to be ejected with severe force, injuring personnel.
- Sound levels can damage hearing.
- In addition to personnel hazards, an arc flash generally results in equipment damage, which requires clean up and repair, and causes system down time.

Anywhere from 3,500 to 30,000 arc flash incidents occur every year [2], and countless have been investigated. Many of these have revealed new insights into the danger. In particular, a number of accidents occurring at the U.S. Department of Energy have been very well documented and the accident reports are available online [3] [4] [5].

There have been countless studies done on a multitude of aspects of the arc flash danger. However, most of these are focused on shore-side installations. This paper, in contrast, will focus on what is unique for the marine application.

ARC FLASH HAZARD ANALYSIS

An arc flash hazard analysis allows us to quantify the arc flash energy lurking inside each electrical panel. The danger is measured in calories per centimeter squared (cal/cm2). This is the energy that would potentially be projected onto the front of a worker at roughly arm's length from the electrical arc. See Figure 1.

It has been found that 1.2 cal/cm2 of thermal energy applied to a person's skin for a short period of time generally produces a second-degree burn, which is not a permanent injury. This threshold is typically used as the upper limit to which personnel may be exposed without extra arc flash specific personal protective equipment (PPE). Arc flashes are generally limited to systems where the bus voltage is equal to or in excess of 208 volts [6]. Lower voltage levels normally will not sustain an arc.

The arc flash hazard analysis is a natural extension from two related studies that may already be required for the installation:

- Short circuit study
- Circuit breaker coordination study

If you have these two common studies, you already have the basis to perform an arc flash hazard analysis.

EBDG has extensive experience performing these arc flash studies for marine electrical systems. We utilize a powerful software package called SKM Power Tools for WindowsTM to perform the arc flash calculations. Nevertheless, an intimate understanding of the electrical engineering underlying this software is critical in its application.

The purpose of calculating the arc flash numbers is not to have them buried in a report for the life of the system. In

contrast, the numbers become an active and ongoing part of safety procedures by being labeled on the electrical equipment. These labels warn the front-line worker of the danger.

In concert with arc flash training and a broader electrical safety program, workers are educated about what level of personal protective equipment is required for the various levels of arc flash danger, specifically the incident energy levels listed in cal/cm2.

REGULATORY REQUIREMENTS

Even shore-side, there aren't any clear-cut regulatory requirements for arc flash studies or arc flash safety practices. But tragic high-profile accidents and the ensuing fines and lawsuits have made them common practice onshore. As a result, National Fire Protection Association (NFPA) Standard 70E has become the consensus standard for workplace electrical safety. Organizations are guided by the policies and procedures in this standard.

Marine standards have historically not addressed arc flashes but are also beginning to add arc flash requirements. DNV now requires arc resistant switchgear for medium voltage systems and generator sections of low voltage IMO compliant systems (Rules For Classification – Ships, 2019, 4-8-2/9.2.2, 4-8-4/1.1.5, and 4-8-4/2.2.1). In 2014, ABS added the requirements for both arc resistant switchgear and arc flash hazard analyses for systems greater than 1000V [Currently MVR 2020 4-8-1/5.1.7(b) and 4-8-5/3.7.4(e)]. Lloyd's Register added an entire section dedicated to arc flash safety (Rules and Regulations for the Classification of Ships, 2019, Part 6, Chapter 2, Section 8). This requires arc flash studies to be performed even for low voltages. BV requires arc resistant switchgear for medium voltage applications (C-2-13/6.2.5).

In 2014, a variety of marine arc flash safety requirements were created by the Institute of Electrical and Electronics Engineers (IEEE): IEEE Std 45.5, Recommended Practice for Electrical Installations on Shipboard -- Safety Considerations. IEEE 45 has had numerous sections called out by 46 CFR (Code of Federal Regulations) for many decades. So, this set of standards may have the strongest connection to those who develop United States Coast Guard regulations, and those who must abide by them.

MARINE OPERATOR EFFORTS

While not yet broadly required by regulation, several marine operators have initiated arc flash investigation and mitigation efforts.

In 2013, the Canadian Coast Guard published a tender notice for arc flash studies [7]. They implemented arc flash safety procedures on two vessels and have been working to expand to additional vessels.

In 2014, the U.S. Army Corps of Engineers began requiring vessels to meet arc flash standards (ER 385-1-100) [8]. This has been implemented on numerous vessels.

EBDG completed arc flash studies for all six of TxDOT's Galveston ferries in 2016 [9]. Shore-side studies had already been performed for the terminals and shore-side maintenance buildings [10].

ARC FLASH AND MARINE DESIGN

Space comes at a premium on a ship. For control and monitoring purposes, switchboards are often placed inside the engine control room. But even for low voltage switchboards, arc flash calculations are revealing that the incident energy levels are much higher than thought. An accident in such a location could not only lead to significant injury but make continued operation from the location very challenging.

Concerns regarding such an arc flash are especially sensitive with regards to the main generator breakers. Should an arc flash develop on the input bus bar to a generator circuit breaker, the circuit breaker cannot interrupt that flow. During an arc, the conductive ionized air called plasma flows through the inside of the switchboard. If an arc starts in one location, it can be assumed that it will propagate to other locations.

Thus, the worst-case assumption is usually that an arc initiating elsewhere will propagate to the input terminals of a generator circuit breaker. In fact, that worst-case may assume that it propagates to the maximum number of generators that might be online. The possibility of this scenario may lead to the construction of low voltage switchboards with generator entrance cubicles built to medium voltage switchgear standards. Medium voltage standards physically segregate the entrance cubicles and make such propagation from another location extremely unlikely.

Another option is to push major power equipment outside of a manned space

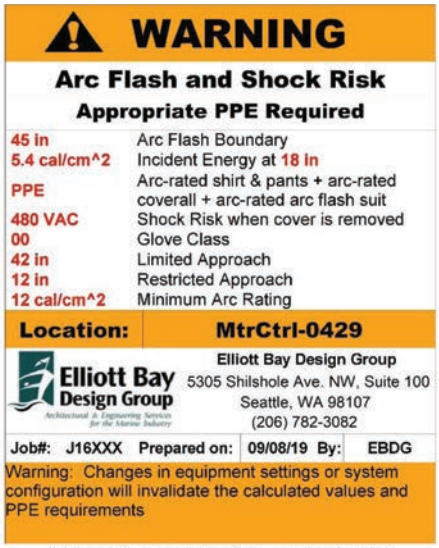

Figure 2: Example of an arc flash label

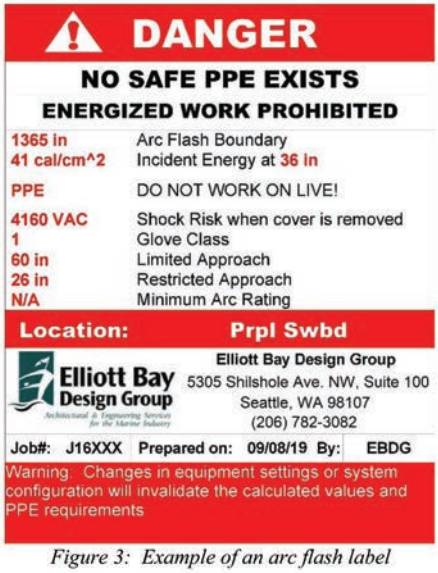

Figure 3: Example of an arc flash label

like a control room, thus separating crew members from a potential arcing event. While mitigating arc risk, such relocation will increase remote control and monitoring requirements so that crew have the same capabilities as if the switchboard had not been moved.

As vessel electrical systems become more complex, arc flash dangers can both increase or decrease with new technologies. This is especially the case with DC propulsion grids, AC or DC drive systems and new energy storage technology.

Specific to the electrical power system design itself, there are a myriad of enhancements and mitigation techniques to reduce or eliminate the arc flash danger. EBDG can help customers navigate the complexity of such methods:

- Zone-selective interlocking (ZSI)
- Differential relaying
- Energy-reducing maintenance switch
- Mitigation system, like ABB's Arc Vault
- Arc flash optical relays
- High-resistance grounding
- Current-limiting fuses or circuit breakers
- Arc Resistant Switchgear
- IEC 61850 networking of protection relays
- Line reactors
- Prohibiting energized work on certain panels

ARC FLASH AND GENERATOR SIZE

*[**Caution:** The following estimates of arc flash energies based on ship service or propulsion generator size are for preliminary assessment only. Nothing contained herein shall be taken to replace a more detailed analysis of arc flash energies for the purposes of ensuring workplace safety.]*

As discussed, the likely worst-case arc flash numbers for a vessel will likely occur at the entrance cubicles where a switchboard receives its power from onboard AC generators. While in no way meant to replace the need for an arc flash study, at a very preliminary level, generator size can be used to approximate that worst-case arc flash energy number.

A few assumptions are necessary (a fuller set can be found in Appendix A). First, the arc is assumed to last for only two seconds. This comes straight out of the 2015 NFPA 70E which indicates this is a sound assumption if the egress of the person performing the energized work is not inhibited. The capability for quick egress needs to be ensured for any energized work that is performed.

Secondly, on many vessels, the AC generators are located near the switchboards receiving power. The resistance supplied by that short run of often very thick cables is usually quite low. Further, it is usually rather small compared to the internal resistance of the generator itself. Eliminating the cable resistances from the calculation will usually lead to only slightly higher arc flash numbers, a conservative approach.

The internal resistance that the generator provides is also a complex set of calculations and depends on a number of variables. In "Understanding Arc Flash Hazards" [14], equations were detailed that underlie IEEE Standard 1584-2002 [15]. In the initial phase of the arc, the arc is primarily a function of the initial peak prospective short circuit current. This peak current is essentially a function of what is termed the subtransient reactance of the generator. This internal resistance varies from machine to machine. Based on our review of numerous generator data sheets over time, this value is often between 0.10 and 0.15 per unit. Some outliers can be found in the range of 0.075 to 0.20. Based on these ranges, Figure 4 through Figure 6 show the approximate worst-case arc flash energies based on total online generator power for 208V, 480V and 600V systems.

There is one caveat to the assertion that generator entrance cubicles present the greatest incident energy level. In cases where a step-down transformer is relatively large in comparison to the on-line generation capacity, the secondary side of the transformer may present a greater incident energy. This is because the increased current, rather than reduced voltage, has a more significant impact on incident energy level.

PPE RANGES

To put the preceding estimated incident energy levels in perspective, it is helpful to compare them to ratings of clothing and personal protective equipment (PPE) available for use during work on energized electrical equipment. NFPA 70E Annex H provides guidance on arc rated clothing and PPE for several thresholds up to 40 cal/cm2. See Figure 7 and Figure 8 for two examples.

Each threshold represents an increase in the level of protection, and consequent increase in complexity, weight, and expense. Clothing and PPE combinations for incident energies up to 12 cal/cm2 are modest additions to a typical shipboard environment. Incident energies between 12 cal/cm2 and 40 cal/cm2 are available, but require a more significant investment in use, donning and removal, storage, and care. PPE and arc rated clothing for incident energies above 40 cal/cm2 are not recognized, and energized work should not be performed on systems with this incident energy level.

LOOKING AHEAD

The definitive guide for performing arc flash energy calculations in the United States, IEEE-1584, was revised and reissued in 2018. It builds upon the foundation created by IEEE-1584-2002, and work prior to that. It is based upon approximately 1,700 experimental trials, versus the approximately 300 trials of the 2002 version, and provides higher fidelity results than the previous version.

From the vessel owner's prospective, the most significant difference between the 2002 and 2018 versions of the standard is incorporation of the geometric configuration of the electrical conductors, enclosures, and worker. The geometric orientations determine which sets of equations to use in determining the incident energy, and thus have a significant impact on the results. The rami-

fication is that this information must be collected from a vessel or design while preparing an arc flash study.

The collection of large quantities of geometric data adds to the already intensive effort required during a ship check to collect electrical information on all relevant components. This expands the time and costs of performing an arc flash energy evaluation.

CONCLUSION

Arc flashes can be quite dangerous, but that danger can be mitigated, and workers can be protected. Arc flash requirements are already entering the marine world and their impact will only increase. EBDG can quantify the danger and be part of the process to reduce or even eliminate it.

The reduction or elimination of the arc flash danger can be implemented with existing systems. But like a lot of things, it's often much easier during an initial design or major upgrade. So, when it comes to major investments in electrical systems, analyzing the arc flash angle now will help protect your investment from the approach of arc flash standards in the future.

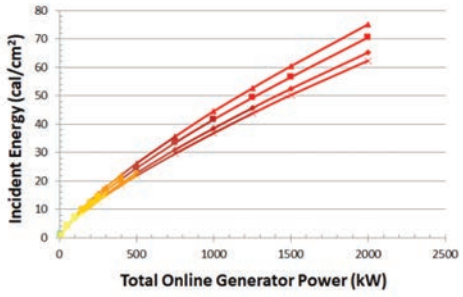

Figure 4: Incoming Switchboard Worst-Case Arc Flash Energy Ranges, 208V

Arc Flash in Marine Installations

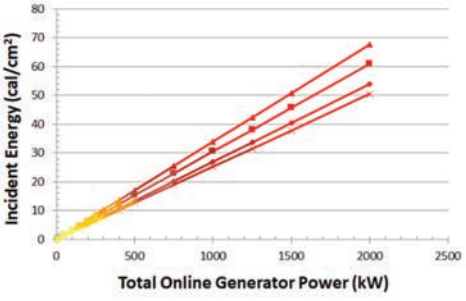

Figure 5: Incoming Switchboard Worst-Case Arc Flash Energy Ranges, 480V

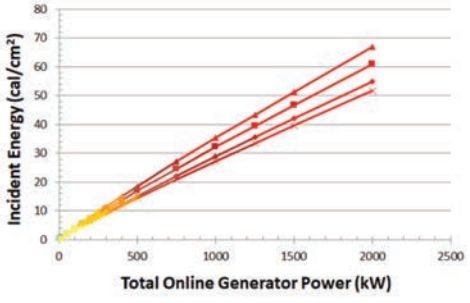

Figure 6: Incoming Switchboard Worst-Case Arc Flash Energy Ranges, 600V

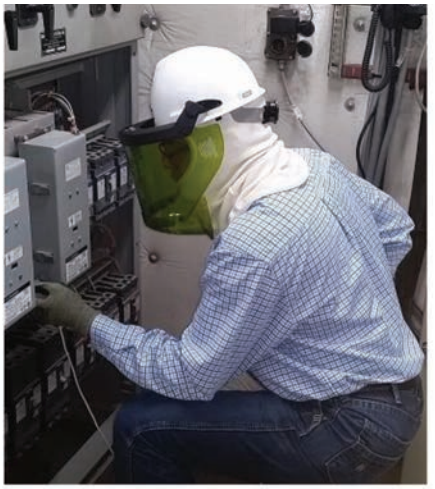

Figure 7: One of the Authors with Arc Flash PPE Protecting up to 12 cal/cm² (including special arc flash gloves, shirt and jeans)

Figure 8: Typical Arc Flash PPE Protecting up to 40 cal/cm²

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Images courtesy Kongsberg Maritime

PROPELLED INTO A CLEANER, LEANER FUTURE

*An upgrade by **Kongsberg Maritime** of the waterjets on a catamaran ferry operated by the family-run firm of AG EMS brings a new level of efficiency and environmental consideration to a route traversed by the company for 143 years.*

Claus Hirsch, the fleet manager with AG EMS, is a likable and personable individual. His easy demeanor suggests that he is contented with his lot in life, and no one would blame him for that. The company he works for is a family-run concern with a benevolent attitude toward its employees and a palpable respect for the precious environmental features in its operational base of Lower Saxony, Germany; an area teeming with UNESCO World Heritage sites.

With its headquarters in the historic seaport of Emden, AG EMS has been operating a ferry service to and from the beautiful island of Borkum for the last 143 years. In addition to this, the company's benign stewardship manifests itself all over the island, with hotels, electric buses, trains and light aircraft all operating under the AG EMS umbrella. "We always keep an open mind," Claus remarks, "and we are always looking for new business opportunities. Nevertheless, we're a small and tight-knit company, and we look out for each other in every venture. Our CEO always says, 'everybody is responsible for everybody else' – and if I want to ask them something, I only have to walk up three flights of stairs to do so."

However enviable this combination of civilized working conditions in an idyllic location may sound, it's as well to remember that AG EMS has been buffeted by circumstance just like the rest of us over the last two years. It's perhaps a measure of the firm's policy of far-sightedness rather than short-term gain that it was still quietly making prudent investments and notching up success stories even in the midst of the pandemic. One such story concerns the replacement of the waterjets on its 40m passenger ferry M/S Nordlicht – an upgrade which brought about a remarkable 26% improvement in energy efficiency.

'The answer was obvious'

Nordlicht, a 38.8m catamaran built in 1989 and capable of carrying 272 passengers, had been using a pair of Kamewa SII waterjets for years, but

when one of the jets sustained major damage, AG EMS was faced with a dilemma. "These things always seem to happen at the height of the season," Claus laughs, "never in the wintertime! So we had two options: one was to repair the old SII version, taking on board the lead time and expenditure of sourcing all the necessary spare parts, or to change the complete system to the next-generation Kongsberg Maritime Kamewa S-4 waterjets."

The lead times for repair or replacement were almost identical, so there was no discernible advantage in that respect to remaining with the existing arrangement. More than that, however, was the realization that no progress would be made by merely repairing the damaged SII. "We wouldn't have had any better outcome later on; we'd still be looking at the same operational status," Claus said. "So in that moment, it was a case of weighing up whether to invest €150,000 to stick with our old system, or spend more money but improve literally everything? We did discuss it at length; but the answer was always obvious."

The type S-4 Kongsberg Maritime Kamewa waterjet boasts a radically improved steering and reversing unit. Building upon the proven technology of the SII, it combines an increased working life expectancy of 10 years with a 15-20% reduction in weight, 20% fewer parts in the waterjet unit and a substantial decrease in CO2 emissions. Conveniently, the hydraulic cylinders and hydraulic hoses are located inboard; a development that has been very gratefully received by the AG EMS engineers, as Claus explains. "Everything used to be located outside the cockpit, in the water: you had to carry out repairs in wintertime on the ice. And then you'd have the feedback cable getting crushed in the ice, so you'd have no steering anymore. It was terrible."

Claus points out that the inboard placement of these components also greatly reduces the risk of oil spills. "Even if the hydraulic hoses are broken or damaged, the oil is contained inside the jet room where you can clean it up and continue with your repairs. You don't have to go outside, onto the water, where everything is wet, dangerous and slippery. It's all so much easier and safer now for our ship engineers."

'It's an easy process'

Kongsberg's own figures suggest that upgrading from SII to S-4 waterjets will improve a vessel's acceleration by 15%, its propulsive efficiency by 7%, and its steering and reversing manoeuvrability by 25%, equating to a reduction in total fuel consumption of approximately 25%. Calculations of this kind are all very well in abstract terms, but customers investing in a pair of new S-4s can be forgiven for requiring hard proof. In the case of AG EMS and Nordlicht, this involved taking a series of comprehensive performance measurements both before and after installation of the waterjets – a procedure which Claus characterises as straightforward. "You cut out the aft plate and insert the new adaptor plate, and the inner ring of the old waterjet fits the new one, so it's an easy process." It's worth pointing out that swapping out the old units and replacing them with S-4 waterjets was accomplished remarkably quickly, in fewer than 10 days.

Following the stringent before-and-after tests conducted along Nordlicht's regular route between Emden and Borkum, the results were as decisive as everyone had hoped. It was found that the passenger catamaran's speed had increased from 30 to 32.6 knots while still only consuming the same amount of energy as before. The extra speed is a godsend in situations where, for example, passengers require more transit time between the train station and the ferry terminal.

"Being able to travel more rapidly if passengers need to make train connections is a choice we've never had before," Claus says. "With the new European passenger rights, you have to make special compensations for any delays. If it's half an hour, you have to give everybody coffee! If it's an hour,

Images courtesy AG EMS

you have to pay an extra surcharge for more than it would cost to pay for putting passengers up in a hotel, so everything is a clear risk for us if we fail to deliver. It's obviously better for everyone if we're running to schedule."

The economic benefits conferred by the S-4 upgrade are also considerable. "We actually calculated that there has been a 26% improvement in energy efficiency – or, looked at another way, a 26% reduction in fuel consumption – when operating at the same speed achievable with the SII waterjets," Claus adds. "It's a very nice story that I could go to my CEO and say, 'we did the right thing'. He was already satisfied, but now he gets this 26% improvement: perfect."

Meanwhile, the claimed 15% improvement in acceleration was borne out when the S-4s were found to have helped Nordlicht reach a speed of 25 knots in 39 seconds, as against 46 seconds with the SII waterjets.

'Far better performance'

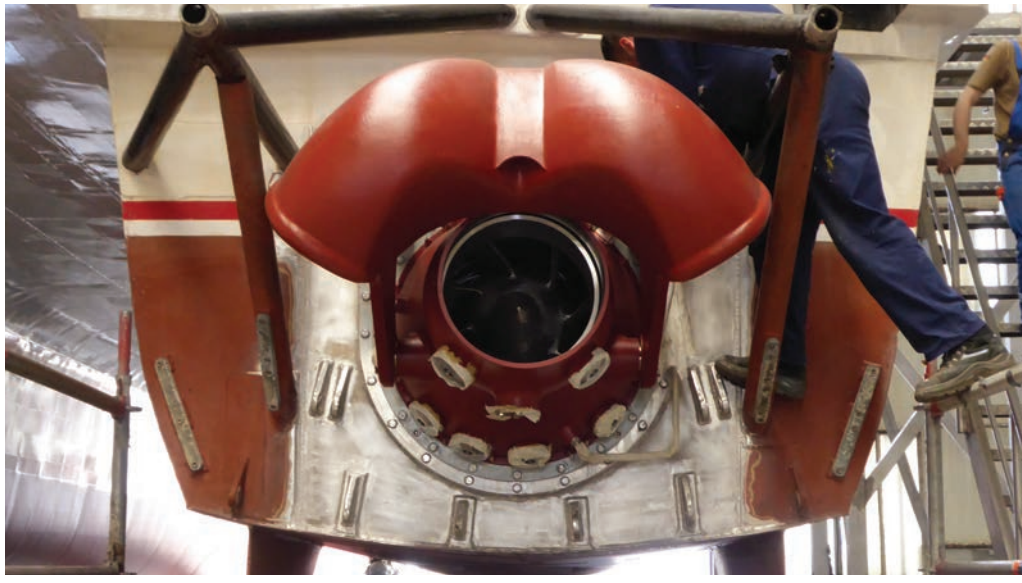
Separate calculations for speeds between 0-25-0 knots, which come under the classification of harbor maneuvering, also showed an efficiency gain of approximately 25%. The fact that S-4 waterjets feature a completely different alignment from their predecessors is a key factor in this outcome, as Claus acknowledges. "The captain has to learn to drive the ship in a totally new way," he laughs, "because the steering handles work the other way from previously. Especially astern. But the interesting thing is that today, nobody misses the old system because we get far better performance from the new waterjets."

Having spent a decade as an engineer with AG EMS before occupying his current role as fleet manager for a further 10 years, Claus is adamant that the new steering arrangement is the reason for this marked improvement. "With the SII, the complete bucket [assembly] was steering all the time. It's a massive piece of steel, so you'd have to pay out quite often for replacement bearings and hydraulics because everything was working so hard to get this big bucket from starboard to port all the time. With the S-4, you just have a small nozzle which steers with a single cylinder."

From Kongsberg's perspective, the replacement of the waterjets neatly upholds and epitomizes several of the company's core principles: technical innovation, cost-effectiveness, the green agenda and impeccable customer service. "Nordlicht may be more than 30 years old, but it's a nicely built and very well-maintained vessel, so it was obvious that AG EMS would want to continue running it for several more years," adds Kai Lindenberg, Aftermarket Sales Manager at Kongsberg in Germany. "I've been in contact with Claus for a long time, and when it came to Nordlicht's waterjets, AG EMS was

initially looking at a full repair of the old units; a sizeable investment, but one without any discernible long-term benefit. It's important to reflect upon and react to customers' needs, so after some discussion we easily arrived at a far more sustainable and sensible solution. Together with Jan Wall, Aftermarket Sales and Product Specialist in Sweden, we were able to present a perfect case study, with huge and valued support from AG EMS."

With its LNG ferries, electric buses and a planned solar roof for AG EMS' parking facility that would generate sufficient electrical power for its headquarters and real estate, the company wears its environmental credentials with pride. For Claus, there's no argument that a green agenda makes sense on every level. "When we changed from SII to S-4 waterjets, that epitomized an operational improvement which simultaneously saves money and is kinder to marine ecosystems. It puts us on the right side ethically and commercially; and it befits companies like ourselves to look to the future and consider what the next generation is asking for. The S-4 waterjets are typical of Kongsberg products in their robust design and the flawless performance they have delivered in their first year of operation; and it doesn't seem unreasonable to suggest that we could still be running Nordlicht for another 30 years."



ESAB Innovation Makes Shipyard Welding More Efficient, Accurate

__Jeff Chittim__, __ESAB__'s North American Senior Product Manager for Heavy Industrial Products, discusses how WeldCloud online applications and the __ESAB__ Heavy Industrial Product Line are a powerful tandem to help shipyards improve weld quality and efficiency.

By Greg Trauthwein

While automation has gone a long way in making shipyards more efficient, today shipbuilding remains a hands-on endeavor, with a dearth of 'welders and fitters' being a common lament.

Technology companies such as ESAB, a global supplier of welding and cutting solutions across industries, aim to help in supplying solutions that not only make it easier to train new employees to deliver quality welds, but supply the welding and cutting machine intelligence and insight monitor real-time performance.

"One of the biggest drivers for the welding equipment industry currently is advancing technologies," said Jeff Chittim, North American Senior Product Manager for Heavy Industrial Products, ESAB, noting that there are two sides to the advancing technology discussion. "We see the need for advancing technologies to improve the operations for the welding, the operator themselves, as we know that the industry is in dire need of more skilled trades workers. We see a need for improving technologies while simplifying the use of those technologies, so it's not weeks or months of training that they need to be able to operate it."

On the flip side is documentation of the weld process to confirm the efficiency of the job and the quality of the finished product. This is where ESAB melds the heavy metal tooling with "Industry 4.0", using IoT and data to monitor, measure, report and ultimately, improve performance.

Welcome to WeldCloud

"WeldCloud is an online application for weld data management. And when we talk about weld data, there's the arc on times for the operators, the welding parameters, so monitoring your amps and volts. There's also the wire deposition rates, wire consumed per part," said Chittim.

The WeldCloud suite is designed to enables users to improve overall operational efficiency by monitoring, capturing, tracking and analyzing data to make intelligent decisions based on accurate information. WeldCloud-enabled machines feature an embedded communication module that digitally connects the machine to WeldCloud via WiFi.

ESAB offers three WeldCloud solutions:

- **WeldCloud Productivity:** Designed for operation and production managers, tracking information generated by the welding process: arc-on time, number of weld sessions, wire use, deposition rate and many other metrics.
- **WeldCloud Fleet:** A service or maintenance manager's new digital assistant designed to manage a fleet of welding equipment across one or multiple locations, with event and service logs, as well as real-time alerts. WeldCloud Fleet also reminds them of maintenance and calibration schedules.
- **WeldCloud Notes:** Designed for Quality Control Managers as it aims to improve welding documentation by digitizing and automating manual processes.

"Overall, with the real-time data readout, you can access this data right from the welding machine," said Chittim. "But you can also access the data from your laptop, your tablet or your cell phone applications. You can get a feel of where certain operators are at; you can get a feel if your automated piece of equipment is operating properly."

"If you see one of the operators is running at a very high input, maybe he's having some wire feed issues," said Chittim. The monitoring intel works the same on automated pieces of equipment, and if an anomaly is found "you can get in touch with the plant manager and say 'Torch number two has a very high amperage. Let's go check out the wire conduits. Maybe it's having a little bit of trouble feeding wire and the amperages are a little out of whack."

WeldCloud uses the Microsoft Azure cloud computing platform to help ensure it is reliable and secure. Designed for ease of use, WeldCloud does not require a sophisticated IT department and is scalable.

While WeldCloud helps to monitor both human and automated equipment to ensure proper functionality and efficiency, it's a powerful business tool

"Everything is recorded, so you can

Source: ESAB

Source: ESAB

access the data," said Chittim. "So, heaven forbid down the road there's a part failure, you have the data in your hands and you can go back and say, 'I know that weld on panel line number two, torch five, at that time, that specific weld, was welded with the right amps, the right wire feed speed, the right voltages, the right travel speeds.'"

Inside the ESAB Heavy Industrial Product (HIP) Line

"The ESAB heavy industrial product (HIP) line is broken into two sectors," said Chittim. "We have the Warrior product line and the Aristo."

ESAB launched its complete line of heavy industrial systems featuring the new Warrior 750i ARCAIR CC/CV power source, the new Aristo 500ix pulsing power source and new Robust Feed Pulse and Robust Feed U6 wire feeders. These four products join the previously launched Robust Feed Pro wire feeder and the existing Warrior 400i and 500i power sources.

With a 750-amp output at 100% duty cycle and an 820-amp output at 60% duty cycle, Warrior 750i ARCAIR offers the power needed to enable greater productivity with the larger diameter electrodes used in such applications as flux cored welding, hard facing, cladding, mechanized applications and arc gouging with carbons up to 0.5-in. diameter.

ARCAIR, an ESAB brand, invented the carbon arc gouging process, which is widely used to back-gouge welds as part of making a full-penetration weld, remove weld defects and remove worn or torn metal in shipyard, offshore fabrication and other heavy fabrication activities. The Warrior 750i ARCAIR also offers Stick and TIG welding output.

"And then we have our pulse capable machines, the Aristos. That's where we get a little bit more into the advanced technologies, creating specific wave forms, having pulse on pulse capabilities for specific, very strategic welding applications, very critical applications, whether it's stainless steel or aluminum," said Chittim.

With the HIP line, ESAB has its synergic line, which are very specific to different applications. "We could have synergic line that's specific to a flux four welding type of wire, generally used in shipyards, specifically for out-of-positions of vertical pull-ups or downs, if you're putting some panels together," said Chittim. "There's very specific, fine-tuned parameters for flux four wires, but we also have them for aluminums and also mild steel wires, stainless steel wires, allowing the equipment to be fine-tuned specifically for the application."

"That was the synergic lines, the specific technology in the equipment. But when we talk about the equipment itself, we have the CC/CV multi process line, which is robust equipment," said Chittim. "It has heavy duty cycles; it can withstand the environment. Partnering with that we have the robust feed line

Source: ESAB

ESAB offers a complete line of multi-process heavy industrial welding systems. The family features the new Warrior 750i ARCAIR and Aristo 500ix power sources and Robust Feed Pulse and U6 feeders.

of equipment," which is flexible to use across different types of welding. "The robust feeder is bench top capable, so you can put it right on top of your welding machine," and it has handles and wheel kits to make it portable. "You can even drag it by your welding gun if you had to," said Chittim, noting that robust feeder, and the entire ESAB product line, is well-adapted to the shipyard environment. "It's portable, robust and reliable."

Keep it Simple … and High Quality

While robust is the ante to get into the shipyard environment, increasingly systems that are designed to make the weld process simpler and more productive – particularly in the face of a lack of skilled trades workers entering the workforce – are mandatory, too. "One of the great features of the heavy industrial product line is we have simplified, user-friendly interfaces for the CC/CV multi process machines," said Chittim. "Once you get into our higher technologies, the pulse wave forms, pulse on pulse wave forms, we simplify it by giving it a limited amount of adjustability for the operators. When you narrow that window of the adjustability, it's quick and easy to learn how to operate these machines."

"We give you the meat and potatoes of the welding parameters, so when you're making those adjustments, you see the feedback in your arc right away," said Chittim. "Whether they're new to the industry or they're changing from being a stick welder to a MIG welder, you're able to see the feedback in the arc right away."

The HIP product line is designed to be extremely user friendly.

"We have the advanced technologies, but we take that human interface and simplified it as much as possible so that you can have those high technologies improve your welding quality, improve your productivity, but also keep it user friendly," said Chittim.

While simplification of the weld process is increasingly an important factor, in the end, for ships that sail at sea and depend heavily on the solidity of their hull and equipment to complete their mission safely and efficiently, it all starts with the quality of the weld in the shipyard.

"One of the great features of the heavy industrial product line at ESAB is the ability to save your welding parameters," said Chittim. "Every customer, every end user has welding procedure specifications. Now you can go to the welding machine and you can save those specific parameters inside the welding machine. So, for example, if you have let's say 350 inches per minute wire feed speed, but you have a plus or minus of five, 10%, depending on the specification allowable, you can save those percentage changes inside the welding machine. And so now, you know those welding parameters are always going to be followed."

Closing the circle on the integration of heavy tooling and digitalization, Chittim concludes: "Also, you have the WeldCloud so that you're monitoring and making sure that those parameters are being followed. So extremely a high due diligence on your welding quality, your productivity, and your repeatability that way."

Friede & Goldman

STEADY LIFTING

A new WTIV feeder barge solution is engineered to make operations safer and more efficient.

By Eric Haun

Offshore wind in the United States is moving forward at pace, thanks in large part to a number of positive developments for the newly emerging industry over the last year or so. For one, the Biden administration at the start of 2021 revealed its aim to have 30 gigawatts (GW) of offshore wind power in development by 2030 and 110 GW by 2050. Those are some big numbers, and the industry is now getting in gear to produce.

It will take a large number of vessels to help build up to reach these targets, including both U.S.- and foreign-flagged tonnage. While it is true that the Jones Act applies to U.S. offshore wind, it is expected that the industry will rely mostly on foreign flagged wind turbine installation vessels (WTIV) working in combination with a fleet of American-built and -crewed feeder assets (such as tugs and barges, or potentially even specially designed ship-shaped feeder vessels) that will transport turbine components from the U.S. mainland for installation offshore.

A Houston-based naval architecture and marine engineering firm with decades of experience in both maritime and offshore oil and gas has come up with a solution engineered to make this process safer and more efficient. Friede & Goldman's (F&G) BargeRack system—patent pending—uses a trussed rack fitted to the transom of a self-elevating vessel to lift feeder barges out of the water, thereby eliminating motions between the installation vessel and the barge while lifting and installing wind turbine components.

"Operators don't want to lift turbine components off of a moving feeder vessel. We've solved that problem by lifting the entire vessel out of the water to completely eliminate the motions," explained Robert Clague, F&G's vice president of engineering.

The BargeRack uses its own rack and pinion jacking system to lower vertically from the WTIV or jack-up into the water. A feeder barge loaded with turbine components is floated over the submerged rack and secured. Then, the self-elevating installation vessel uses its onboard jacking system to elevate, while also lifting the rack, and therefore the feeder barge and its cargo, out of the water entirely. From this position, the main crane installs the turbine components directly from the stationary barge onto the turbine foundation. After turbine installation, the self-elevating unit jacks down to submerge the rack and refloat the empty feeder barge.

In addition to eliminating the barge motion, Clague noted another advantage of the system is that the rack can load the barge even after the jack-up is already raised out of the water, reducing wear and tear on the leg/hull interface. "On a jack-up, once the legs are engaged with the seabed, you want to preload and get the hull out of the water as soon as possible," Clague said. "Once the legs touch bottom, even the minimal environment on the hull—waves and current—place wear and tear on the legs, guides, jacking system, etc. - because all of that load from the hull travels through the leg/hull interface down to the seabed. With

our solution, we're able to quickly go through the entire preloading of the leg footings and get to our minimal air gap before bringing the feeder on. Then, the rack is deployed, the feeder comes on and we elevate the barge."

The solution, while initially created for relatively small jack-ups in the U.S. that would not transport wind turbines due to Jones Act restrictions, has also been tailored for use on larger WTIVs that could potentially operate internationally as well. "The rack easily comes on and off the vessel. The owner puts this removable rack on the vessel, and it operates in the U.S. as part of a feeder solution. And then, if the vessel gets a different contract outside of the U.S., those feeder racks can be taken off."

The BargeRack has been engineered to be installed on newbuilds or retrofitted, whether on F&G's designs or others. F&G's latest iteration is designed to lift a barge of sufficient size and capability to transport 20 megawatt (MW) turbines. Clague said the company has been working with turbine vendors, crane manufacturers and even barge builders to "future-proof" its designs.

A WTIV designed with the BargeRack system was recently granted approval in principle (AIP) from the American Bureau of Shipping (ABS). According to Clague, this "gives owners more confidence that there's no show-stoppers, that the technology is feasible and practical."

F&G has been presenting its BargeRack to the market with hopes of cashing in as the U.S. offshore wind industry ramps up. "We see a big opportunity for feeder solutions, given (a) the cost of a Jones-Act-compliant installation vessel, and (b) the infrastructure challenges in the U.S.; both of those things point toward the feeder solution, Clague said. "We've done the design, we've filed for the patent, and we think we have the best feeder solution. Now it's just a matter of partnering up with the field developer and the vessel owner and the logistics companies."

Maersk Supply Service

MAERSK'S FIRST WTIV
Will Support US Offshore Wind

Empire Offshore Wind, a joint venture between Equinor and bp developing an offshore wind farm off the coast of New York, awarded a contract to Maersk Supply Service for the charter of its newbuild wind turbine installation vessel (WTIV). This vessel—Maersk's first dedicated exclusively to offshore wind operations—will operate together with U.S.-constructed tugs and barges built and operated by Kirby Offshore Wind for the installation of the project's Vestas V236-15 megawatt (MW) turbines.

The ABS-classed WTIV will be built in Singapore by SembCorp Marine, with a steel-cutting ceremony slated for the fourth quarter of 2022. The jacking units, load transfer system and crane will be provided by NOV, while Kongsberg Maritime will supply the complete electrical system and the integrated control system. The design work has been supported by ABS.

Scheduled to be delivered into U.S. waters in 2025, the newbuild will go to work for the buildup of Empire Wind, located 15-30 miles southeast of Long Island. The project's two phases, Empire Wind 1 and 2, have a total installed capacity of more than 2 gigawatts (GW), that is 816 MW and 1,260 MW respectively.

In conventional offshore wind installation operations, jack-up vessels are used both for transporting turbine components from port to location and for installation before the process is repeated with next the load. Maersk's vessel will rely on a fleet of tugs and feeder barges that will carry out the transportation between port and site, freeing the jack-up from transportation and allowing it to remain on location to carry out successive installations. Importantly, the feeder approach also allows the non-U.S.-built WTIV to operate in compliance with Jones Act regulations in the U.S.

The vessel will feature a patented load transfer system jointly developed by OSK Group and Maersk Supply Service where the jack-up locks the barge in position and pushes it into the sea to eliminate wave motions and stabilize the barge. According to OSK, the so-called "push concept" enables a safe craning operation from one stable or fixed platform to another, expanding the operational window for the vessel as unloading and installation can take place in wave conditions exceeding 2 meters.

Maersk's new WTIV will be supported by two newbuild tugs and barges, which will transport the wind turbine components from the South Brooklyn Marine Terminal to the Empire Wind lease area. Kirby Offshore Wind, a subsidiary of Kirby Corporation, will have the two new ABS-classed feeder barges and diesel-electric hybrid tugboats constructed in U.S. shipyards for a total combined cost in the range of $80 million to $100 million. Each feeder barge will have the capacity to transport next-generation turbines of 15 MW and higher as turbine technology advances.

Tech Files

The month's best technical innovations

Amasus Shipping/bound4blue

Wind Propulsion

The M/V EEMS Traveller, owned and operated by Amasus Shipping, will start harnessing the power of wind. The 91-m general cargo vessel will be retrofitted with two 17-m-high eSAILs during a port call in 2022. A similar unit was installed by bound4blue in December 2021 on M/V La Naumon, being the largest suction sail ever built and installed on a ship. The sails are expected to reduce the ship's fuel costs and annual CO2 emissions by up to 30%.

bit.ly/3Lyvpog

C-Job

New CSD Concept

C-Job Naval Architects launched its new Cutter Suction Dredger (CSD) series and headlining the series is a new self-propelled CSD concept.

The 34-in.self-propelled cutter suction dredger features cutter power of 3,500 HP and a total installed power of approx. 26,000 HP. The CSD includes two 6,300 HP dredge pumps on deck and one 3,500 HP submerged dredge pump on the cutter ladder enabling a maximum dredging depth of 95 feet.

bit.ly/3r28Mkx

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'Solid Sail' for Cruise Ships

Bureau Veritas delivered an Approval in Principle to Chantiers de l'Atlantique for its sailing propulsion system, Solid Sail, tailored for the large ships market. Solid Sail is a 1,200 m² rigid sail made of composite panels assembled together, which was developed specifically for large vessels. The system overcomes the usual size limitations of standard fabric sails. Moreover, the rigidity of the sail panels induces less flapping and therefore increases the estimated life.

bit.ly/3j1zjdq

Newport Shipping/Marine Service

Containerized LNG

Marine Service GmbH and Newport Shipping announced an Approval in Principle from Bureau Veritas for a jointly developed containerized LNG solution. The 40-ft. ISO LNG Fuel Tank Container System is suitable for LNG-fuelled newbuildings and retrofits of container vessels. The LNG fuel tank container is a class approved Type C LNG fuel tank in accordance with the IGF-code and is based on German TÜV certified IMDG Container.

bit.ly/37bVhaK

MARIN

Crash Barriers for Wind Farm

Dutch maritime research institute MARIN tested three innovative barriers aimed at averting collisions between ships and wind turbines. The research was prompted by the incident involving the Julietta D on January 31 this year. This drifting bulk carrier initially collided with a tanker before hitting a transformer platform and a turbine foundation for the Hollandse Kust Zuid windfarm currently under construction.

bit.ly/3NWO1AH

Autoship

Stability for Jack-Ups

Autoship Systems in cooperation with their Norwegian Reseller, Coastdesign Norway (CDN) announced its Autoload - Jack Up version was chosen for installation onboard Seaway 7's first self-propelled jack-up vessel, VIND 1. Autoload is also installed onboard their entire fleet of vessels which include open deck semi-submersible heavy transportation vessels, cable lay, heavy lift crane installation and Installation support vessels.

bit.ly/3DJcvZh

WorkFloat

'Workboat in a Box'

The military force for the Kingdom of Bahrain purchased the self-propelled WorkFloat, a 12 x 6m WorkFloat platform which has the unique ability to fold up—including all equipment—and fit into a standard 40-ft. shipping container.

The WorlkFloat platform is designed for a range of support tasks, with the version for Bahrain equipped with a 10-tm crane that can lift just under half a ton at 13m, a deck load capacity of over 10t, a 2t deck winch that can be used for mooring work, a central moon pool for drilling or GI work, full electrics and navigation, bow loading ramps for military vehicles, spud cans for 10m spud legs, a retractable bow thruster and 2 x 70hp Yamaha high thrust outboards that give an impressive 7 knots and 1.2t of bollard pull.

WorkFloat told *MarineLink.com* that it is now designing the next evolution of the system.

Dubbed WF1200, it is a modular system that continues to use the benefits of a space frame structure with plastic floats. It has a higher payload capacity, much bigger crane options, larger engines, can scale to sizes 24m plus and critically can be jacked up out the water.

bit.ly/37f34V6

WorkFloat

In the Shipyard

Latest Deliveries, Contracts and Designs

Photo courtesy HII/Ingalls Shipbuilding Division

LPD 29

Dales Marine Services launched a new multi-cat style vessel Réalt na Farraige, with quayside support from Whytes Crane Hire and McIntosh Plant Hire. The launch was made more significant considering that the last time the Dales Marine's Aberdeen dry dock saw a new vessel built was more than 33 years ago.

Halcón III

SAAM Towage expanded its fleet in Chile with the addition of the tug Halcón III, the company's fourth RA2400SX-series tug acquired from the Turkish ship yard SANMAR over the past three years. Measuring 24.4 x 11.3m, the tug features bollard pull of 70 tons and a max. speed of 13 knots. It is powered by two Caterpillar 3516C main engines, each achieving 2,100 kW at 1,600 rpm.

P/B New York for Sandy Hook Pilots

Sandy Hook Pilots Association welcomed its new Pilot Station Boat New York, a converted oil spill response vessel (OSRV), which, at 208 feet long, is the largest in the Sandy Hook Pilots fleet.

On February 3, the new P/B New York sailed to its new home, the Sandy Hook Pilot base in Staten Island, N.Y., situated alongside its predecessor, the old P/B New York.

Sandy Hook Pilots searched for years for a vessel to replace the aging P/B New York, when it came upon OSRV Maine Responder, made available by Marine Spill Response Corporation. A full study of the OSRV ensued, with surveys of the entire vessel including sea trials of a sister vessel on pilot station to compare seakeeping and ship handling capabilities to the present station boats.

JMS Naval Architects, of Mystic, Conn., were hired to survey the OSRV and assist in the conversion. The completed version includes a new deck house for pilot berthing and facilities with enhancements to the existing house and superstructure.

The conversion project was conducted in three phases. Phase one took place at Caddell Drydock and Ship Repair of Staten Island, and consisted of a hull inspection, dropped rudders, shaft inspection and a complete modification of the stern, readjustment of mast and observation tower and developing of anchor pockets. There was also an initial inspection and project approvals made by the American Bureau of Shipping and the Coast Guard.

The final two phases were completed at Feeney's Enterprises situated in Kingston, N.Y. Two main projects that Feeney's had to complete before seasonal weather changes were the tear outs of the vessel's oil/water recovery system on deck and in the holds. New potable water tanks were fabricated to allow the vessel to keep stationed up to six weeks before returning for fuel and water. One major addition was the construction of a two-deck house that sleeps up to 28 pilots, with a pilot's lounge and mess hall.

The bridge wings were extended to give a clear view of the pilot launch landing area on each side of the vessel with CCTV camera system installed throughout the vessel's interior and exterior spaces.

In the Shipyard

Latest Deliveries, Contracts and Designs

Sunflower Kurenai: Japan's First LNG-fueled Ferry

Mitsubishi Shipbuilding Co., held a christening and launch ceremony for the Sunflower Kurenai, the first of two large LNG-fueled ferries being built for Mitsui O.S.K. Lines, Ltd. (MOL). The ceremony took place at the Enoura Plant at MHI's Shimonoseki Shipyard & Machinery Works in Yamaguchi Prefecture. The handover is scheduled for December 2022, following completion of interior work and sea trials. The new vessel will go into service from January 2023 on a regular route between Osaka and Beppu operated by Oita-based Ferry Sunflower Limited.

Sunflower Kurenai is 199.9 x 28m, with gross tonnage of approximately 17,300. The vessel has capacity to accommodate 716 passengers, an estimated 137 13-m trucks, and roughly 100 passenger cars. The main engine is a high-performance dual-fuel engine – the first of its kind featured on a domestic ferry – that can run on both liquefied natural gas (LNG) and A-type heavy oil. It is designed to provide a 20% reduction in CO2 emissions and close to zero emissions of sulfur oxides (Sox).

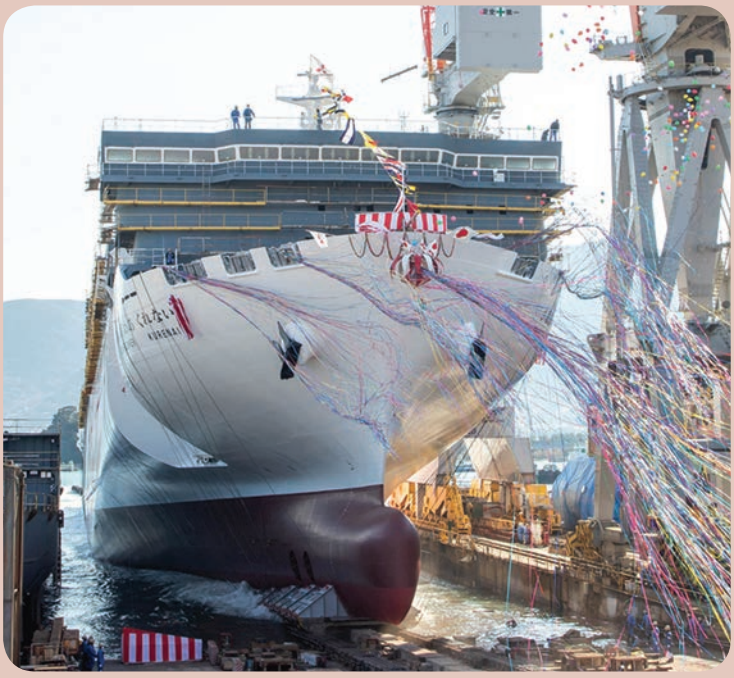

Photo courtesy Mitsubishi Shipbuilding

Elisa Aquila: LNG Carrier for Edison

On March 3, the liquefied natural gas (LNG) carrier Elisa Aquila commercially managed by France LNG Shipping and under a long-term charter contract with Edison SPA, a Milan-based energy company, was delivered. Elisa Aquila will be the second vessel to be chartered to the EDF group, a French electric power company, on a long-term basis (up to 20 years including extension options) and will be engaged in LNG transportation under the ship management of Gazocean, a French ship management company specialized in LNG, jointly owned by NYK and Geogas LNG, a French ship management company.

Elisa Aquila is propelled by WinGD-manufactured, dual-fuel slow-speed diesel engines, and feature an Air Liquide–manufactured Turbo-Brayton refrigeration system that can tap surplus boil-off gas. Manufactured by GTT, the 174,000-cubic meter capacity membrane-type tank will be made of advanced insulating materials that reduce the vaporization rate.

Photo courtesy NYK

Vessel Particulars

Length o.a.	297m
Breadth	46.4m
Gross tonnage	118,753 tons
Main engine	X-DF diesel engine
Cargo tank capacity	174,000 cu. m.
Speed	19.5 knots
Shipbuilder	Hyundai Samho Heavy Industries Co., Ltd

Image courtesy NYK, MTI, Elomatic Oy

ARLFV

NYK, MTI and Elomatic completed the development of a concept design for an ammonia-fuel ready LNG-fueled vessel (ARLFV). In this project, which started in September 2021, NYK Group and Elomatic started the development of a concept design for an ARLFV that can efficiently be converted from an LNG-fueled vessel to an ammonia-fueled vessel, based on the assumption that ammonia will become a next-generation marine fuel.

With ARLFV Phase 1 design complete, Phase 1.5 will continue until June 2022, with the team designing a similar concept for a capesize bulk carrier and a very large crude oil carrier. Until the end of 2022 in Phase 2, the team will proceed with the actual design of an ARLFV with a shipyard and marine manufacturers. This project will be completed when the actual ship design is completed, and the plan is to be in a shipbuilding contract in 2023, with a complete building of the first ARLFVs by 2025.

Photo courtesy RINA/FKAP

Tanker Concept Exceeds '50 Targets Using Fossil Fuels

RINA announced the Approval in Principle (AiP) of Swedish designer FKAB Marine Design's hydrogen powered MR Tanker, the first AiP of a design using currently viable technology and fuels that achieves IMO 2050 targets. Conceived by the class society and designed by FKAB, the propulsion is based on combining the ship's fuel (LNG) with steam to produce hydrogen and CO2. The MR LNG/hydrogen-fueled vessel is the result of a joint project with ABB and Helbio (a subsidiary of Metacon AB).

This new design enables the use of hydrogen as a fuel today without the need for bunkering and storage on board and exceeds IMO 2050 targets for 70% reduction of carbon intensity.

The MR tanker design is based on combining LNG with steam in a Helbio gas reformer to split LNG molecules into hydrogen and CO2. Hydrogen is then directly used to fuel the internal combustion engines and fuel cells in a hybrid marine power system by ABB. The CO2 is captured by splitting the LNG molecules, rather than from exhaust gas.

Using this design, hydrogen usage can be progressively increased to maintain a top CII rating throughout the life of the ship, reducing CO2 emissions in a parallel slope with the applicable regulations. The designer claims the ship can meet full decarbonization targets by either running the engine on 100% hydrogen, or by producing all the power needed by fuel cells. In this way, the owner can decide the rate of CO2 reduction.

Carbon disposal will be a vital technology for the future to meet global decarbonization goals across all sectors. The concept will not require onshore carbon disposal technology to be available before 2032.

Andreas Hagberg, Head of Sales & Marketing Department at FKAB, commented, "The concept is revolutionary because it does not require any portside hydrogen infrastructure. The hydrogen is created onboard the vessel and all necessary equipment can be easily fitted on deck, so ship owners can convert existing vessels. The fuel cells have been specifically developed to produce more power and fewer emissions."

CO2 is liquefied by the cryogenic steam from the LNG and can be used as the inert gas for the tanker. No additional bunkering, aside from normal LNG, is required. The hydrogen produced can be used to power the main engine, or fuel cells, or a hybrid of the two. The AiP covers the hybrid option.

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Woods Hole, Martha's Vineyard and Nantucket Steamship Authority

NOTICE OF REQUEST FOR PROPOSALS TO PROVIDE A FREIGHT TRANSPORTATION SERVICE FOR THE ISLAND OF MARTHA'S VINEYARD

CONTRACT NO. 10-2022

The Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (the "SSA") has issued a Request for Proposals ("RFP") from responsible and eligible proponents who wish to be considered for a license agreement to provide a freight transportation service for the island of Martha's Vineyard. Proposals will be accepted until **2:00 p.m. Eastern Daylight Savings Time on Tuesday, August 2, 2022**, at the SSA's Procurement Office, which is located on the second floor of the SSA's Administrative Offices, 228 Palmer Avenue, Falmouth, Massachusetts 02540.

The SSA has established this deadline for submitting proposals so that potential proponents will have sufficient time to submit questions and suggestions regarding the RFP after reviewing both the RFP and the documents referred to therein. The SSA asks that such questions and suggestions be submitted as soon as possible so that the SSA in turn has sufficient time to respond to them well in advance of the deadline for submitting proposals.

The SSA's hope is that the successful proponent's new freight service will become a long-term part of the marine transportation network providing the island of Martha's Vineyard with adequate transportation of persons and necessaries of life. Towards this end, although the SSA anticipates that most proponents will submit proposals to provide a conventional roll-on/roll-off ferry service to carry freight trucks and other vehicles between the mainland and the island of Martha's Vineyard, the SSA encourages the submission of proposals to provide other methods of transporting freight to and from Martha's Vineyard that might be more efficient, economical and/or ecofriendly than a conventional ferry service. If a proponent would like to submit such a proposal and is not certain whether its proposal would be considered responsive to the RFP or suitably evaluated under the evaluation criteria set forth in the RFP, the proponent should contact the SSA so that this RFP can be appropriately revised well in advance of the due date for the submission of proposals without prejudice to fair competition.

In order to receive electronic versions of the RFP and all subsequent addenda issued by the SSA to the RFP, please email the SSA's Procurement Officer, Peggy Nickerson, whose email address is **pnickerson@steamshipauthority.com**. Electronic versions of those documents may also be requested by calling Ms. Nickerson at (508) 548-5011, ext. 515, during the SSA's regular business hours.

The SSA is utilizing a RFP procurement process for this License Agreement. Under such a process, the selection of the most advantageous proposal will be based upon proposed compensation and other evaluation factors specified in the RFP. The RFP fully details the procurement process and the requirements for each proposal, and persons interested in submitting proposals for the License Agreement must comply with the provisions thereof. Unless all proposals are rejected, the SSA shall award the License Agreement to the eligible and responsible proponent who offers the most advantageous proposal to the SSA, based upon the RFP requirements and the evaluation criteria established for the License Agreement.

The SSA is soliciting competitive proposals pursuant to a determination that such a process best serves the interest of the SSA and the general public, and not because of any legal requirement to do so. The SSA reserves the right to accept or to reject any and all proposals, to modify or amend with the consent of the proponent any proposal prior to acceptance, and to waive any informality, all as the SSA in its sole judgment and discretion may deem to be in its best interest.

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