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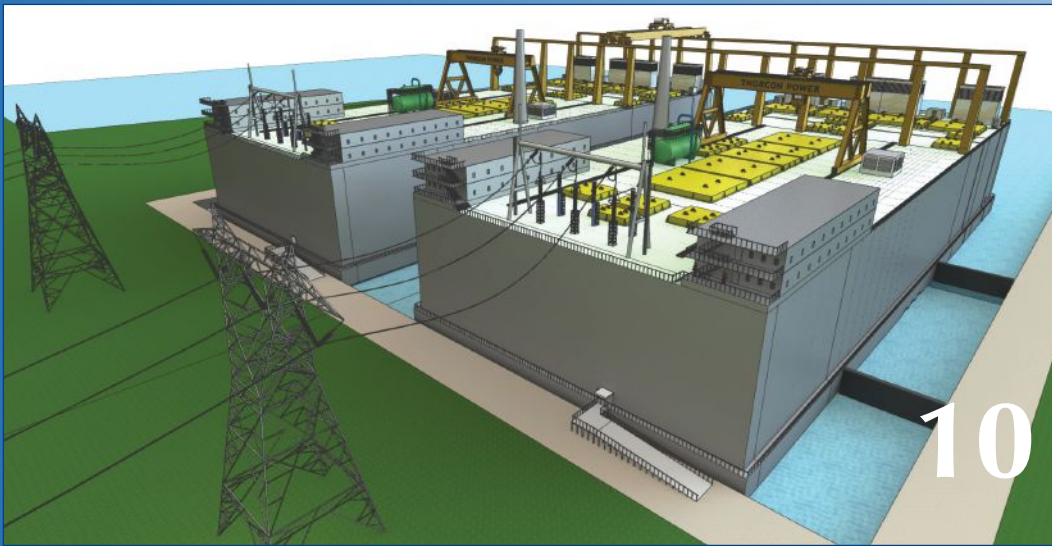


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A Markey Machine capstan windlass for pull anchors, model VEP-16-40, for BHP Billiton (Towage Services) in Port Hedland, Australia. (Credit: Markey Machine)

NEXT MONTH

Tools to measure the impact of ocean industry on the global carbon cycle ... Power-to-ammonia plant ... Machine learning approach to wave-induced vessel response ... Artificial reef installed as breakwater off Rotterdam ... Real-time wind measurement for wind-assisted propulsion.

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)) Global Ocean Energy Alliance. Leaders from 20 Pacific Island Countries and Territories (PICTs) have approved the Global Ocean Energy Alliance (GLOEA), highlighting the implementation of the 1.5-MW ocean thermal energy conversion (OTEC) platform being developed for deployment in São Tomé and Príncipe, in partnership with Global OTEC, as the basis for the implementation of an ocean energy program in the Pacific. The announcement was made during the Fifth Pacific Regional Energy and Transport Ministers' Meeting, hosted by the government of Vanuatu under the theme of "Accelerating Decarbonisation in the Blue Pacific." A major outcome of the meeting was an agreement to develop an ocean readiness program preparing the PICTs for future ocean renewable energy technologies. This measure aims to mitigate barriers and brings the latest innovations to the Pacific. Projections suggest that by 2030 the ocean economy could reach over \$3 trillion and create 40 million jobs. Global OTEC's platform called "Dominique" is a first-of-a-kind 1.5-MW floating OTEC platform being developed by the U.K.-based company, funded by a Global Environment Facility/Green Climate Fund (GEF/GCF) project. It is expected to be deployed in 2025 in São Tomé and Príncipe, located off the West coast of Africa, in the Gulf of Guinea. São Tomé and Príncipe have taken the lead in demonstrating the commercialization of OTEC in small island developing states, which will prove how diesel fuel imports can be replaced with clean energy from the ocean.

)) Launch of New US Oceanographic RV. The first of three new oceanographic research vessels dedicated to advancing marine science along U.S. coasts has been launched. The RV *Taani* is part of a project, led by Oregon State University and funded by the U.S. National Science Foundation, to provide scientists with valuable new tools to study critical issues, such as rapidly changing ocean conditions and human impacts on the marine environment. The Regional-Class Research Vessel project, supported by more than \$390 million in grants, is charged with delivering three nearly identical ships to the U.S. Academic Research Fleet. The ships are being built by Bollinger Shipyards in Houma, Louisiana, with construction staggered about six months between each vessel. *Taani* will be operated by Oregon State University and based in Newport on the Oregon Coast. The launch was led by Bollinger, which worked with LaShip, a subsidiary of Edison Chouest Offshore. "Taani" is a word used by the Siletz people meaning "offshore," and the name was chosen to recognize Oregon's indigenous peoples. The second vessel, the RV *Narragansett Dawn*, will be operated by the East Coast Oceanographic Consortium led by the University of Rhode Island. The third vessel, the RV *Gilbert R. Mason*, will be based in the Gulf of Mexico and managed by the Gulf-Caribbean Oceanographic Consortium, led by the Louisiana Universities Marine Consortium and the University of Southern Mississippi. The 200-ft. ships are designed to operate with 13 crew and up to 20 scientists for missions up to three weeks at sea. Construction of *Taani* is expected to be completed in 2024, and its first research expeditions are expected in 2025.

)) Data Set on Ecosystem Impacts of Offshore Wind. With the rapid expansion of offshore wind energy to meet ambitious global net-zero targets by 2050, Plymouth Marine Laboratory (PML) in the U.K. has produced a new evidence base on the impacts of offshore wind farm developments and the outcomes for marine ecosystem services to inform decision makers. Wind turbine substructures introduce hard surfaces that are rapidly colonized by epibenthic marine organisms, altering biomass and biodiversity within the local ecosystem. As offshore wind development continues to grow and modify marine habitats, changes in biological populations and processes could affect the provision of ecosystem services. The new data set is the first synthesis of global primary and U.K. gray literature on the ecosystem services outcomes of offshore wind farm developments. Grey literature refers to: "information produced on all levels of government, academia, business and industry in electronic and print formats not controlled by commercial publishing."

)) Autonomous Inland Vessel Demo. Kongsberg Maritime has successfully completed a live trial of autonomous shipping technology in Bornem, Belgium, demonstrating the progress the company has made in fully autonomous systems. The test vessel, *Zulu 4*, an inland waterway barge owned by Blue Line Logistics NV, is equipped for remote-operated and autonomous transport demonstrations for the AUTOSHIP project, which is part of Horizon 2020, an EU research program. As part of the test, *Zulu 4* maneuvered and navigated on unrestricted waterways, and it demonstrated berthing and unberthing capability. The vessel was upgraded with onboard control technology for remote monitoring from the onshore remote operation center (ROC). The ROC team and vessel had to show situational awareness, engine and machinery monitoring, berthing/unberthing and maneuvering in port. The same tasks were demonstrated under autonomous control, as well as collision avoidance, grounding avoidance, transit sailing and automatic mooring. *Zulu 4* also demonstrated the ability to switch between autonomous and remote-controlled operation. A safety crew was on board the vessel during the test. The *Zulu 4* completed a 16.5-km circuit, starting from a port in Niel on the Rupel River. The vessel entered a busy sea canal before traversing locks and passing several bridges, as well as a yacht club and marina. KONGSBERG technologies used in the trial included aut docking, autocrossing, automatic navigation systems, cloud-based communications systems and advanced simulations. **ST**

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Is a Cybersecurity Standard On the Horizon?

The argument for a U.S. ports cybersecurity standard was highlighted in last year's Jones Walker LLP Ports and Terminals Cybersecurity Survey, which reflects the responses of 125 C-suite executives and other leaders in the ports and terminals space. While 90 percent of respondents reported they felt prepared to withstand an attempted cyberattack, 74 percent indicated that their systems or data had been targeted by cybercriminals in the previous year. The survey also revealed that while 73 percent of the respondents purported to have a written incident response plan (an effective way to decrease exposure to cyberattacks), only one-third of those review and update their plans regularly.

The U.S. Coast Guard (USCG), the coordinator of national maritime cybersecurity, has warned that a cyberattack on U.S. ports and terminals could not only cripple cargo operations but also cause injury to people and equipment, enable contraband smuggling, and even threaten the nation's security. The USCG is tasked with ensuring the cyber readiness of the Marine Transportation System (MTS), including over 360 U.S. ports and terminals. The MTS touches more than 90 percent of all trade goods nationwide. The rising demand on capacity is pushing against the cybersecurity challenges inherent in the introduction of new and complex technologies.

To fulfill its cyber mission, the USCG determines risks in the MTS and develops mitigation strategies in partnership with other agencies and private stakeholders. Currently, the USCG requires Maritime Transportation Security Act (MTSA)-regulated facilities to conduct facility safety assessments (FSA) that identify cybersecurity vulnerabilities and incorporate protection and response components into their facility security plans (FSP). To assist stakeholders in this effort, the USCG has issued regular guidance on how to prepare for and respond to cyber incidents. The USCG Cyber Strategy manual was published in January 2015 and updated until February 2020, when the USCG issued the first formal cyber guidance, the Navigation and Vessel Inspection Circular (NVIC) 01-20, which provided facility owners with direction on non-mandatory compliance with the MTSA's cybersecurity requirements.

In January 2023, the USCG published a comprehensive, yet also voluntary, Maritime Cybersecurity Assessment and Annex Guide (MCAAG), which recommends a process for identifying and describing cybersecurity vulnerabilities so that an FSP can meet the MTSA's requirements. On the same day it released the MCAAG, the USCG published a "Notice of Proposed Rulemaking" in the Federal Register, quietly making public its plan to develop cybersecurity-specific rules as "part of an ongoing effort to address emerging cybersecurity risks and threats to maritime security by including additional security requirements to safeguard the maritime transportation system." The rulemaking process is well underway, and the proposal could be released for comment as soon as this fall.

Could the industry finally have a uniform MTS cybersecurity standard? It remains to be seen if the USCG rule will establish baseline cybersecurity practices and sensible policies that link cyber- to physical security practices and requirements, or that will impose meaningful penalties on stakeholders that fail to take cybersecurity readiness steps. And enforcement raises questions of the burden of USCG's responsibility and how it will be carried out.

While predicting the future MTSA framework would be unwise, one thing is clear: Cyber safety regulation protecting critical maritime infrastructure is necessary to preserve trade and supply chains essential to the nation's economy and to sustain the physical and economic safety of the MTS. **ST**

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APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

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Sustainable Energy for Indonesia

Molten Salt Nuclear Power Barge Project

By Jose Esteve • Erik Dagorn • Dr. Kun Chen

As we face a pressing need to combat climate change, the importance of cross-industry collaboration cannot be overstated. To address the demand for CO₂-free energy sources, Bureau Veritas (BV), a global leader in testing, inspection and certification services, and ThorCon, a company that specializes in molten salt nuclear technology, have joined forces on a project to develop a molten salt nuclear power barge in Indonesia. This collaboration not only demonstrates the power of partnership between industry leaders but also highlights the potential for new technologies to play a critical role in building a more sustainable future.

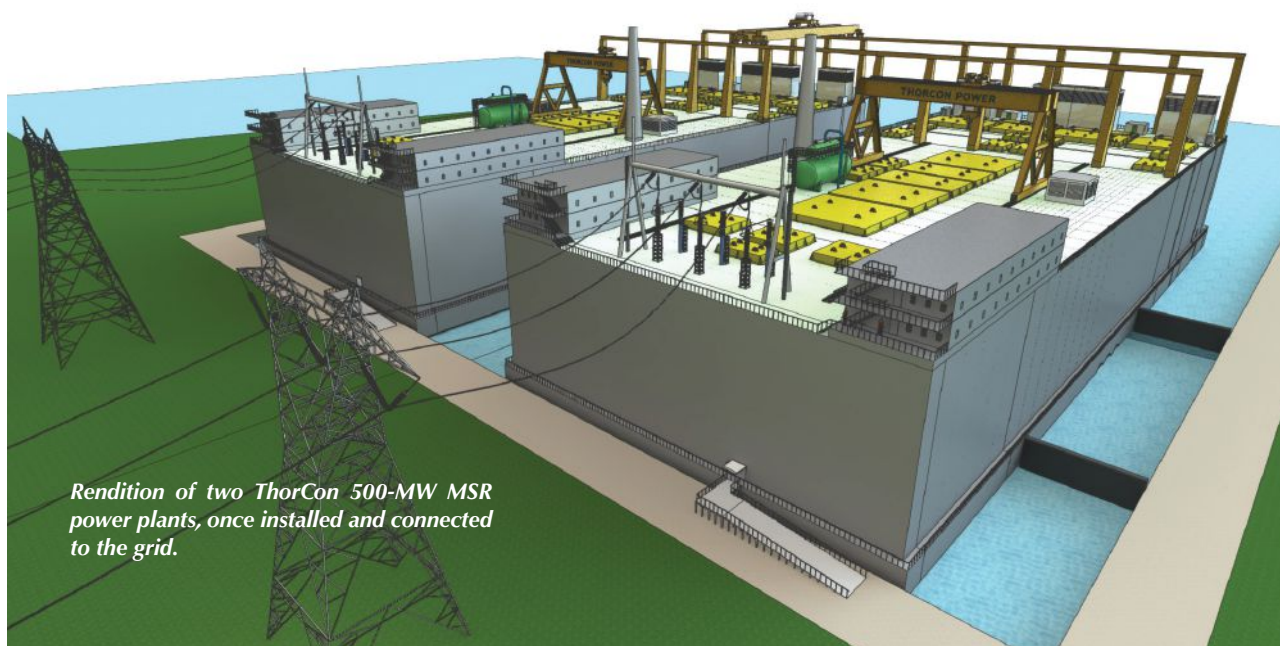
The Technology

ThorCon's TMSR-500 is a fourth-generation nuclear

technology in which an encapsulated molten salt nuclear reactor is set into the hull of a barge and is located on the seabed in shallow water near an island. If replicated across several sites, this could provide low-cost, dispatchable electricity to support Indonesia's economic growth and resource development.

The TMSR-500 reactor uses molten salt as the nuclear fuel and to transfer heat, resulting in increased efficiency at nearly atmospheric pressure and a higher operating temperature. The heat produced generates steam to drive a turbine to produce electricity. With a negative temperature coefficient, the power output drops as temperatures rise, enabling automatic shutdown if temperatures exceed normal levels, ensuring intrinsic safety.

The barge has three gas-tight barriers between the fuel



Rendering of two ThorCon 500-MW MSR power plants, once installed and connected to the grid.



ThorCon 500-MW MSR power plant in ship hull cutaway view.

salt and the atmosphere and is constructed similarly to a tanker, with a 3-m-wide double hull and a 3-m-deep double deck. Around the reactor “room” the double hull and deck are filled with sand or concrete to provide additional radiological protection to the surrounding area and to protect the reactor from external action. Impact simulations include supporting a direct hit from a Boeing 777 at 400 kt. without breach.

The joint work being done by ThorCon and BV covers the marine and offshore codes and standards that are relevant for the design, construction, installation, and operation of the asset, as well as the industry quality procedures to the level that would be expected by the nuclear safety regulator. If successful, the costs and time required for construction and deployment could make this a very promising zero-carbon energy alternative, without compromising safety.

Competitive on Cost

These barges are an appealing solution for islands and developing nations that are currently dependent on fossil fuels, as they provide affordable, consistent and carbon-free energy. They should also be more cost-effective, smaller and quicker to develop than traditional nuclear power systems on land.

The TMSR-500 generates cheaper electricity than coal because its capital and fuel costs are lower. It can also compete with natural gas costs in Europe and Asia. In comparison to solar and wind power, which are intermittent energy sources with a need for natural gas turbine generators as backup power when there is no wind or sun, ThorCon’s electricity cost is lower, and the generated electricity is cheaper than storage-buffered wind and solar electricity.

Meeting Indonesia’s Needs

At the G-20 Summit in Bali in 2022, Indonesia’s President Jokowi reaffirmed the country’s commitment to re-

duce greenhouse gases and achieve net zero. Indonesia encourages research and development of electricity generation technologies, including nuclear energy. Therefore, the Nuclear Energy Regulatory Agency of Indonesia (BAPETEN) has recently agreed on a terms of reference with ThorCon to carry out a pre-licensing consultation for its TMSR-500 demonstration project.

ThorCon partnered with Indonesian universities to conduct a survey on the project’s impact, which showed public support for decarbonization. The TMSF-500 can not only provide clean energy but also enhance the grid’s resilience, which in turn can help encourage foreign investment in Indonesia. As history has shown, countries with the fastest growth are those that have access to reliable, cheap energy. This translates to a virtuous circle of jobs generation, particularly pertinent for a country such as Indonesia with a young, growing population.

BV Partners on Safety

BV’s role is to support ThorCon in assessing and addressing risks to ensure the technology meets the highest safety standards. Experts from BV’s Nuclear Certification Department and its Marine & Offshore (M&O) Division will collaborate throughout the process, drawing on existing nuclear and shipbuilding codes where possible to build on current technical knowledge and safety protocols.

A key area of work has been to identify the applicable standards, codes and class rules and the potential gaps within them, and to develop new guidance notes and rules if needed. This collaborative process between BV and ThorCon is well underway, with different elements of the technology identified as being covered by international marine and offshore, nuclear, or civil engineering safety standards and design codes, or as requiring a new technology development approach. BV rules for marine and offshore classification are also being considered.

The next stage is to assess existing codes and stan-

“The TMSR-500 is a cost-effective, carbon-free energy solution that will provide electricity to support Indonesia’s economic growth while helping the country achieve its net-zero goals.”

dards for relevance to safety functions regulated by nuclear safety codes. Another important consideration is to evaluate the approach’s maturity compared to nuclear safety regulations by ranking consequences of failure to people and the environment. Following this, the team must define a qualification plan for items as part of the demonstration of meeting nuclear safety regulator expectations.

A key challenge is to ensure that all parties have access to the right technical expertise and resources to provide the right answers within the project time frame. Currently, there are many innovative projects that are focused on the energy transition and decarbonization, both in the maritime industry and beyond. That is why BV has focused on pooling expertise and insights from across its divisions to ensure that this project benefits from a pan-industry perspective on the latest innovations, technical knowledge, and standards.

The unique nature of this project has also meant that the entire concept is being assessed with fresh eyes, not taking anything for granted, while having the foundation of experience from nuclear land-based facilities, with their particular regulatory environment.

This project features innovative technology and provides the chance to work with new technologies and perspectives. It has been a welcome opportunity for BV’s colleagues in the nuclear energy and the marine divisions to collaborate, bringing together different methodologies and experiences. This has allowed the project team to challenge prior assumptions and encourage innovative thinking, which is crucial in developing new solutions that support the global effort to reduce emissions and meet climate goals.

Cross-Industry Collaboration

The entire project has benefited from a culture of learning across the multi-disciplinary team. From ThorCon’s perspective, it has been enlightening to learn more about marine engineering and to be able to take advantage of shipyard mass production capabilities, accelerating the construction and deployment of mitigating solutions for climate change. Project designers have brought a lot to the table, explaining why and how certain engineering choices have been made, and designers have shared their experience in other projects and brought a flexible mindset.

Cross-industry collaboration between nuclear engineering and maritime engineering has necessitated agreement on vocabulary, as terms can have different meanings in different fields. For example, the term “qual-

ification” has very different formal implications between the nuclear and the M&O industries, although its overall meaning remains similar.

Another example is the “construction” activity. For the M&O industry, this means a physical activity “at yard” leading to the erection of entire plant blocks comprising fabricated elements, plus the subsequent connections (for example, through welding) between blocks in order to build the plant. In the International Atomic Energy Agency (IAEA) glossary, “construction” is the process of manufacturing and assembling the components of a facility, the carrying out of civil works, the installation of components and equipment, and the performance of associated tests. Within the nuclear context, “construction” is one of the six major stages of the lifetime of a nuclear power plant and often requires a license from the nuclear regulator.

The project partners aim to work with shipyards, designers and manufacturers of critical equipment, as well as bringing regulators into the discussion, so all parties have a precise understanding of the terminology and technology.

Construction and Design

The multidisciplinary teams need to pull the threads of all the different systems present in the TMSR-500 plant in order to properly identify those functions and equipment that could be related to the nuclear safety functions and safety auxiliary functions, as these will be the focus of the technology qualification assessment being carried out. It also allows identifying those components that will have to go through the traditional nuclear safety regulatory process. Finally, it allows declaring the remaining other functions and items as appropriate for application of M&O codes, standards, and procedures typical for barge hull and marine equipment.

Examples of items that will have particular attention is the steel plates, with its different grades and qualities to be used, depending on their location and if part of a nuclear safety barrier. Another critical point will be the welding, its consumables, personnel qualification and procedures, as it is an essential factor to the risk of system leaks.

Design and construction involves global partners, such as a European nuclear facilities designer and a South Korean shipyard to build barges, highlighting the maritime industry’s expertise in manufacturing large and complex assets that can be transported to the installation site. This approach should be significantly more efficient than building nuclear power plants on land. If successful,

the concept should allow the dedicated construction of up to 20 units in a year at a yard, for a total power output of 10 GW.

The reactor itself will be designed and built by specialist nuclear equipment designers and manufacturers. It will be engineered for encapsulation—enclosed safe compartmentalization, allowing the storage of used nuclear fuel in the barge.

Much of the conceptual design phase has now been completed, expressed in 2D drawings and 3D CAD models, and shared with potential suppliers. Suppliers' cost estimates for future production match the company's electricity production costs.

Staged Implementation

In March 2023, ThorCon signed an agreement with the Indonesian nuclear regulator BAPETEN to commence a safety, security, and safeguard consultation in preparation for licensing a 500-MW demonstration nuclear power plant to be located on the uninhabited island of Kelasa in the Province of Bangka-Belitung. This is a significant step toward delivering the project.

The consultation with BAPETEN prepares the regulator, applicant, and stakeholders for the formal licensing process and creates a roadmap with schedules, roles and responsibilities, applicable laws and regulations, scope and format of the technical and administrative docu-

ments in the license applications, and evaluations of the design readiness.

The consultation is also a major milestone for Indonesia, which does not have nuclear power plants at present, and it signals the government's commitment to providing efficient regulation for the licensing of nuclear power in a timely and economic manner.

Demonstrating safety is important for the public acceptance of fission power. Initially, ThorCon plans to build a non-fission test facility. The fuel salt won't contain enriched uranium or generate power at this stage. Electric heating will bring components up to temperature. With no radioactivity, intrusive instrumentation, direct observation and internal access are possible. Tests will include: sudden loss of load, overheating the fuel salt, loss of water in the cooling pond, failure of shutdown rods and operating pumps, and unplanned drains. Thermal expansion, heat transfer rates, thermal hydraulic characteristics, and sensors will all be measured and verified by expert engineers, ensuring utmost safety. These tests are possible because of multiple layers of defense in the design.

Protecting the Future

The technology qualification process is expected to take three years, with an additional two years for deployment if successful. While the timeline anticipates that the

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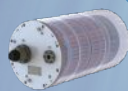
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power plant will be operational by 2029, the main priority is meeting BAPETEN's safety, security and safeguard mandates, which will ultimately dictate the timeline. Here is where BV plays a vital role, bringing its maritime and nuclear experience in technology qualification and compliance together to ensure these goals are met.

Ultimately, ThorCon intends to establish an assembly line in Indonesia to manufacture more nuclear power plants. This concept of mass production is founded in the shipbuilding industry rather than traditional nuclear plant construction techniques. The company is also working with several universities to create training programs regarding molten salt reactor technology. These activities will create a new industry in the national economy and help transform Indonesian power generation into one of the cleanest on the planet.

In conclusion, the collaboration between Bureau Veritas and ThorCon to introduce a new molten salt nuclear power barge in Indonesia highlights the importance of cross-industry partnerships and innovative solutions in addressing the urgent need for sustainable energy sources. The TMSR-500 is a cost-effective, carbon-free energy solution that will provide electricity to support Indonesia's economic growth while helping the country achieve its net-zero goals. BV's role in ensuring the technology meets the highest safety standards highlights the importance of rigorous testing and certification for new technologies. This project provides opportunities to work with novel tech and perspectives and encourages innovative thinking, which is crucial in developing solutions to meet global emissions reduction goals. **ST**

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Alternative Maritime Power

Shore-Side Grid Connection for Decarbonization, Cleaner Ports

By Dimitris Tsoulos

Berthed vessels connecting to a port's energy grid is a concept that is gathering pace. Several years ago, it became obligatory at ports along the West Coast of the U.S., and the growing requirement for shore power capabilities has since expanded to Europe and Asia. By enabling vessels to connect to the shoreside electrical grid while berthed, shore connection significantly reduces emissions in ports and improves a vessel's carbon intensity indicator (CII).

As gateways to global trade, ports are critical economic hubs. They are also a major source of air pollution. While vessels are berthed in port and running their diesel-fueled auxiliary engines to power the auxiliary equipment and accommodation load, they emit a harmful combination of pollutants, including carbon dioxide,

nitrogen oxides, sulphur oxides and particulate matter. Given the proximity of ports to densely populated urban areas, this has serious consequences for human health. The impact on marine life and the environment is also significant.

Through containerized or stand-alone options, ERMA FIRST's BLUE CONNECT offers ship owners unrivaled flexibility over how they access clean shore power. Shipping's need for shore power that is practical, adaptable and highly efficient offered an opportunity too good to miss. If ports are to continue operating in accordance with regulations, they will have to eliminate air and noise pollution sooner rather than later. There are a number of different challenges that need to be addressed when it comes to shore-side grid connection, such as different

BLUE CONNECT provides shore power to reduce carbon emissions at port.



regulations, vessel types, voltage requirements and port infrastructure. BLUE CONNECT provides shipowners and operators with a single solution that will help ports worldwide to achieve environmentally friendly operations by offering vessels of all types, power demands, and operational requirements flexible access to the electrical grid while berthed.

The 'Alternative' Route

Regulators worldwide have introduced measures directly targeting cleaner ship operations in ports. A common theme throughout the provisions is the requirement for vessels and ports to have the capacity for shore connection, otherwise known as "alternative maritime power" (AMP) or "cold ironing."

By connecting to an onshore power supply (OPS) and using it for all the energy it needs to meet hotel load requirements, a vessel can shut down its onboard generators while at berth and eliminate emissions. For shipowners, AMP is an investment with a positive ROI that can increase the commercial value of the vessel. It enables adherence to port regulations in emissions control areas (ECAs) while contributing to overall emissions reduction targets; for example, benefiting performance as calculated by the International Maritime Organization's CII. When an AMP system is used, it significantly reduces the greenhouse gas (GHG) intensity of energy consumed by the vessel and minimizes any risks associated with non-compliant port calls. Additionally, it helps ship operators reduce operating costs by reducing the burden on the auxiliary engines, extending their life cycle and minimizing the frequency and cost of maintenance.

A further incentive for shipowners and managers to invest in an AMP system such as BLUE CONNECT is charterers' increasing demand for vessels to be equipped with such functionality, frequently resulting in a willingness to cover or share the installation costs.

Yet the benefits of AMP extend far beyond those available to the vessel operator. The elimination of emissions and engine noise has a positive impact on local marine life, as well as the well-being of vessel crew, port staff and residents of port-adjacent communities, while the reduction of engine vibrations has a similarly positive effect for marine life and crew. The technology enables ports to evolve as regulations become increasingly stringent and widespread.

Regional Regulations

Europe. Published in July 2021 under the European Union's Green Deal, the "Fit for 55" legislative package contains proposals to promote and deploy shore power. Its Alternative Fuels Infrastructure Regulation (AFIR) includes requirements for ports to have OPS infrastructure in place by January 1, 2030 to supply passenger and container ships of over 5,000 gross tonnage. The AFIR defines thresholds for the number of calls above which ports are required to implement the infrastructure. Meanwhile, the FuelEU Maritime regulation includes provisions to promote the use of OPS in ports by the same ship types, requiring them to be emissions-free at berth from 2030.

North America. As of 2023, in selected California ports, 80 percent of a berthed vessel's power must come from AMP. The rule, enforced by the California Air Resources Board (CARB), initially applied to container, reefer and cruise ships. However, CARB has updated the regulation to include car carriers and tankers, which are responsible for over 56 percent of all fine particulate matter emitted by docked vessels. Following the update, car carriers have until 2025 to achieve compliance, as do tankers at the ports of Los Angeles and Long Beach. Tankers at the Port of Richmond have until 2027.

Elsewhere in North America, the government of Canada launched the Shore Power Technology for Ports Program in 2012, giving Canadian ports access to up to 50 percent of the funding needed to implement marine shore power. The program helped ports in British Columbia, Nova Scotia and Quebec to install the technology.

China. According to a China Classification Society (CCS) technical notice issued in 2018, ships engaged on international voyages and equipped with shore power capability—except tankers and vessels using equivalent measures, such as clean fuel or onboard batteries—should connect to an OPS while docked for over 3 hr. at a port inside an emissions control area (ECA). If the vessel is berthed at an inland ECA port, the threshold is 2 hr.

The CCS guidelines came into force on July 1, 2019—and as of January 1, 2021, they also applied to cruise ships, which should connect to shore power when berthed for more than 3 hr. at an ECA port with OPS capacity.

Flexible Shore Connections

ERMA FIRST's BLUE CONNECT system is a revolutionary high-voltage shore power solution suitable for both retrofit and newbuild installations, which are available as containerized or stand-alone versions. While standard models currently cater to Ro-Ro, Ro-Pax and pure-passenger ferries, as well as containerships and tankers, the system can be tailored to the needs of other vessel types upon request.

BLUE CONNECT includes a cable management system (CMS) for connecting the vessel to shore, a power transformer to convert high voltage to low voltage, and the necessary switchgear to protect crew and equipment. Operation is controlled and monitored by the shore connection main control panel, while power changeover supports shore-to-vessel synchronization to ensure an uninterrupted power supply upon connection. The solution can also be integrated into a vessel's alarm monitoring and/or power management system.

Based on vessel requirements, BLUE CONNECT is available in four configurations: low-voltage fixed connection, low-voltage portable connection, high-voltage fixed connection and high-voltage portable connection. The low-voltage options are designed for ships with an onboard power distribution of 440 V/60 Hz, while the high-voltage versions serve vessels with a power distribution of 6.6 kV/60 Hz. The fixed systems are suitable for ships requiring connection from one side only and involve a permanent connection to the main switchboard.

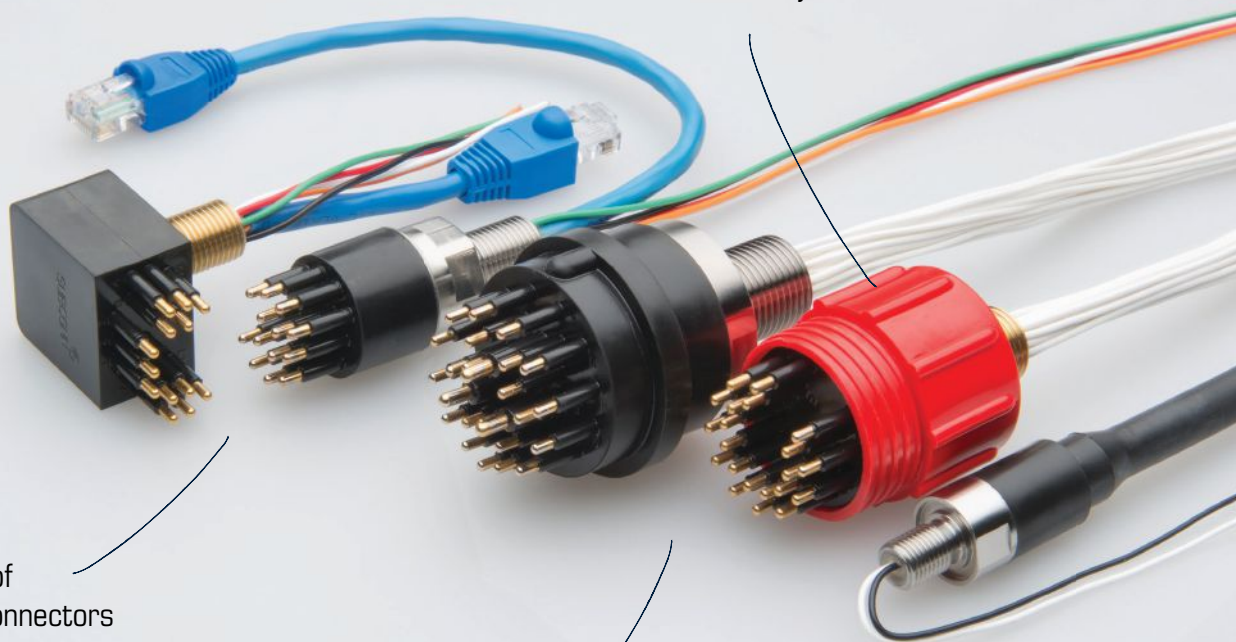


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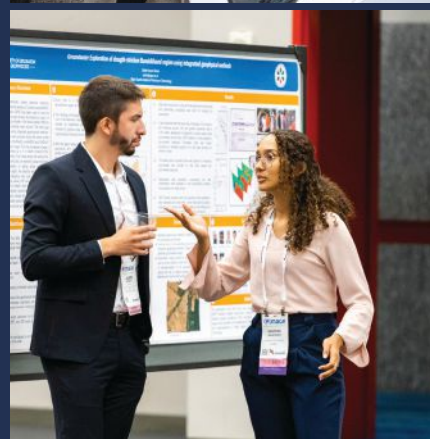
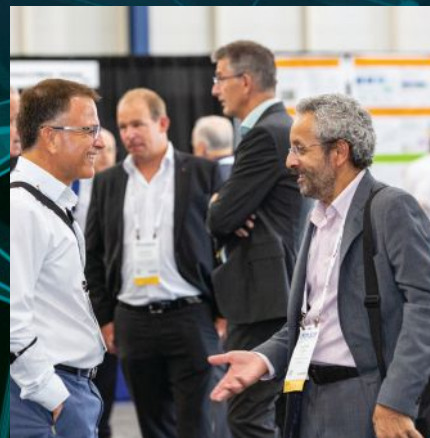
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The portable system configuration enables a plug-in connection at the port or starboard side of the vessel.

Shore Power Setup and Safety

With a growing number of ports promoting and mandating the use of AMP, standardization is paramount to ensuring the safe and efficient deployment of AMP technologies worldwide. The IEC/IEEE 80005 “Utility connections in port” series provides general requirements for high- and low-voltage shore connection systems, including detailed guidance on shoreside and onboard infrastructure—as well as the shore-to-vessel interface—and the corresponding safety measures.

On the shore side, an electrical substation including electrical protection equipment must be installed to convert the voltage and frequency levels of the local electrical grid to levels that can be utilized by the vessel as per regulations. A cabling and earthing system is also required to connect the port’s substation upstream to the main power source and downstream to the onboard connection point.

Onboard installations include all the technology needed to ensure compatibility of the vessel- and shoreside power networks, in addition to the required safety devices for protecting people and equipment. They comprise either stand-alone equipment or a containerized solution that incorporates all the necessary components.

The ship-to-shore interface centers on a CMS installed either on shore or on board according to the vessel type. If cranes are required for loading and unloading the vessel, as applicable to container ships, the space at berth is limited and the CMS must be installed on board. Cruise ships and roll-on/roll-off vessels, conversely, require a shoreside CMS installation.

For both the shoreside and onboard infrastructure, a comprehensive risk assessment is critical, including HazID (hazard identification), HazOP (hazards and operability) and FMEAC (failure modes, effects and criticality) analyses.

Required safety measures and components as described by IEC/IEEE 80005-1:2019 include the implementation of adequate protection for the medium-voltage switchboard, earth fault protection, earth switches, the mechanical interlocking of connectors and safety loops. Continuous monitoring of the system’s operations

is also essential, while various conditions must be met to ensure safe connection and disconnection.

Ensuring Safety at All Levels

Alongside flexibility, BLUE CONNECT’s other key characteristic is safe design. Typically, AMP solutions incorporate safety measures exclusively for high-voltage installations since the risks at the low-voltage level are deemed less severe. However, while less dangerous, low-voltage installations are not immune to faults. To ensure the protection of the onboard electrical grid and the system itself in line with the above requirements, ERMA FIRST conducted a risk assessment of its low-voltage solution during the BLUE CONNECT development process, and, based on the results, implemented measures including self-diagnostics that make it easy for the operator to identify the cause of any communication or power loss.

Backed up by ERMA FIRST’s engineering capabilities and marine installation expertise, BLUE CONNECT has been designed in line with the industry standards and best practices to ensure safety, reliability, flexible installation, ease of operation and regulatory compliance.

With the global regulatory landscape surrounding the use of AMP at berth finally taking shape, shipowners are increasingly acknowledging shore connection as a crucial capability. As a result, ERMA FIRST has experienced a surge in inquiries as demand increases for AMP technologies that maximize flexibility and support sustainable ship and port operations. In providing a comprehensive range of options to exploit shore power, BLUE CONNECT is offering ports worldwide unparalleled flexibility along the route to minimizing emissions. **ST**

Dimitris Tsoulos is the BLUE CONNECT director at ERMA FIRST, a leading manufacturer of ballast water treatment systems (BWTS) and sustainable marine solutions. He has an extensive understanding of marine water technologies, having worked with De Nora, Evoqua Water Technologies and Siemens. He has a master’s in electrical power engineering and management.



Evolving Power Systems

Battery Power Is Integral to the Future of Vessel Energy

By Erik Larsen

The main motivation for incorporating batteries on vessels has been to reduce carbon emissions. Today, with a decade of data and technological development, we know that a vessel's operational performance is improved with battery power, and projects are cost-justified by reduced fuel and engine capital and maintenance costs.

These days, newbuild vessels that require maneuverability or have dynamic loads due to frequent acceleration/deceleration or operation in rough seas almost always use power systems with electric drives. Key advantages of electric drives include the availability of maximum torque across the entire speed range, as well

as flexibility in installation of equipment and availability of electric power for all the vessel's loads.

Furthermore, batteries are relatively easy to incorporate into the power distribution network and energy management systems, including those using emerging alternative fuels, providing flexibility in hybrid energy and power management.

Instantaneous, Reusable Power

Batteries can optimize a vessel's power and energy management systems in two primary ways. One is instantaneous power availability. The energy stored in a battery is available almost immediately. There is no ramp-up pe-



Corvus Energy will supply the battery-based ESS for the ABB electric propulsion system on board the all-electric tug eWolf by Crowley. (Credit: Crowley)



Corvus Orca BOB, a modular battery room solution, will be used for shoreside charging of the Crowley eWoli in the Port of San Diego. (Credit: Crowley)

riod, as with combustion engines. Thus, battery power is ideal for peak shaving in vessels with dynamic load profiles. The other is rechargeability. The energy stored in batteries can be used and replaced thousands of times. The electrochemical reaction in a battery can provide power for a vessel's load one moment, and a moment later be reversed to recharge and store energy again.

Thus, batteries on board add to the capability to store renewable energy and reduce consumption of the main fuel source. Even if a greener fuel is used to reduce the fuel's carbon footprint, a battery will reduce fuel consumption, thus reducing fuel costs.

To Corvus Energy's knowledge, every significant manufacturer of marine engines and propulsion systems, as well as integrators of hybrid power management systems (PMS) and energy management systems (EMS), is incorporating battery energy storage systems (ESS) into their new designs—regardless of the fuels used.

There are numerous considerations to match a vessel's operating profile with the appropriate battery cell chemistry and to optimally integrate the energy storage system, and it is important to work with suppliers of PMS/EMS and ESS with experience in hybridization of a wide variety of vessels.

Alternative Fuels Complemented by Energy Storage

Responsible for about 12.5% of the transportation sector's CO₂ emissions, it is clear that the maritime industry needs to quickly find alternatives to diesel and marine gas oil. A variety of alternative fuels are already in use, being demonstrated, or under investigation.

There is no single "best" alternative fuel for the marine industry. Each has its advantages and disadvantages, depending on the vessel operational profile. Two factors impact the deployment of alternative fuels. One is whether the power source is an internal combustion engine (ICE) or fuel cell (FC). The other is energy density: How will sufficient fuel be stored for the entire voyage? Generally, gases will need to be compressed or liquefied to increase energy density and stored in tanks on board.

Chief among the fuels already in use is natural gas. Advantages of using natural gas are: lower emissions than diesel; the ability to use dual-fuel (natural gas/diesel) engines; availability of liquid natural gas (LNG) at many ports and bunkering facilities; and widespread knowledge of safe distribution and operation practices. However, due to the risk of releasing methane (CH₄)—the primary compound in natural gas and a greenhouse gas almost 25 times worse than CO₂—natural gas is considered a transitional fuel on the path to decarbonization.

Hydrogen (H₂), ammonia (NH₃) and methanol (CH₃OH) are also expected to gain traction as alternative fuels in coming years. However, liquid hydrogen, ammonia and methanol have 34, 51 and 63 percent of the volumetric energy density of LNG, respectively. In turn, LNG has only a third the volumetric energy density of diesel, making fuel efficiency paramount in a vessel's propulsion system to reduce the size of storage tanks on board vessels.

Moreover, gas engines inherently have slower response rates than liquid-fuel engines and are thus complemented with instantaneous battery power. Fuel efficiency can be improved by 10 to 25 percent by incorporating a battery energy storage system in a hybrid power configuration.

Hydrogen Fuel Cell Range Extender

Hydrogen and ammonia hold the potential for carbon-free emissions, and hydrogen will likely be the first carbon-free fuel to have a significant presence in the marine industry. Already, dozens of smaller boats and yachts are using hydrogen fuel cells as their primary source of electricity. A number of pilot projects are underway on larger vessels.

Challenges to widespread use of hydrogen include: required liquification for storage and transportation due to the low energy density of gaseous hydrogen; limited production capabilities of "green" hydrogen produced by electricity-intensive and expensive electrolysis of water; and lack of bunkering infrastructure at maritime ports.

***“Batteries can optimize a vessel’s power and energy management systems in two primary ways.
One is instantaneous power availability ...
The other is rechargeability.”***

Still, the advantages outweigh the disadvantages. The hydrogen fuel cell reaction produces no carbon emissions. Furthermore, hydrogen fuel cell technology is relatively advanced and understood, albeit not fundamentally designed for the marine industry.

In response, Corvus Energy is developing an inherently gas-safe maritime fuel cell based on technology from Toyota, scheduled to be available in 2024. In addition, Corvus is leading a research consortium to optimize hydrogen-powered marine vessels, as well as reduce costs and extend the lifetime of both the hydrogen FC and batteries in hybrid configurations.

Battery-Powered and Battery-Assisted Propulsion

Similar to electric vehicles, batteries in marine vessels can be used in three modes. Hybrid mode reduces emissions by 10 to 50 percent. A battery can be paired with a fuel cell or a combustion engine and be used in conjunction with any traditional or alternative fuel. The battery can be recharged either with shore power (plug-in hybrid) or by the vessel’s generator when there is excess power generated. Fuel savings come from peak shaving and load leveling, such that the engine can run at optimal loads. Engine maintenance costs can be lower due to reduced engine hours.

Fully battery-powered, zero-emission mode is ideal for a vessel that docks routinely multiple times a day. Vessels can also switch from hybrid to full battery power to enter emission-free areas.

Spinning reserve or auxiliary power mode eliminates the need for engines used for spinning reserve, thus avoiding the capital and maintenance costs for those engines. Maritime authorities now permit the battery banks used for auxiliary power to also be used for peak shaving and other applications, as long as a minimum energy capacity is maintained for auxiliary power.

A Variety of Solutions

Given the wide variety of vessel types and different modes of operation, it has become evident over the decade since large-scale battery energy systems started being used in marine applications that there is no single battery chemistry and ESS design that suits all needs. For this reason, Corvus Energy offers various battery ESS in its product portfolio, each with different ideal use cases.

Orca ESS is a versatile model with high energy density and high C-rate that allows for fast charge/discharge. Orca is well suited to ferries, offshore vessels and workboats. Dolphin ESS is a lightweight and high-energy-den-

sity ESS with a flexible, modular design that allows the ESS to fit into irregularly shaped battery compartments. Dolphin is well suited to passenger ferries, yachts and workboats. Blue Whale ESS is designed to be deployed in massive multi-megawatt-hour ESS and is best suited for large Ro-Pax and Ro-Ro ferries, merchant vessels, and cruise ships.

Zero-Emission Port Infrastructure

Because of increasingly strict emissions regulations in ports around the world, batteries are also making their way into two shore-based applications: port handling equipment and energy bunkering.

Corvus has deployed hundreds of battery systems for rubber-tired gantry (RTG) cranes—both battery-diesel hybrid and fully battery powered—resulting in 40 to 100 percent emissions reduction. Further, Corvus is providing the battery for what we believe to be the first hybrid system in combination with a hydrogen fuel cell.

We expect significant growth in the use of batteries for shore-based energy bunkering to store energy at off-peak times, reducing the burden on a weak grid and taking advantage of reduced rates at off-peak times. Whether for private fleets or as a commercial energy-as-a-service enterprise, containers filled with batteries will become a common sight near shipping, marine services and transportation operations.

Infrastructure development for widespread electrification will only come with the collaboration of a variety of technology and service providers, including but not limited to: the grid electricity provider, municipal and port authority, port operator, shipping company, vessel charter, maritime regulatory authority, and battery and other electrical systems providers.

A Case Study in Collaboration

A perfect example of this type of collaboration is the effort led by Crowley, a U.S.-based maritime, energy and logistics company. As part of its commitment to decarbonization, Crowley has ordered the construction of an all-electric tug from Master Boat Builders, with a 6.2-MWh Corvus Orca ESS integrated into the electrical system and EMS provided by ABB. The *eWolf*, an 82-ft. assist tug with 70-ton bollard pull, will be the first electric tug operating in the United States. Furthermore, two containers with a total energy storage capacity of almost 3 MWh will be provided by Corvus for shoreside charging. Operation is expected to begin in San Diego by the end of 2023.

It has taken considerable consultation and collaboration to make this groundbreaking project a reality. The eWolf is a result of a partnership among Crowley, the San Diego County Air Pollution Control District, the California Air Resources Board, the Port of San Diego, the U.S. Environmental Protection Agency and the U.S. Maritime Administration, which all provided financial support and other resources. Furthermore, Crowley and Shell Trading (US) Co. ("Shell") have signed a memorandum of understanding to support alternative energy solutions for shoreside and terminal operations.

"Corvus Energy's storage system will enable Crowley and our federal, state, and local partners to reach our shared commitment of reducing emissions and providing cleaner air for the San Diego community," said Paul Manzi, vice president, Crowley Shipping. "The innovative technology also will help ensure high performance and reliability as the tugboat serves customers, providing a model for sustainability at ports around the nation."

The eWolf and the shoreside infrastructure are designed to allow the vessel to operate fully electric with full performance capabilities, as well as draw energy at off-peak hours from the grid. The use of the Corvus ESS shoreside will allow eWolf to charge quickly, potentially avoiding the need to upgrade the electricity grid infrastructure at the port.

Future-Proofing with Batteries

As the marine industry grapples with decarbonization, power systems and the technology needed to store energy for long voyages and provide power on demand are in focus. We see a variety of alternative fuels being tested and piloted. We see combustion engine/generator sets (gensets) undergoing transformations to accommodate these emerging fuel sources. Fuel cells are being redesigned and repackaged to suit stricter maritime safety regulations. Progressive energy producers are collaborating to build out the infrastructure that will be needed—from green fuel generation and distribution to liquification plants to bunkering and on-vessel fuel storage.

One thing is clear: Regardless of the fuel source, battery energy storage will be integral to improving the performance of future electric-drive power systems with better fuel efficiency, extended range and zero-emissions operation. **ST**

Erik Larsen is the vice president of sales in the Americas at Corvus Energy. He brings two decades of marine industry experience to the role. Since early on, he has had a strong interest in the maritime business, with five generations of family at sea. Throughout his career, Larsen has worked in a wide variety of roles, including engineering, sales, management, operations and business development. He has experience working with electrical systems, switchboards, alarms and monitoring, and HM&E (hull, mechanical and electrical) equipment from previous roles at Rolls-Royce and Trident Maritime Systems. He received his B.E. in naval architecture and U.S. Coast Guard Third Mate license from SUNY Maritime College in New York. He resides in Osprey, Florida.



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Driving Decarbonization

Toronto's Marilyn Bell Ferry Goes Fully Electric

By Andy Wright

Around the globe, the marine industry is moving toward decarbonization, replacing diesel engines with electric power. Greenhouse gas emissions and air pollution from diesel fuel, along with noise pollution and the potential for oil and chemical spills, have a significant impact on both human life and the marine ecosystem.

Many ports and municipalities have implemented initiatives to decrease carbon emissions and noise volume from vessels. But retrofitting older vessels with a new power system is a challenge.

PortsToronto faced this challenge with its *Marilyn Bell* ferry. Named after the first person to swim across Lake





Work in progress building out the electrical system that now powers the ferry. (Credit: Canal Marine and Industrial)

Ontario in 1954, the ferry had been in use since 2009, providing passenger, vehicle and cargo transportation to Billy Bishop Toronto City Airport, a regional airport owned and operated by PortsToronto and located on the Toronto Islands. PortsToronto had launched an initiative to reduce carbon emissions from the airport and all the vessels in its fleet. In 2018, the ferry was converted to run on biodiesel fuel, but by 2020, PortsToronto was looking to fully decarbonize it.

Achieving Full Electrification

PortsToronto hired Ontario-based Canal Marine and Industrial, a leading provider of electrical engineering installations, to deliver the complete electrification retrofit of the formerly diesel ferry, from conception to installation. Canal had a long history of working with Danfoss Drives and knew that its VACON Common DC Bus electrification products would work seamlessly to power the electrical system.

"Danfoss drives are robust and well accepted in the industry and integrate with a variety of applications," said

Shawn Balding, general manager at Canal.

The vessel's propulsion system consists of two electric motors, each powering a thruster, forward and aft. There are two autonomous power plants for redundancy, each utilizing battery arrays, air-cooled VACON NX Series drive modules, grid converters and DC/DC converters, plus filters, all working together in common DC bus topologies to provide power conversion between the batteries and motors to power the vessel's thrusters and other electrical systems. The batteries are charged through the common DC bus distribution system via an automatic

power connection to shore.

Each vessel function—ventilation, radar, pumps, hydraulics—is connected to the main AC bus distribution, supported from the common DC buses via dual redundant grid converters.

"Fundamentally, all functions relating to energy storage, propulsion and essential services are duplicated and autonomous," said Balding.

The vessel makes four round trips per hour during a 19-hr. day and recharges each time it docks at the mainland via an automated 400-kW pantograph charging system. This creates a shore-to-vessel DC connection, the first of its kind in North America, which integrates with the Danfoss electrification system, utilizing the active front end module to convert the AC utility power to DC power for use by the vessel systems. As soon as the vessel docks and the vehicle ramp is lowered, the vessel starts charging via the pantograph, initiated using wireless communication between the vessel and the equipment onshore.

"The Danfoss VACON product line is a complete range," said Chris Wright (no relation to the author), lead electrical engineer at Canal. "The DC/DC converters, drives, active front ends and grid converters are all based on the same platform and are flexible and scalable. It's great to have all that available in one set."



(Left) Onboard ferry controls used by the operator. The digital display shown here depicts the electrical system. (Below) Marilyn Bell is now a fully electric ferry with resulting zero emissions and lower operating noise.



Installation and Implementation

Once the system was designed, built and factory tested, installation and commissioning, including tearing out the existing engines and related equipment, took about five months, with the ferry back in service by the end of 2021. The ferry was fully operational from the first day. With the electric power system, it starts up with just a flip of a switch. In addition to reducing startup time (with its diesel engines, the vessel would need about a half hour to warm up and for the crew to check fluid levels), the electric system is easier and cheaper to maintain, saving PortsToronto an average of \$150,000 in energy and operating costs per year. Other than periodic checks of the vessel's fans, motor and filters, little maintenance is required. A monitoring system alerts the crew if something requires their attention.

The electric motor has also significantly reduced noise from the ferry's operation, to the benefit of the neighborhood. And by eliminating the use of 196,000 liters of diesel fuel per year, the electrification of the ferry has helped PortsToronto lower its carbon footprint substantially.

"Powered entirely by electricity from clean wind and solar sources, the retrofitted *Marilyn Bell* has eliminated greenhouse gas emissions from the ferry operation, reducing Billy Bishop Airport's direct emissions by approximately 530 tons per year," said Chris Sawicki, vice

president of infrastructure, planning and environment at PortsToronto. "In addition to operating more efficiently and eliminating related air emissions, the retrofitted vessel builds on the airport's award-winning Noise Management Program, as it will operate far more quietly, dramatically reducing related noise in the surrounding community."

This project shows the market potential and environmental benefits of electric-powered vessels, particularly short-haul ferries, and also highlights that the technology is as applicable to existing vessel conversions as it is for newbuilds. The savings in expensive diesel fuels, zero emissions and much lower operating noise levels all justify the investment. This is yet another example of deploying proven technologies to meet emissions reduction targets. **ST**

Andy Wright has over 40 years of experience in the sales and applications of drives. He is currently a technical opportunity manager at Danfoss Drives, assisting the regional sales managers and specializing in marine and electrification projects.



AHC Winch Design

How Operational Conditions Factor into Defining the System

By Iván Arias • Brais Muñoz



Ibercisa Deck Machinery has collaborated closely with Scantrol for over 10 years.

Every day our customers request winches with ever more precise control. This is the case for vertical profiling winches, where requests for active heave compensation (AHC) are predominant. The main objective of AHC is to maintain a load at a constant depth, compensating for the vessel's movements. This is most often in demand on oceanographic vessels, where capturing high-quality samples or avoiding damage to scientific equipment is the main objective for this level of control.

Ibercisa Deck Machinery's close collaboration with Scantrol for more than 10 years has enabled both compa-

nies to grow and expand their know-how in this field. The experience acquired, with the help of all our customers, has positioned both companies as world leaders in the oceanographic sector.

The design of winch equipment requires a great number of inputs. A detailed analysis of the operational conditions that the winch will be subjected to is fundamental, as well as of the peripherals that make up the operation (cables, scientific instruments, etc.) and an integration study of the vessel's diverse auxiliary equipment (frames, pulleys, etc.). As such, open communication is



The specifics of operational conditions are essential to Ibercisa's custom winch design.

needed during the entire design process between the vessel designer and shipowner to fulfill the expectations of the end-user.

Design Factors

Defining the operational conditions is vitally important for winch design. Ideally, data would include the movement at the vessel's cable exit points, but in most projects, especially during the initial phases, such information is not available. The studies and trials that yield these data are denominated as "seakeeping," which can be defined as the dynamic behavior of a vessel at sea. This behavior depends on many parameters related to the geometry of the boat and the sea's characteristics in the area of operation, as well as the use of passive stabilizing tanks that can be controlled. Thus, we have to carry out the movement calculation as an approximation of a sinusoidal wave based on known period and ampli-

tude. This allows us to establish the maximum required acceleration and speed.

Working depth is another of the main variables in winch design, particularly affecting cable selection and, consequently, its weight. This will be important in deep-sea operations, especially for winches with capacity of more than 10,000 m of cable. Once operational depth is established, cable selection will depend on the purpose of the winch, for example, whether it's for use for a camera, CTD, etc. This will determine the physical properties of the cable and the calculation of the winch's working conditions, with the weight being the main variable. Correct cable selection helps to optimize the winch design.

Definition of the scientific equipment, and its weight both in air and water (payload), is the next necessary calculable variable. A well-defined payload will help the winch work within an efficient range of operation. It's worth mentioning the particular needs of AHC towing mode (as opposed to vertical profiling mode). Here we see a new variable dynamic: force generated by the speed of the vessel. In towing mode, we focus on drag force rather than payload, which is the physical force caused by the towing of the scientific equipment.

When designing a winch system, it is important to know its position on the boat and the various related launch and recovery systems (LARS) because these factors will define the cable exit positions on the winch. These variables will be crucial in figuring out the movement to compensate, taking data from the motion reference unit (MRU), such as Scantrol's mTrack, to achieve the pulley's final position. We all know the importance of space on vessels and

the need to design for the limited space available, which is why the size and efficient positioning of elements are key to a more precise operation of the equipment, even to the extent of increasing its working life.

In a winch where dynamic behavior is a factor, a detailed analysis of the powertrain focusing on optimization of inertia can lead to significant improvements in required power. This is the Ibercisa philosophy: personalized and iterative analysis in search of the right solution for the requirements of an operation. As such, it is common to carry out numerous studies and redesigns to find a solution that satisfies those needs while not limiting other uses of the system or causing an excessive increase in the power demand.

In terms of the type of drive used, while there are still clients that consider hydraulic drive the best option, our recommendation for applications that need very precise position control is electric drive. There are also certain technologies that can bring further improvements to the dynamic behavior of the equipment, such as the use of permanent magnet motors, as this type of drive allows a greater inertia/power ratio. These considerations are made without losing sight of the objective of a safe, efficient and highly reliable operation.



company Skipsteknisk. This project includes fishing and oceanographic winches, such as a camera/CTD/acoustic winch and an oceanographic winch, both with AHC that will compensate vessel movement at depths of up to 6,000 m.

Other operators that have chosen Ibercisa winches with AHC mTrack from Scantrol for their new vessels are: Instituto Español de Oceanografía, Spain; Instituto Português do Mar e da Atmosfera, Portugal; the National Research Council, Italy; Belgian Science Policy Office and Royal Belgian Institute of Natural Sciences; Irish Marine Institute; Environment Agency, United Arab Emirates; Greenland Institute of Natural Resources; Swedish University of Agricultural Sciences; and the Indonesian Navy. To learn more, visit <https://ibercisa.es>. **ST**

Scantrol's mTrack is an AHC controller with integrated motion reference unit. It is used in combination with Ibercisa's equipment.

Alongside the search for efficiency, we are a company committed to looking after the environment, with our solutions focused on energy management and storage systems. We are creating significant energy savings, in some cases attaining 50 percent energy savings and reducing the carbon footprint of the equipment.

Projects

A standout project on which Ibercisa and Scantrol are working involves the new research vessel *Kaharoa* for the National Institute of Water and Atmospheric Research (NIWA) of New Zealand, currently being built at Armón Shipyard in Vigo, Spain, to a design by the Norwegian

Iván Arias is a senior engineer with more than 15 years in the naval sector, and he has been the CTO at Ibercisa Deck Machinery since 2016. He focuses on the design and operation of deck machinery.



Brais Muñoz is a mechanical engineer with over 10 years of experience in the industry. He has combined his education in industrial engineering with his experience in winch service activities. He is currently working at Ibercisa as an expert in research vessel operations.



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Abate Notation for Jackup

Vahana Aryan, the flagship vessel of the Dubai-based Vahana Marine Solutions DMCC, has become the first jackup unit to receive DNV's Abate-Ready notation. The Abate notation is designed to assist the owners and operators of offshore units to identify and implement measures that can lead to reductions in greenhouse gas (GHG) emissions.

While the International Maritime Organization (IMO) is implementing a range of regulations to reduce the carbon intensity of sea-going vessels, offshore installations are not currently covered by the same rules. With stakeholder pressure high, the offshore industry is still seeking greater sustainability at its installations and is keen to explore different ways of achieving this. DNV's Abate notation helps offshore operators

reach these goals by providing a framework for operational and technical GHG abatement measures.

Indigenous Operator of Support Vessels in Guyana

Bourbon Marine & Logistics has partnered with the Guyanese company Tethys Marine & Logistics, which has become a 51 percent shareholder of the Bourbon Guyana joint venture. With 75 percent Guyanese directors, Bourbon Guyana is the first indigenous offshore support vessels operator in the country, fully compliant with the most recent local content regulations.

With a fleet of six vessels (large PSV, AHTS and tugs) and the full range of marine services, Bourbon Guyana has operated in the country since 2019 and has since then successfully supported ExxonMobil Guyana and Saipem Guyana for

the development of Stabroek field, promoting local employment with more than 70 Guyanese seafarers on board its vessels.

Fugro FEED Surveys in UAE

Fugro has been awarded a contract for site characterization services in support of one of the largest long-term field development programs in the United Arab Emirates. The series of offshore surveys includes geophysical, geotechnical and ROV inspections supported by advanced engineering and geoconsulting studies to help inform the front end engineering design (FEED). The project consists of approximately 600 km pipeline route assessment with 800 crossings, 49 jacket surveys and island offshore surveys.

Near-real-time insights into the ground conditions will be available using Fugro's remote data management solutions. Delivered via Fugro's digital platform, these insights

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will allow the client to reduce uncertainties related to ground conditions, make timely and well-informed design decisions and realize significant capital expenditure savings across the field development program.

OTEC Milestone

An important milestone on the way to building the first commercial ocean thermal energy conversion (OTEC) platform was achieved by Global OTEC Resources. The U.K.-based company has received its first certificate of approval for the methodology of installation of a cold-water riser, for the purposes of an off-shore OTEC platform. This forms a crucial step in the design process, using standards already tested and applied to the oil and gas industry for implementation in OTEC deployments.

The certificate was issued by the marine warranty surveyor company ABL Group. This approval is particularly important given the technical challenges faced by OTEC installations and the long history of OTEC's unsuccessful implementations. Previous OTEC projects highlight where to exercise caution, so third-party technical due diligence from the earliest stage is important for Global OTEC's success.

Global OTEC has designed what will be the first commercial-scale OTEC system: The 1.5-MW floating platform named "Dominique." Set to be installed in São Tomé and Príncipe in 2025. Generating power from the temperature difference naturally present across the tropical area of the ocean, OTEC uses warm surface seawater to evaporate a fluid, which produces a vapor that spins a turbine. Cold water from deep in the ocean is then used to cool the vapor and condense it back into a liquid so the cycle can continue all year round.

Safety in Seas Awards Winners

The National Ocean Industries Association (NOIA) has named Halliburton and Oil States International as the winners of the 2023 NOIA Safety in Seas Awards competition, sponsored by Compass Publica-

tions, the publisher of *Sea Technology*. Halliburton has won the Safety in Seas Safety Practice Award, and Oil States has won the Safety in Seas Culture of Safety Award.

Halliburton was recognized for its Risk Management and 5 Checks to Go programs, which are part of Halliburton's "Journey to ZERO" vision of achieving zero safety incidents, zero environmental incidents and zero nonproductive time.

Oil States was recognized for the overlapping suite of processes to improve safety performance across the company's global operations, including: executive commitment and monitoring; clear communication of vision; development and implementation of structured management systems; and the consistently applied commitment of each employee to protect themselves and others. **ST**

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Guidelines for Shipboard CCS

ClassNK has released “Guidelines for Shipboard CO₂ Capture and Storage Systems” that include provisions for indicating the class notation for vessels equipped with CO₂ capture and storage systems or designed as “ready” for their installation.

In addition to fuel transition, interest in capturing CO₂ from ships’ exhaust gas is growing as a way to reduce greenhouse gas emissions, and the development of on-board systems for capturing and storing CO₂ is being undertaken. ClassNK has joined the Carbon Capture on the Ocean (CC-Ocean) project with Mitsubishi Shipbuilding Co. Ltd. and Kawasaki Kisen Kaisha Ltd. on the world’s first marine-based CO₂ capture system on actual voyage, and has been involved in the evaluation and verification of the entire project from a safety perspective.

Working Group on Methanol Bunkering

DNV has joined a working group on methanol bunkering, managed by the Standards Development Organisation at Singapore Chemical Industry Council (SCIC-SDO), the classification society announced at Singapore Maritime Week. The multi-stakeholder working group will develop a technical reference (TR) for methanol bunkering for Singapore, the world’s largest bunkering hub.

The SCIC, formed the working group in consultation with the Maritime and Port Authority of Singapore (MPA). The working group, which includes government agencies, bunker suppliers, bunker craft operators, engine manufacturers, testing and certification bodies, shipowners and operators, terminal operators, as well as classification societies such as DNV, will develop a TR that will cover custody transfer requirements (quantity and quality) for the delivery of methanol as a bunker fuel. It will examine all aspects of bunkering, from the bunker tanker to the receiving vessels, the operational and safety requirements for methanol bunkering, and crew training and competency.

New Partners for Seabed 2030

The Nippon Foundation-GEBCO Seabed 2030 Project has partnered with SEA-KIT International, a provider of cutting-edge USVs to the maritime, ocean science and research industries. NORBIT Oceans, a provider of underwater imaging and mapping technology, has also partnered with Seabed 2030.

These partnerships accelerate the mission to map the entire ocean floor before the end of the decade. All data collected and shared with the Seabed 2030 project is included in the free and publicly available GEBCO global grid.

Updating Maritime SAR for Climate Change

The International Maritime Rescue Federation (IMRF) has launched its #FutureSAR initiative that will identify the key challenges the global maritime search and rescue

(SAR) industry will face as a result of climate change and propose guidance and best practices that will aid rescue operations in the future.

The initiative, which is being funded by Lloyd’s Register Foundation, is the world’s first SAR industry-wide response to the effects of climate change on the maritime SAR sector as coastal communities, maritime activity and the infrastructure that they depend on become exposed to increasing risks.

#FutureSAR will look at new rescue scenarios (e.g., storm surges), alternative fuels and protecting infrastructure, to name a few.

Sonardyne Chooses UK ADCP Reseller

Sonardyne has appointed RS Aqua as the U.K. reseller for its new Origin 600 ADCP. It is the first ADCP to include an integrated acoustic modem and advanced onboard Edge processing, enabling remote access to all core features and providing high-quality, intelligent data in near real time. It can also link to other external sensors.

Innovasea Moves into Greece

Innovasea, specializing in advanced aquatic solutions for aquaculture and fish tracking, has purchased Aquanetix, a U.K.-based aquaculture software company, and moved its operations to a new office in Greece. This is Innovasea’s second major expansion in the last three years. Founded in 2015, Aquanetix’s cloud-based aquaculture management software provides customers with deep insights into farm operations.

Underwater Cable for Subsea Garden

NOVACAVI has supplied an underwater hybrid cable for the Nemo’s Garden experimental project, the world’s first underwater cultivation system of terrestrial plants, located off the coast of Noli, Italy. The garden comprises an array of suspended, transparent, dome-shaped greenhouses called biospheres, anchored to the bottom of the sea. The garden is monitored on land through cameras and sensors, thanks to the underwater cable, which is part of the AQUANCABLE range.

Oil Analyzer Business Transfer

Auramarine Oy and Finnish Measurement Systems Oy (FMS) have entered into a business transaction whereby FMS’s business operations will be transferred in their entirety to Auramarine. FMS has been an active oil analyzer manufacturer since 1996. Its main product is the Porla Analyser fuel quality analysis device for the oil refineries market to analyze the compatibility of oils. With today’s expanding variety of fuel oils, Auramarine sees the benefits of this product along the maritime fuel supply chain.

Company Change at Sea-Bird Scientific

Sea-Bird Scientific will become part of a new public company, Veralto, in the fourth quarter of 2023. For existing customers, the brand and customer interfaces will remain intact, along with Sea-Bird’s commitment to advancing ocean science. **ST**

California Legislation Promotes Ocean Energy

The California Senate has introduced a bill to promote and facilitate the development and growth of wave and tidal energy in the state, which will help California reach its ambitious clean energy goals. The bill calls for a comprehensive and collaborative study to “evaluate the feasibility and benefits” of these renewable energy resources. It also requires the state’s Energy Commission to develop a strategic plan for the deployment of wave and tidal energy technologies, infrastructure and facilities.

The bill notes that ocean energy represents the “third largest source of renewable energy and the largest source of underutilized renewable energy.”

\$562 Million for Climate-Ready Coasts Initiative

The U.S. Senate Committee on Commerce, Science and Transportation and NOAA have announced \$562 million to fund projects across the country to support coastal communities responding to climate change through the NOAA Climate-Ready Coasts initiative, including \$477 million for 149 natural infrastructure projects in 30 coastal states and territories. The funding for these grants was secured through the Bipartisan Infrastructure Law and Inflation Reduction Act.

The funding also includes \$46 million through the National Fish and Wildlife Foundation National Coastal Resilience Fund for projects that will help communities prepare for increasing coastal flooding and more intense storms while improving thousands of acres of coastal habitats.

The funding also provides for \$39.1 million to the 34 state coastal zone management programs and 30 national estuarine research reserves that work in partnership with NOAA under the Coastal Zone Management Act.

Historical Research on Hurricanes and Climate

The U.S. Geological Survey (USGS) is working with several partners to capture real-world data and identify the frequency and strength of past storms that weren’t previously studied.

One effort led by the USGS looked back 2,000 years at hurricanes in northwest Florida. During that time period, local climate conditions, including sea surface temperatures in portions of the Gulf of Mexico and northern Atlantic Ocean, were similar to today and what is anticipated in the future. The reasons for warming differ between the two time periods, though, as past conditions were due to natural factors, such as changes in the sun’s radiation, and more recent warming is primarily due to human activities.

The USGS research suggests that existing records of recent storms may under-represent how often powerful hurricanes have made landfall in northwest Florida. The research also supports forecasts by organizations such as NOAA that the number of intense hurricanes could increase in the future in parts of the Gulf of Mexico and Atlantic Ocean as oceans warm.

This science can help improve hurricane forecasts and inform policymakers and managers as they prepare adaptation and mitigation plans to protect people, infrastructure and the environment. Studying the past provides a new baseline context and perspective of storm activity, as well as new insight on how the climate and other environmental factors can influence hurricanes.

MARAD Grants for Small Shipyards

The U.S. Department of Transportation’s Maritime Administration (MARAD) has announced \$20.8 million in grant awards to 27 small shipyards in 20 states through the Small Shipyard Grant Program. The funds will help shipyards modernize, increase productivity, and expand local job opportunities while competing in the global marketplace.

“As shipbuilding technologies continue to advance, Small Shipyard Grants help America’s shipyards acquire the equipment they need to compete, thrive and expand America’s maritime industry,” Maritime Administrator Ann Phillips said. “These grants are also economic boosts to the communities in which shipyards are located, as well as to our industrial supply chain.”

Final EIS for Ocean Wind 1

In support of the Biden-Harris Administration’s goal of deploying 30 GW of offshore wind energy capacity by 2030, the U.S. Bureau of Ocean Energy Management (BOEM) has completed its environmental analysis of the proposed Ocean Wind 1 wind project offshore New Jersey, which could power up to half a million homes with clean renewable energy.

Ocean Wind LLC proposes to construct up to 98 wind turbine generators (WTGs) and up to three offshore substations within its lease area. At its closest point, the Ocean Wind 1 project will be at least 13 nautical mi. southeast of Atlantic City, New Jersey. Export cables are anticipated to make landfall in Ocean County and Cape May County, New Jersey. If all 98 WTGs are approved for installation, the estimated capacity range will be from 1,215 to 1,440 MW, capable of powering up to 504,000 homes per year.

If approved, Ocean Wind 1 will be the third commercial-scale offshore wind project located on the U.S. Outer Continental Shelf approved by the Biden-Harris Administration.

Supreme Court Narrows Clean Water Act’s Scope

In its recent ruling on *Sackett v. EPA*, the U.S. Supreme Court has narrowed the scope of federal protection of wetlands under the Clean Water Act, restricting protection to wetlands that directly adjoin rivers, lakes and other bodies of water. Critics of the ruling warn that this decision renders wetlands more vulnerable to filling and development and, thus, more pollution.

The Clean Water Act tasks the federal government with regulating water pollution, while regulation of land use is the responsibility of state and local governments. Regulation of wetlands is contentious because the line between water and land is constantly changing. **ST**

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Offshore Vessel Optimization



The new version of Vessel Performance provides enhanced onboard decision support through a more user-friendly interface. Optimizing running engines and reducing excess equipment usage, Vessel Performance assists the crew in reducing fuel consumption and maintenance costs. Data are shared in real time with onshore personnel. Kongsberg Digital.

Attenuation Sensor

AC-S provides in-situ optical data of beam transmission and absorption over a minimum of 75 wavelengths in real time. This broad spectrum attenuation sensor with new LED installation has applications for climate modeling, ocean color validation and carbon cycling research. Based on the highly successful AC-9, the AC-S offers almost an order of magnitude increase in spectral resolution of in-situ absorption and beam attenuation coefficients. Sea-Bird Scientific.

S-100 Data Management System

SDMS is designed to help organizations better manage their S-57/S-100 data sets and comply with the dependencies set out in the standards. Manufacturers of electronic navigation charts can apply predefined workflows to ensure that the ENC quality assurance process is as compliant as possible with standards. SevenCs GmbH.

Multi-Domain ASV

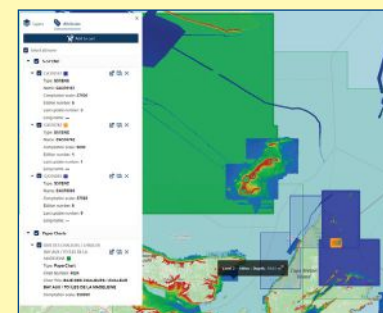
Devil Ray T24 is a 7-m ASV. The base configuration offers burst speeds up to 50 kt., open-ocean cruising

ranges up to 600 nautical mi., and a payload capacity up to 1,800 lb. The T24 can execute missions with multiple advanced above- and below-surface sensors over both line-of-sight and satellite datalinks. It enables easy adoption of emerging AI capabilities. Maritime Tactical Systems Inc. (MARTAC).

Vessel Management

The new extension of the popular MyFleet vessel management tool enables users to calculate and predict Carbon Intensity Indicator (CII) and other performance parameters for upcoming voyages. MyFleet 1.15 enables users to choose the most fuel-efficient route, reduce their operational carbon footprint, and easily record and report data. ChartWorld GmbH.

Hydrospatial Data Management



CARIS Cloud platform has three new applications: the CARIS Bathymetry Data Service, S-57 ENC Service and Chart Data Service. The robust and scalable CARIS Cloud allows for the management, processing and distribution of hydrospatial data, all from one platform. Leveraging CARIS Cloud accelerates and automates product delivery, enabling hydrographic offices to focus on planning and implementing the transition to S-100. Teledyne CARIS.

Weather Monitoring

Deep Navigation Analytics (DNA) Platform is a centralized,

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Oyster Aquaculture Could Improve Potomac River Estuary

Oyster aquaculture in the Potomac River estuary could result in significant improvements to water quality, according to a new NOAA and U.S. Geological Survey study published in *Aquatic Geochemistry*. All of the nitrogen currently polluting the Potomac River estuary could be removed if 40 percent of its riverbed were used for oyster cultivation, according to the study. [3-23-2023](#)

Navy's Laser Weapon Ready For Summer Deployment

Navy engineers are making final adjustments to a laser weapon prototype that will be the first of its kind to deploy aboard a ship into the summer. The prototype, an improved version of the laser weapon system, will be installed on the USS Ponce for testing in the Persian Gulf. Navy leaders have made electric-energy weapons a top priority to counter what they call asymmetric threats. [3-23-2023](#)

Ferry Sinks Off Coast of South Korea

With 462 passengers onboard, a ferry sailing from Incheon, South Korea, to the island Jeju sank near the southern tip of South Korea Wednesday, according to Associated Press. Most of the more than 100 people on the ship were high school students and people on the ship were high school students. In the rescue effort, more than 100 vessels and at least 18 aircraft swept in to pull passengers from the water to safety. [3-23-2023](#)

Pay Increase for Sailors Soon to Come

Sailors serving for the U.S. Navy could see a pay raise in the coming weeks, reported the Virginia Pilot. On May 1, sailors serving on board ships will receive a pay raise. The increase in pay comes as an effort by the Navy to increase the pay of sailors. Currently, this spend is a part of a job involving long deployments. [3-23-2023](#)

US Senate Reviews DOE Budget Request

For fiscal year 2025, the Department of Energy requested \$21.8 billion. The U.S. Senate Appropriations Committee, Subcommittee on Energy and Water Development, held a hearing last week to review the funding request and discuss financial priorities. According to Lamar Alexander (R-Tenn.), research should be a focus of spending. [3-23-2023](#)

US Technology Helps in Search for Flight 370

More than a month after Malaysia Airlines Flight 370 went missing, crews are hard at work trying to uncover what happened to the Boeing 777. Acoustic signals emitted from the flight, provide a lead to the location of the plane, and eight countries are participating in the effort to scan the waters off the coast of Northwest Australia. Crews Johnson from Naval Sea Systems Command told Sea Technology how the U.S. Navy is helping in the search. [3-23-2023](#)

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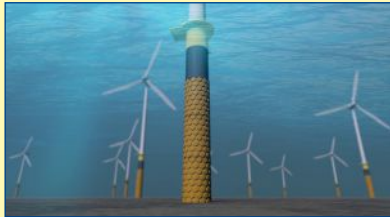
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space-powered hub that delivers essential insights to maritime stakeholders. The product features maritime weather data APIs, actionable intelligence APIs, decision-support solutions and visualizations. DNA offers a holistic view of global fleet positional data while visualizing real-time weather conditions in an online dashboard. Spire Global Inc.

Scour Protection System



HexDefence integrates seabed protection and flow reduction to minimize offshore operational costs and potential cable failure. The structure eliminates the requirement to dump rock, instead providing a non-invasive approach to protecting the monopile and the immediate surrounding area. Balmoral Comtec Ltd.

Managing Vessel Performance

OneLink combines several performance platforms under one umbrella, helping maritime operators manage the intricacies of vessel performance and emissions regulations. It incorporates the latest digital tools, such as using AR/VR to create digital twins and applying machine learning to solve performance issues by predicting hull and engine health. OneLink.

Data for Offshore Operations

Data Explorer enables users to evaluate both real-time and historical data from multiple devices in one application. It allows for integration of various types of data from a wide range of sensors. Users from any offshore-related sector can set up their own custom-built dashboards, based on their preferred parameters and the type of information they want to access and analyze. Miros Group.

Tactical Diving Vehicle

Shadow Seal is an adaptable light-

weight TDV able to transport a pilot, navigator and two passengers in surface, semisubmerged, and submerged mode with a range of 80 nautical mi. It is tailored to Special Operations Forces to covertly cross the expanding offshore and littoral water gap. Adaptable to suit a variety of ISTAR and combat requirements, the platform provides sophisticated protection to complex, high-value platforms and critical infrastructure. JFD.

Cable Fault Information

Cable Fault Heatmaps comprise the analysis of over 4,500 historical fiber-optic faults. This tool enables you to plan cable routes in the lowest fault-rate areas, understand likely fault causes, and make informed decisions about maintenance requirements in the future. Cable Fault Prediction Reports enable you to consider the security of a specific cable route ahead of installation and plan in advance for the optimum maintenance provision over

the life of a cable system. OceanIQ (Global Marine Group).

Scalable Ocean Data Camera

CoastAware BuoyCam provides subscribers access to 360° real-time views through images from sensor locations along coastlines. This improves the way search and rescue, vessel pilots, and coastal aviation companies navigate the coast and open seas with access to a visual reference to better understand conditions, such as fog and debris in the water. MarineLabs.

Metocean Data for Offshore Wind

The cloud-based Marine Data Platform (MDP) for offshore wind development and operations has been upgraded with native metocean data forecasts, so marine survey, energy company and offshore contractor end-users can improve data quality control from various sensors, e.g., multibeam echosounders and sub-bottom profilers. True-Ocean GmbH and Spire Global. **ST**

A Twitter advertisement for Sea Technology. It features a blue cartoon bird holding a magazine titled 'SEA TECHNOLOGY SERVICES THE WORLD'. The magazine cover shows an offshore oil rig. The text 'FOLLOW SEA TECHNOLOGY ON...' is at the top in large yellow letters. The Twitter logo and the URL 'twitter.com/SeaTechnology' are at the bottom in yellow.

US Navy Orders More Defender ROVs

VideoRay has received a \$16.1 million order for Mission Specialist Defender ROVs and related components for the U.S. Navy's Maritime Expeditionary Standoff Response (MESR) program. This brings the U.S. Navy's total procurement of Mission Specialist Defender vehicles and accessories to \$49 million since entering into a production-other transaction agreement (P-OTA) with VideoRay.

With this order, the U.S. Navy continues its efforts to procure and equip Explosive Ordnance Disposal (EOD) units with the Mission Specialist Defender as the base platform for the MK20 Defender ROV program. This program uses advanced technology provided by these ROVs to locate and neutralize underwater mines, such as those being laid near Ukraine and in other maritime war zones.

ABB Electric Propulsion for Spain's Flagship

ABB has secured a breakthrough contract with the Spanish state-owned Navantia shipbuilding company to retrofit the Spanish Navy flagship, *Juan Carlos I*, with an electrical propulsion system based on dual ABB Azipod units. Due completion in 2025, the project is the first of its kind on a naval ship.

The contract follows a study undertaken by ABB in 2020 to determine the feasibility of installing new pro-

pulsors on the ship. ABB's scope of supply for *Juan Carlos I* comprises two Azipod propulsors and medium-voltage drives, with support and maintenance available locally from the ABB service center in Spain and worldwide via ABB's global service network.

Nigerian Navy Partners with Seabed 2030

The Nippon Foundation-GEBCO Seabed 2030 Project has a new partnership with the Nigerian Navy in support of its mission to achieve a complete map of the ocean floor by the end of the decade. This partnership marks a significant milestone for Seabed 2030, as it is the first collaboration of its kind in Africa.

The Nigerian Navy is among the largest navies on the African continent and brings valuable expertise and resources to the initiative. In addition to providing defense services, the Navy acts as the sole national authority on hydrographic, charting and tidal matters. With the potential involvement of up to 20 vessels in the Nigerian fleet, the country's participation with the Seabed 2030 project will enable the initiative to expand its reach and make great strides in its goal.

A quarter of the global seabed has been mapped thus far. All bathymetric data from the project are freely available via the GEBCO Ocean Map.

Glider Launch Milestone at Sea

Teledyne Marine and the U.S. Navy have successfully executed the first-ever undersea glider launch from a helicopter and the first-ever successful deployment from an aircraft. The Teledyne-owned Slocum glider, configured with Littoral Battlespace Sensing – Glider (LBS-G) mine countermeasures (MCM) sensors, was launched from the ramp of a U.S. Navy helicopter flying "low and slow" over shallow waters. Teledyne Marine provided Slocum glider piloting and technical support in theater.

The MCM commander now has the capability for rapid and widespread glider deployment by task force elements under direct, tactical control, eliminating the dependency on strategically tasked oceanographic ships. The gliders provide critical environmental information to optimize acoustic and optical MCM sensor performance. This constitutes a revolution in MCM decision support.

BIO-SEA BWTS for US Navy Vessels

BIO-UV Group's BIO-SEA ballast water treatment system (BWTS) designed for the U.S. Navy has completed factory acceptance tests at the production facility in France. BIO-UV Group now has approval to ship the system to a U.S. Navy facility for operational testing.

BIO-UV Group is working with The Columbia Group, Inc. (TCG), a U.S.-based engineering partner and prime contractor in the development project. Teaming up with BIO-UV Group, TCG was awarded a contract in 2021 to develop a military version of BIO-SEA's U.S. Coast Guard-approved ultraviolet light (UV) ballast water disinfection system to equip future Navy ships. The system developed for the Navy is a robust, filtration and UV-based BWTS that can handle flow rates up to 300 m³/h. Plans include a system capable of up to 1,000 m³/h. **ST**

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ABS Certifies Vessel Insight

Kongsberg Digital's cloud infrastructure Vessel Insight has received the American Bureau of Shipping (ABS) Product Design Assessment (PDA) certificate for SMART (INF) for data infrastructure in accordance with the ABS Smart Functions Guide, in addition to ABS CyberSafety PDA certification. This is the first time ABS has awarded this combination of endorsements to a single product.

Vessel Insight is a software-as-a-service (SaaS) solution that provides vessel-to-cloud data infrastructure, capturing and aggregating quality data in a cost-effective and secure way, enabling quality reporting, empowering transparency, and allowing for in-depth analysis to optimize performance.

Furthermore, the Kongsberg Vessel Insight platform is the first to be reviewed by ABS for compliance with the newly released International Association of Classification Societies (IACS) UR E27 cybersecurity requirements. UR E27 aims to ensure system integrity is secured and hardened for the cyber resilience of onboard systems and equipment.

Fast-Charging Station in SF

Marine fast-charge operator Aqua superPower has announced the installation of the first marine fast-charging station in the San Francisco Bay Area at Westpoint Harbor in Redwood City. Westpoint Harbor offers modern slips up to 120 ft. and dry storage. As a Clean Marine award holder, Westpoint Harbor leads the way with sustainable marina management practices, and the decision to become the first Aqua network host in the Bay Area continues that tradition by supporting the growing number of boat users who want to switch to clean electric boating.

Electric propulsion is rapidly becoming a significant trend in the boating industry, and Aqua superPower has been at the forefront of supporting marinas, commercial operators, boat builders and boat

owners in bringing electric power to the water since 2021.

Aqua superPower's chargers use the Combined Charging System (CCS) for both leisure and commercial electric boat users. The company's self-titled app helps customers find charging stations, check availability, provide real-time charge session management and handle billing.

Aquaculture Resident Drone

Hydromea, a Swiss-based autonomous underwater robotics company, has partnered with Unplugged, a Norwegian specialist in inductive charging and data transfer technology, to develop a resident underwater drone system for continuous inspection and monitoring of underwater assets. The project received €2 million in grant funding from the partners' respective national organizations and will take 30 months to complete.

The initial focus of the drone solution is on the aquaculture industry. The system will be designed to remain underwater for months at a time and perform daily data sweeps, providing farmers with up-to-date comprehensive remote condition monitoring of operations.

AiP for Cyber Resilience Tech

Korean Register (KR) has awarded an approval in principle (AiP) to HD Hyundai Heavy Industries (HD HHI) and HD Korea Shipbuilding & Offshore Engineering (HD KSOE) for their innovative Technical Procedures and Methodology for Implementation of Ship Cyber Resilience (IACS UR E26). This milestone achievement marks the successful collaboration between KR and HD Hyundai in the development of ship cyber resilience technology.

Ship cyber resilience encompasses measures taken to reduce cyber accidents and mitigate their impact on the operational technology systems essential for the safe navigation of ships. IACS UR E26, introduced in April 2022, establishes unified requirements for cyber

resilience in ships and will become mandatory for vessels contracted for construction from January 2024.

Software to Lower Emissions

Following the successful pilot of emissions.AI, Repsol Sinopec is extending the use of OPEX software to several of its U.K. Continental Shelf operated assets in alignment with its emission management plans. As part of the company's commitment to emissions reduction and net zero, the extended roll out will see the technology adopted across four installations.

Repsol Sinopec initially deployed OPEX's emissions.AI on its Piper Bravo asset for a trial period of three months to evaluate and demonstrate how the technology can identify sources of operational emissions and provide quantifiable emissions reduction opportunities. The technology enables visual access to granular energy and emissions intelligence through an intuitive web-based platform.

Guidelines for E-Logbooks

ClassNK has released "Guidelines for Electronic Logbooks," specifying basic requirements for approving electronic logbooks used on ships.

Electronic logbooks for decks, machinery, etc., are expected to become more widespread because of the benefits of reducing the workload on crews for recording tasks, improving accuracy, and transitioning to a paperless system. Meanwhile, currently, only logbooks required by MARPOL have defined electronic media specifications. Unified requirements for electronic logbooks in other areas, such as the deck, have not yet been established, so electronic logbooks for such purposes requires individual approval from flag state governments.

ClassNK has developed these guidelines to contribute to the expansion of the safe and effective use of electronic logbooks for any purpose on ships. The guidelines also include product testing, drawing on existing International Maritime Organization guidelines and other international standards. **ST**

environmental monitoring

Emission Compliance

A new paper, led by Plymouth Marine Laboratory with partners at exactEarth Europe Ltd. and TNO, has highlighted possible solutions to help improve ship emission compliance and attribution.

A number of new regulations have been implemented by the International Maritime Organization (IMO) over the last decade, following global concerns over air quality. Emissions of sulphur dioxide (SO₂) and nitrogen oxides (NO_x) from ships have been limited in emission control areas, where high shipping activity is in close proximity to coastal regions with high populations, such as northwest Europe and the eastern seaboard of the U.S.

Any legislation needs to have a robust and rigorous monitoring program to ensure compliance and prove attribution to individual vessels. Current compliance is measured by inspection of logbooks and fuel samples taken in port, which is time consuming and costly. Some innovative techniques, such as “sniffer” drones, are being trialled but are unlikely to meet the scale of coverage needed, and in-port inspections are still needed to meet legislative compliance standards.

As the global population and ship-based trade increases, without enforceable regulations, the impact of SO₂ and NO_x pollution is expected to increase, including negative health effects.

The ship emission monitoring network needs to expand significantly so it has the capacity to cover all locations where there is shipping activity, around the clock. The team’s recommended concept builds on two widely accessible technologies of low-cost portable gas analyzers, designed to measure automobile engine exhausts, and satellite-based automatic identification systems (S-AIS). By combining these technologies with devices that already transmit ship locational data via S-AIS, the approach has the potential to cover 100 percent of the global ocean while also being able

to attribute emissions to individual ships in real time.

Foggier Arctic Affects Routes

As the Arctic warms and loses sea ice, trans-Arctic shipping has increased, reducing travel time and costs for international trade. However, a new study published in *Geophysical Research Letters* finds that the Arctic Ocean is getting foggier as ice disappears, reducing visibility and causing costly delays as ships slow to avoid hitting sea ice.

Arctic sea ice has been shrinking for decades. That loss has opened shipping channels in the Northwest Passage and the Northern Sea Route, allowing even non-icebreaker vessels to skip the time-consuming Panama and Suez Canals farther south. But as the ice recedes, cold air is exposed to more warm water, and warm vapor condenses into fog in those new passages. Hidden chunks of ice already pose risks to vessels making their way through foggy, low-visibility routes.

Fog is cutting into time gained by taking the much shorter Arctic routes; shipping speeds on foggy days are slower than on clear days. As the Arctic gets foggier, shipping could continue to slow unless routes are adjusted. A multi-day delay due to fog quickly increases the costs of a trans-Arctic crossing.

Role of Dust in the Ocean

New research led by Oregon State University has begun to determine the role dust plays in nourishing global ocean ecosystems while helping regulate atmospheric carbon dioxide levels.

The ocean plays an important role in the carbon cycle; carbon dioxide from the atmosphere dissolves in surface waters, where phytoplankton turn the carbon into organic matter through photosynthesis. Some of the newly formed organic matter sinks from the surface ocean to the deep sea, where it is locked away, a pathway known as the biological pump, which is one of the key controls on atmospheric

carbon dioxide that drives global warming and climate change. The new paper, to which the University of Maryland and NASA contributed, estimates that deposition of dust supports 4.5 percent of the global annual export production (sink) of carbon. Regional variation can be up to 20 to 40 percent.

In low-latitude ocean regions, the signature of dust input is predominantly seen as an improvement in phytoplankton health, but not abundance. In contrast, phytoplankton in higher-latitude waters often show improved health and increased abundance when dust is provided. This contrast reflects differing relationships between phytoplankton and the animals that eat them.

Lower latitude environments tend to be more stable, leading to a tight balance between phytoplankton growth and predation. Thus, when dust improves phytoplankton health, or growth rate, this new production is rapidly consumed and almost immediately transferred up the food chain.

At higher latitudes, the link between phytoplankton and their predators is weaker because of constantly changing environmental conditions. Accordingly, when dust stimulates phytoplankton growth, the predators are a step behind, and the phytoplankton populations exhibit both improved health and increased abundance.

Water Quality Probes Along the River Eider

MacArtney Germany GmbH has been operating four water quality probes at the River Eider in northern Germany since January 2023 as part of the Zukunft Eider project for the Waterways Authority Elbe-Nordsee. The EXO III probes by YSI are mounted at four stations along the outer and tidal parts of the river and have been collecting data on water temperature, conductivity, dissolved oxygen concentration, and turbidity. The high-resolution data set from a 12-month period will inform models for river basin and hydro-engineering system analysis and a forecast model. **ST**

contracts

Telenor Maritime, Arendal, Norway, has entered a collaboration agreement to develop solutions to meet the rising demand for high-quality, high-capacity connectivity with a cyber-secure, redundant IT infrastructure. Globetech AS.

GE Power Conversion, Villebon-sur-Yvette, France, has signed an agreement to renew its partnership to develop marine fuel cell solutions, building on a pilot project for a large-scale marine fuel cell application that resulted in feasibility support to a cruise provider for its technical and commercial evaluation of decarbonization solutions. Nedstack Fuel Cell Technology.

MIND Technology Inc.'s, The Woodlands, Texas, Seemap unit has received an additional order for a GunLink source control system for delivery later this fiscal year. Undisclosed.

VIKING's, Esbjerg, Denmark, Life-Craft system will be installed as the main evacuation solution on board the new diesel hybrid-electric Interislander ferry fleet operated by KiwiRail to connect the two main islands of New Zealand. KiwiRail.

VARD, Ålesund, Norway, has signed a contract for the design and construction of two battery hybrid commissioning service operation vessels (CSOVs) for a U.K.-based offshore wind services provider, with an option for two additional vessels. Purus Wind.

EST-Floattech's, Badhoevedorp, Netherlands, Octopus Series battery system will be installed on board a fully electric ferry. The new E-Cat Ferry will operate between Norddeich and the island of Norderney. Damen Electric Fast Ferry and AG Reederei Norden-Frisia.

ICR Integrity, Abu Dhabi, United Arab Emirates, and its partner Advanced Petro Services (APS) will

deliver a five-year composite repair project for all Adnoc Offshore assets using the Technowrap engineered composite repair solution. Adnoc Offshore. **ST**

meetings

Note: The coronavirus (COVID-19) pandemic could affect event dates. Check event websites for the latest updates.

AUGUST

August 20-24—World Water Week, Stockholm, Sweden. www.worldwaterweek.org.

August 28-September 1—IMAGE 2023, Houston, Texas. <https://tinyurl.com/uc2db9k3>.

SEPTEMBER

September 6-8—Fleet Maintenance & Modernization Symposium, San Diego, California. www.navalengineers.org/Symposia/FMMS2023.

September 11-15—London International Shipping Week, London, U.K. <https://londoninternationalshippingweek.com>.

September 12-13—International Antifouling Conference, Gothenburg, Sweden. <https://antifouling-conference-2023.confetti.events>.

September 18-20—FWS – South America Offshore Wind, Rio de Janeiro, Brazil. andrew.chadderdon@questfwe.com or <https://fws.southamerica.com>.

September 18-22—National Marine Electronics Association (NMEA) Conference & Expo, Orlando, Florida. 410-975-9425, mreedenauser@nmea.org or www.nmea.org.

September 25-28—OCEANS 2023 Gulf Coast, Biloxi, Mississippi. <https://gulfcoast23.oceansconference.org>.

OCTOBER

October 3-5—International Boat Builders' Exhibition and Conference, Tampa, Florida. www.ibexshow.com.

October 18-20—NOIA 2023 Fall Meeting, Amelia Island, Florida. www.noia.org/event/noia-2023-fall-meeting.

October 22-25—AAPA Annual Convention & Expo, Aurora, Colorado. <https://aapa.getregistered.net/2023-annual-convention-and-expo>.

October 24-27—WISTA International AGM and Conference, Montevideo, Uruguay. <https://wistainternational.com/event/2023-wista-international-agm-conference>.

DECEMBER

December 3—Naval Power Egypt, Cairo, Egypt. www.navalpoweregypt.com.

December 4-6—AAPA LATAM Convention of Ports, Barranquilla, Colombia. <https://aapa.getregistered.net/latam-convention-of-ports>.

December 4-6—Marine Renewables Canada Conference, Ottawa, Canada. <https://marinerenewables.ca/event/marine-renewables-canada-2023-conference-december-4-6-in-ottawa>.

2024

FEBRUARY

February 26-29—Blue Innovation Symposium, Middletown, Rhode Island. <https://blueinnovationsymposium.com>.

NOVEMBER

November 4-7—EURONAVAL, Paris-Nord Villepinte, France. www.euronaval.fr.

November 7-9, CLEAN GULF—San Antonio, Texas. www.clean-gulf.org.

For more industry meetings, visit sea-technology.com/meetings. **ST**

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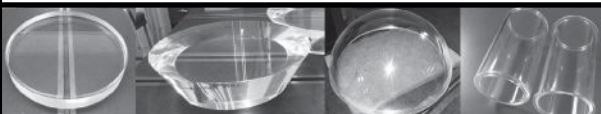
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The Magic of Marine Microalgae—Dr. Charles Greene

Dr. Charles Greene has a Ph.D. in oceanography from the University of Washington (UW), was a post-doctoral fellow at the Woods Hole



Oceanographic Institution, and directed Cornell University's Ocean Resources and Ecosystems Program. Currently, he is associate director for research and strategic planning at UW's Friday Harbor Laboratories and chief sustainability officer for Sophie's Bionutrients.

The world population recently surpassed 8 billion people, and global food production will need to increase by more than half to meet society's projected nutritional demand in 2050. Yet our global food production system is unsustainable and inadequate to meet even today's demand. About one quarter of the world's population is malnourished, with 2 billion people consuming diets deficient in essential nutrients and over 800 million people unable to secure their basic caloric requirements.

An overlooked source of food from the sea could help close this global nutritional gap. Marine microalgae hold important nutritional and environmental benefits and, with the right investments to bring them into the global food market, could sustainably feed the world population in a way that existing food sources cannot.

Consider terrestrial agriculture, which currently provides the backbone of our global food production system. The potential of meat, dairy, and food crops to close the projected nutritional gap will be highly constrained by their negative impacts on climate, land use, freshwater use, and biodiversity.

There are also constraints on existing food sources from the sea. Most wild-capture fisheries are fully exploited or overexploited. An expansion of finfish, shellfish, and

seaweed aquaculture using current practices would increase nutrient pollution; the spread of diseases and parasites among wild populations; and conflicts with fishermen, ocean energy providers and other competing stakeholders, exhausting available space in the coastal ocean long before closing the projected nutritional gap.

Marine microalgae cultivated in onshore aquaculture facilities offer an attractive alternative. They provide a better source of protein and essential amino acids than terrestrial plants. They also provide certain micronutrients, including vitamins, antioxidants, omega-3 polyunsaturated fatty acids, and minerals, that are difficult to derive from other nutritional sources. Similar to soy, microalgae-derived protein powders can be incorporated into supply chains to produce dairy and meat substitutes, as well as pastas and baked goods. Due to the miracles of modern food science, algae-based products can look, taste and smell like the food products they are substituting for. Plus, they tend to be nutritionally superior.

An onshore marine microalgae aquaculture industry can offer many environmental advantages when compared to today's terrestrial agriculture. Marine microalgae exhibit growth rates that are typically more than an order of magnitude greater than the most productive terrestrial crops. Thus, the onshore cultivation of marine microalgae can produce an equivalent amount of food from less than one-tenth the land area. This land footprint advantage would enable marine microalgae to close the global nutritional gap in ways that would be impossible to achieve with terrestrial agriculture.

Additionally, because the onshore cultivation of marine microalgae does not require soil, irrigation and fertilizer applied directly to the environment, such an aquaculture industry would not need to com-

pete with agriculture for arable land and freshwater, nor lead to fertilizer runoff and the subsequent downstream pollution of freshwater and marine ecosystems. By reducing agriculture's arable land and freshwater footprints, such an aquaculture industry can reduce the pressure of deforestation, potentially leading to globally significant reductions in greenhouse gas emissions and terrestrial biodiversity loss.

Not all areas of the world are created equal when it comes to cultivating marine microalgae. While Eurasia and North America have long served as the world's breadbaskets, a marine microalgae aquaculture industry's greatest potential lies in the Global South. Favorable financing will determine if such an industry can take hold there and improve the balance of food production between the two socioeconomic hemispheres. Land and labor costs are relatively low in the Global South, which can encourage development.

The Loss and Damage Fund recently adopted at COP 27 may prove to be the most compelling financing incentive. Worth hundreds of billions of dollars, it was conceived to compensate vulnerable developing nations for their losses and damages resulting from climate change. Implementation of similar funding mechanisms in the past have failed because the incentives for wealthier countries to contribute solely to climate adaptation in the developing world have been weak.

Marine microalgae aquaculture can offer mutually beneficial investment opportunities for wealthy and developing countries while providing climate change mitigation and enhancing global food security. Promoting use of the Loss and Damage Fund to advance marine microalgae aquaculture in the Global South should rank high on the agenda as preparations begin for COP 28 in Dubai later this year. **ST**

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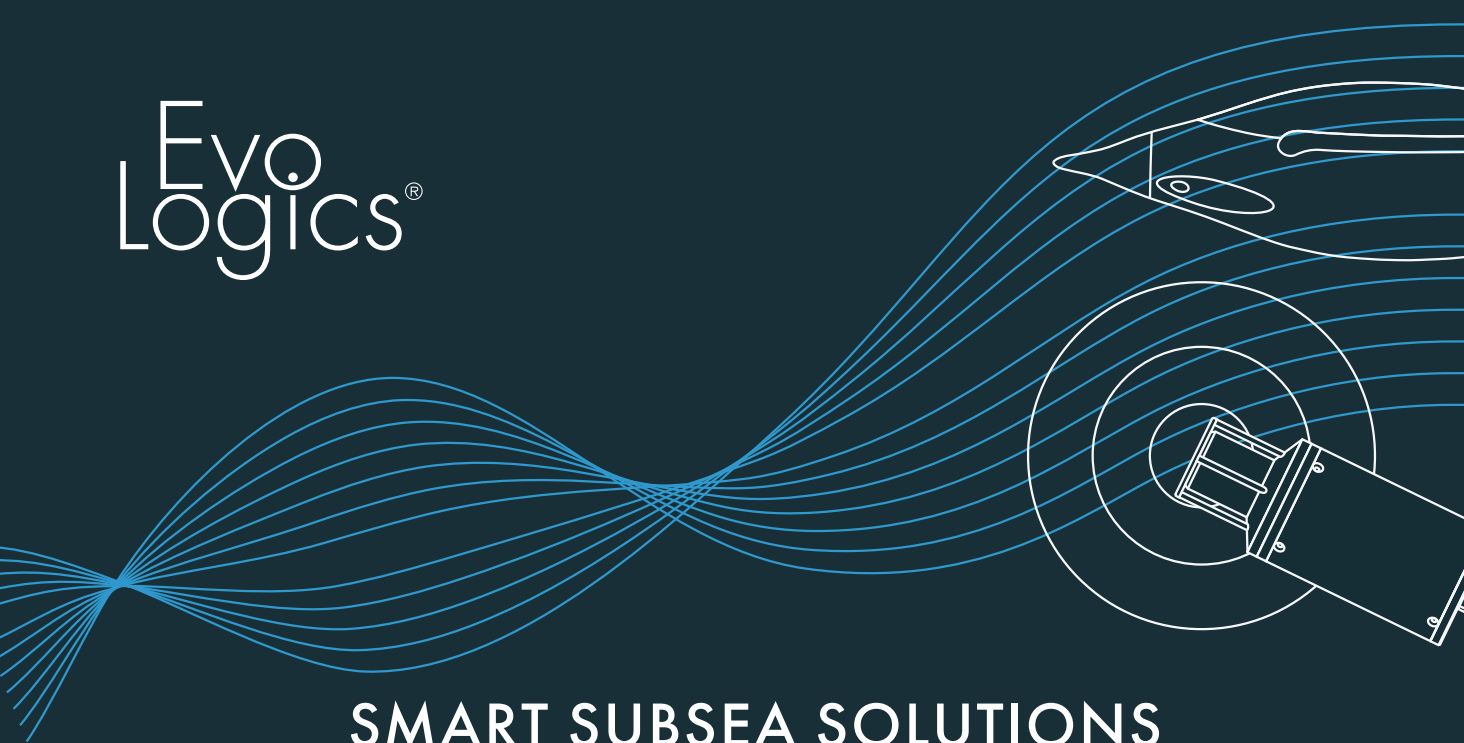
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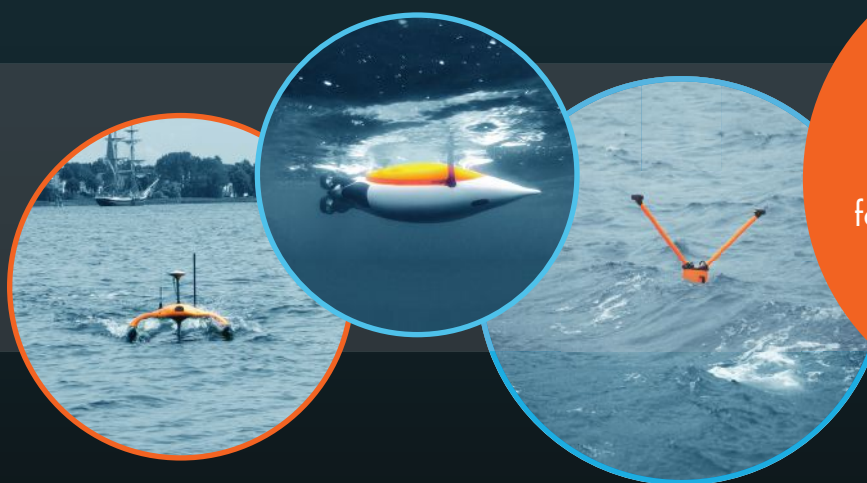
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