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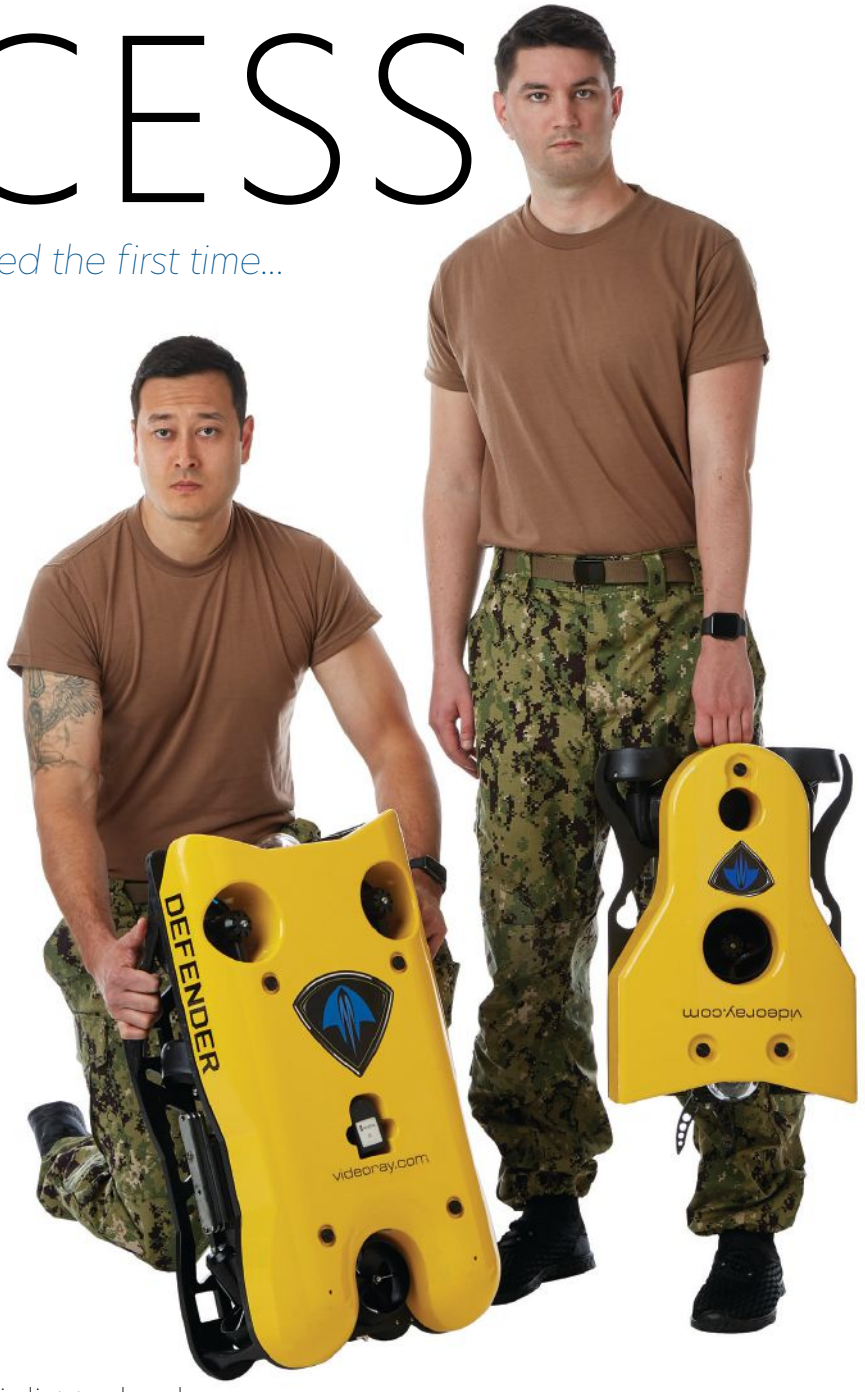

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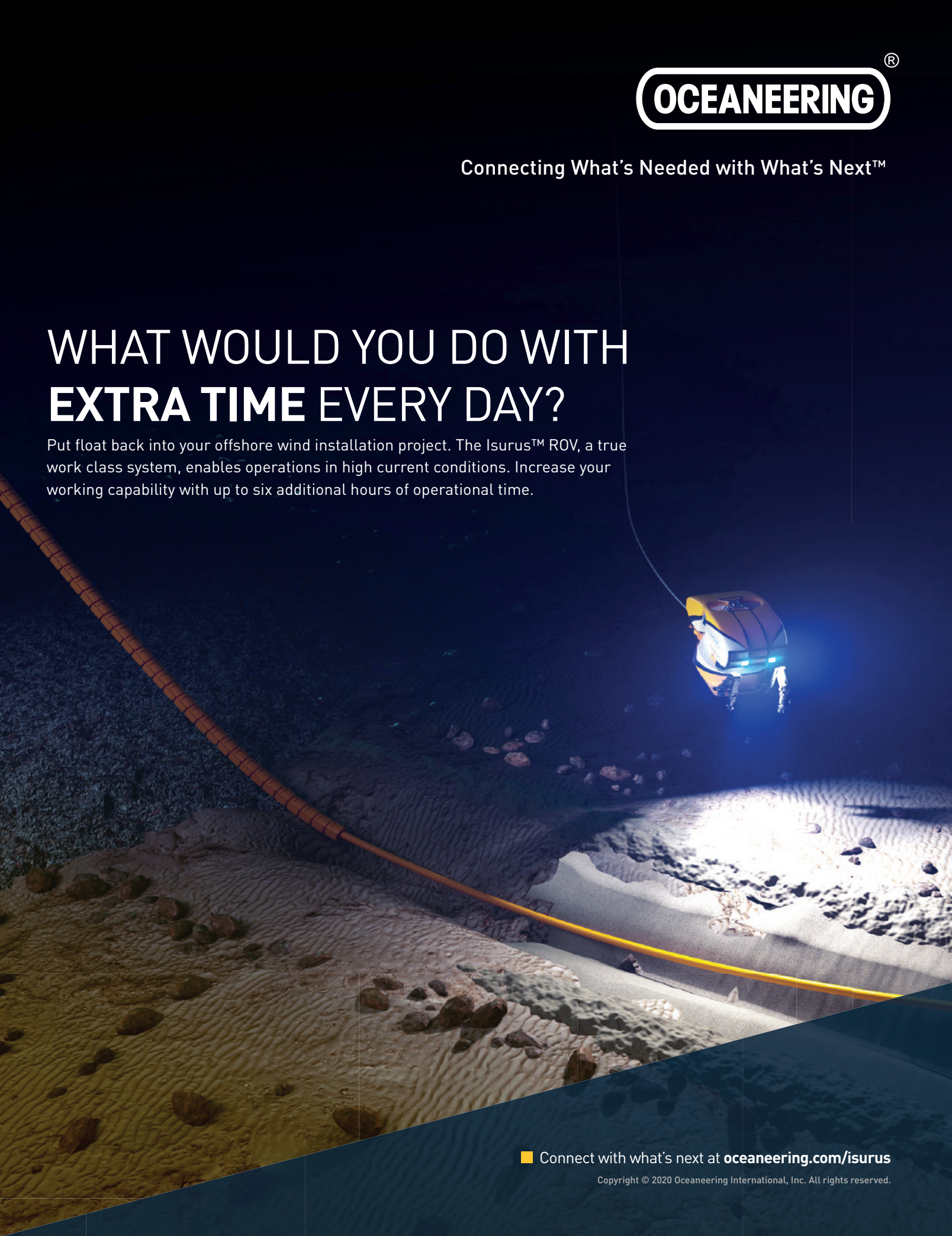

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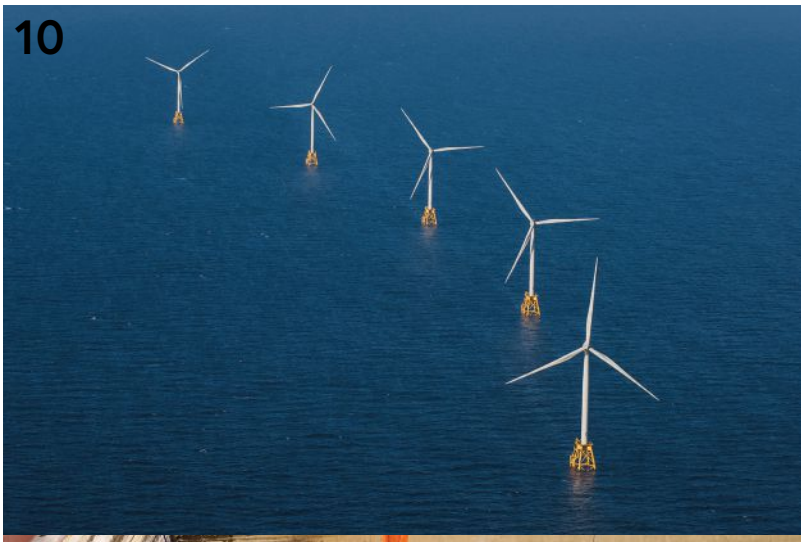

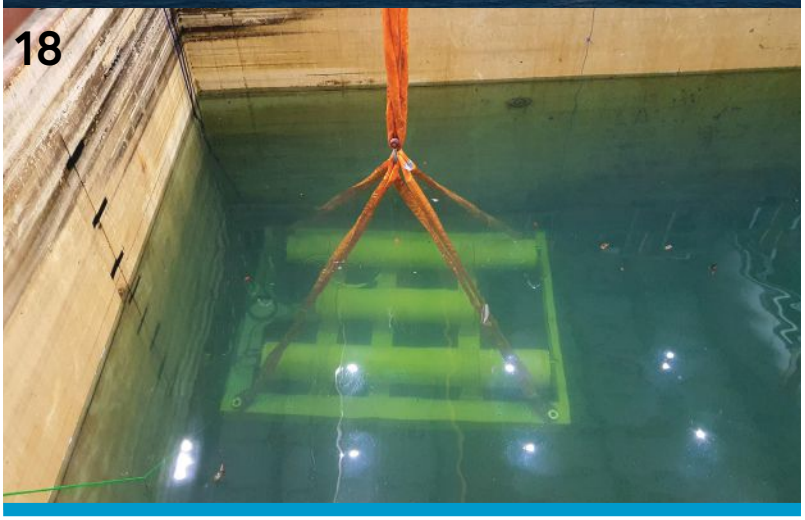

FEATURES

DEPARTMENTS

IN EVERY ISSUE

ON THE COVER:
Ørsted's Block Island Wind Farm is American's first offshore wind project and powers 17,000 Rhode Island homes with clean, reliable energy. (Photo credit: Ørsted)

EDITOR'S NOTE

Interest in marine renewable energy has never been greater, with unprecedented levels of capital investment being poured into offshore wind, tidal, and wave energy projects across the globe. But fueling this transition will not be easy.

*It will take the experience and knowhow of offshore wind pioneers like **Ørsted** to plan, construct, and manage wind farms on a never-before-seen scale. It will take the engineering might of subsea tech developers like **EC-OG** to tackle the challenges of energy storage. It will take the ingenuity of infrastructure manufacturers like **Acteon** to design innovative end-to-end solutions for marine energy developers. It will take the dedicated stewardship of scientific experts like **JASCO Applied Sciences** to measure the environmental impacts of offshore activities. It will take first-rate test and evaluation faculties like those managed by **Ohmsett** to advance technologies through rigorous R&D.*

Above all, it will take collaboration, so thank you to our guest contributors this month.
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Published by
Technology Systems Corporation
PATRICK C. LAGRANGE, CEO

Ocean News & Technology ISSN# 1082-6106 is published 11 times a year in print and digital by Technology Systems Corporation, 8502 SW Kansas Ave, Stuart, FL 34997, telephone 772-221-7720.

PRINTED IN THE USA | PRINTED WITH SOY INK

THE HIDDEN PROMISES WITHIN OFFSHORE WIND

BY LIZ BURDOCK
President & CEO, Business Network for Offshore Wind

Spring innately brings promise, no more so than this year. On a global scale, countries are slowly easing out of COVID restrictions, economies are coming back to life, and the offshore wind energy industry is beginning to see the fruits of the Biden Administration's early directives on clean energy adoption and job creation.

Offshore wind energy is a once in a generation economic opportunity to build a new American industry that will involve nearly every conceivable occupation, from geophysicists and marine operators to mechanical engineers and port studies project managers and everything in between. Together, we can grow jobs while improving our air and making the electricity millions across the U.S. rely on both cleaner and more reliable.

MOMENTUM SHIFT

For over a decade, the U.S. offshore wind industry made slow progress. In the last four years, trailblazing state leaders pushing the market forward with bold procurement commitments has led to at least $3.5 billion in lease investments, port infrastructure upgrades, and new vessel constructions before commercial scale development has begun. Now, with the keen interest and support of the Biden Administration, the industry is taking its place as a game-changing renewable energy source that will help achieve our national clean energy goals and create tens of thousands of well-paying jobs.

The Biden Administration's goal of 30 GW by 2030 goal is realistic and reflects just how far the industry has come in the past few years. Now, the industry's potential is attracting the attention of other industry leaders, like Chevron who recent investment announcement makes it the first U.S. oil & gas major to diversify into offshore wind energy. However, to make offshore wind and other clean energy sources a reality, the Administration must leverage the full weight of the federal government to help alleviate long-standing hurdles to development.

This will facilitate a steady, predictable, and sustainable pipeline of offshore wind projects that will ripple through and create opportunities for all ocean technology sectors. To help sustain momentum, the industry needs port infrastructure improvements to sustain the logistical needs of the new offshore industry, an increase in local vessels to support wind farm construction, operation, and maintenance, and concerted support for localized R&D addressing unique coastal demands long the East, Gulf and West Coasts of the U.S., which all point to bolstering a robust U.S. offshore wind supply chain that can efficiently meet growing industry demands.

SEIZING OPPORTUNITIES

Bureau of Ocean Energy Management (BOEM) Director Amanda Lefton emphasized the important role of offshore wind and supply chain growth on the Network's Offshore Wind Insider podcast. In it, she notes that BOEM is working expeditiously to process current construction and operation (COP) plans for offshore wind projects on the East coast and expects to see additional future release opportunities that will push toward the Biden Administration's 30 GW goal. To that end, BOEM just announced plans to lease the New York Bight and started processing New Jersey's Ocean Wind Environmental Impact Statement. These early actions show the rapid pace that offshore wind has adopted moving into 2021. There are so many new opportunities for companies to take advantage of as the offshore wind industry grows. Soon, the U.S. industry will go from infancy to walking on its own two feet. But it needs companies, and a lot of them, in order to run. Get involved, educate yourself, and find opportunities like the annual International Partnering Forum to network with industry decision makers. As the fastest growing global renewable energy, you have nothing to lose but a lot to gain.

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COLLABORATION IS KEY FOR TECHNOLOGY INNOVATION IN OFFSHORE WIND

By Neil Hamel
Head of US Innovation & Venture Hub, Ørsted

At Ørsted, innovation has been a core part of our DNA and has helped us in transforming our business. In 1991, we were the first company to install turbines in the ocean, creating the world's first offshore wind farm off the coast of Denmark. At that time, the cost of offshore wind energy was significantly higher than energy from fossil fuels, but we saw an opportunity for the future. Through our focus on innovation, we've increased the scale of our offshore wind farms with technological advances and improvements to installation methods, foundation designs, logistics and digitalization. In 2019, Ørsted completed construction of the world's largest offshore wind farm, Hornsea 1, that is capable of providing renewable energy to over 1 million homes. Throughout this journey, we've helped to continually drive down operational costs at each stage of development so that today, offshore wind energy is cheaper than fossil fuels in an increasing number of markets globally.

INNOVATION HUB

Over the last three decades, we've grown our offshore wind business to a global leadership position and have transformed from one of the most carbon-intensive energy companies in Europe to being ranked the world's most sustainable energy company in the Corporate Knights Global 100 Index. But the offshore wind industry has matured tremendously since we started, and we believe there is now immense potential to identify novel ideas and solutions from the external environment, and work together to create a world that runs entirely on green energy. For this reason, we launched the Innovation Hub. Based in Rhode Island, the Hub will act as a bridge between Ørsted and external innovation ecosystems, partners, and solutions.

The Innovation Hub will identify, develop, and at times finance companies focused on driving next generation technologies in offshore wind and adjacent markets with complementary applications in offshore wind, like blue tech. The scouting focus is driven by internal business challenges and opportunities identified by business unit leaders.

However, the most important aspect of external, or open, innovation is understanding the needs of the companies pioneering new technologies and processes as well as finding ways to help enable their mission and remove obstacles in their path. The Innovation Hub is working on vehicles and partnerships to help companies with their challenges at each stage of development:

Early stage:

- **Access to expertise:** Whether it's connections to internal subject matter experts or industry partners, insights can help early companies develop products that are more likely to fit potential customer needs and it helps them avoid costly pitfalls.

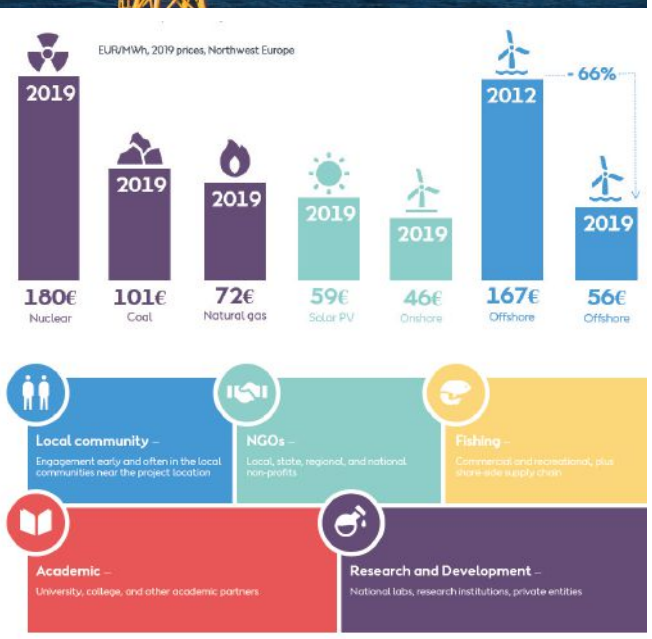
- **Patient capital:** We work in an industry of long timelines and "hard tech" challenges. This requires funding that has longer timelines than standard venture capital. Corporates are in a unique position to deploy patient capital.

- **Lab/test space:** This often ties directly to capital, but even well capitalized startups in offshore wind and blue tech tend to work on unique challenges that require specialized testing space and needs.

Commercialization:

- **Proof of Value Projects:** Offshore Wind is a highly regulated industry and "up time" is critical. This means testing new solutions in a live environment is difficult to do because we need high levels of certainty that a new solution won't cause unforeseen issues even when they don't perform as intended. In some instances, we need regulatory approval to perform the test or will need to test alongside currently approved methods, which can drive up the cost. However,

» Next-generation turbines (bottom left) will prove critical to advancing U.S offshore wind plans beyond the country's only in-service project to date, Block Island Wind Farm (top), as the cost per MW continues to fall, as seen in Europe from 2012 to 2019, thanks to increased investments in stakeholder management and R&D (bottom right). (Image credits: Ørsted)



in a little bit of a catch-22, live proof of value tests are also necessary to evaluate the efficacy of new solutions and provide a path to scale as a supplier.

- Path to Scale: If a live proof of value project can be scoped and executed, it's important that an internal path to scale the company as a supplier is identified for both companies to understand the future potential impact across their businesses.

Established industry adjacent:

- Starter projects: Often, established companies with proven solutions in adjacent industries can adapt their solutions to offshore wind challenges, however they may not fit in to a typical tier 1 or 2 supplier status. This makes it difficult for them to compete in procurement tenders. In these cases, smaller projects with paths to increased future work may need to be scoped on an ad hoc basis.

CRITICAL TIMING

If there's one thing that's constant about innovation across all industries it's that it always wants to go faster, and to win, incumbents and challengers alike must play a fast-paced offense. Speed can seem daunting in offshore wind considering the average timelines we currently work with – which are critical for companies at all stages hoping to work in offshore wind to understand.

- Bids and awards: 1 – 2 years

- Site investigations: 5 – 8 years

- Construction: 1+ weeks per turbine

- Operation: 30+ years

Those are very rough approximations with a lot of dependencies, but when you consider that each step has many smaller components you start to see how small deviations in the process could extend timelines and costs. It is critical for companies developing new technologies for offshore wind to be in lock step with these timelines. This is particularly true for proof of value projects because attempting to execute after these stage gates can encounter higher costs and potentially further permits and regulations.

COLLABORATION IS KEY

We need more partnerships like Ørsted has forged with NOAA to share physical and biological information and data in Ørsted-leased waters. It's not enough for startups to work solely with Ørsted to advance their solutions and ideas. It's critical that they spar with industry stakeholders on potential paths forward and gain collective approval.

BY AIR AND BY SEA: NOVEL MOBILE PLATFORMS BRING ACOUSTIC MONITORING TO OFFSHORE WIND FARMS

By Dr. Roberto Racca
Chief Communications Officer,
JASCO Applied Sciences

The construction and operation of offshore wind farms carries regulatory requirements for acoustic monitoring of both noise emissions from the activity and marine mammals' vocalizations. The latter reveal the presence of animals that could be at risk from noise exposure or collision with service ships. Such requirements call for innovative monitoring technologies capable of rapid deployment, efficient relocation, and wide area coverage. Autonomous marine vehicles equipped with advanced acoustic receptors, on-board processing, and long-range telemetry are the clear future of this sector. Viable carrier designs include underwater, surface, and even airborne vehicles with water landing capacity; any of these can deploy a single or several hydrophones to sample sound levels in the water.

The sensors may be mounted directly on a vehicle's hull or suspended from an adjustable cable to achieve optimal configurations for transit and active monitoring. Such positioning is often critical to addressing flow noise, the acoustic disturbance from water rushing past a hydrophone that can potentially mask the sounds of interest. Flow noise is a common hurdle of underwater acoustic measurements from platforms that move through the medium; mitigating solutions include the hydrodynamic shaping of surfaces near the sensors and the adaptive control of the vehicle's motion during measurements.

MOBILIZING SENSORS

JASCO Applied Sciences (JASCO), a leading developer of underwater systems for acoustic monitoring, has been researching and optimizing the integration of such devices on a range of mobile platforms to meet the expanding requirements of the offshore wind industry.

The evolution of mobile ocean sampling platforms began largely below the water surface, driven by the rapid development and ubiquitous use of tethered Remotely Operated Vehicles (ROVs) to perform diverse subsea tasks in the immediate vicinity—a few hundred meters—of a support vessel or dock. From that technology arose autonomous vehicles in which the physical tether to a control station was replaced by inertial navigation and other onboard intelligence often complemented by periodic confirmation and updating via satellite during surface visits. Running a vehicle mostly at depth does shield it effectively from the adverse impact of surface weather, and for acoustic monitoring it eliminates some significant background noise from waves slapping against the hull.

Traditionally propelled autonomous underwater vehicles (AUVs) are large and complex, and their use remains primarily confined to long-range research missions lasting from weeks to months. The simpler and more agile subsea gliders rely on variable buoyancy and hydrodynamic lift for their forward motion; they have gained popularity as practical platforms for systematic monitoring of small regions such as the surroundings of an offshore wind farm. JASCO adapted its OceanObserver module, a high performance acoustic and oceanographic data acquisition and processing system, to fit as a standard payload in various commercial glider models. The company is developing optimized solutions for equipping these platforms with various configurations of acoustic sensors to enable, for example, the directional localization of sound sources relative to the vehicle's orientation.

TAKING TO THE SKIES

Perhaps the most intriguing possibilities for mobile underwater acoustic monitoring are opened when unmanned aerial vehicles (UAVs), commonly known as "drones", are brought to bear. The convergence of a UAV with a body of water, generally dreaded as the terminal outcome of a flight gone awry, has become an intentional and fully recoverable phase of a mission for novel devices designed to land on the waves, float on the surface, and later resume flight to return to base or reposition to a new site.

JASCO is currently engaged in developing a full mission-capable, airborne, acoustic monitoring platform in collaboration with a manufacturer of specialized amphibious UAVs, a variant of which could ultimately swim below the surface as well as flying. An example of the unique capabilities of drone-based monitoring was provided in 2019 by then JASCO scientist Dr. Héloïse Frouin-Mouy and collaborators in Baja California, Mexico. The team collected and published an unprecedented high-quality

repertoire of context specific gray whale vocalizations by landing a lightweight hydrophone-equipped UAV near the animals as they engaged in different social behaviours. The ability to combine the scouting power of aerial observation (from the same or an ancillary drone) with the rapid airborne dispatching of an acoustic sensor to the location of sighted animals does also enable the finely targeted monitoring of underwater noise exposure levels for the protection of endangered species.

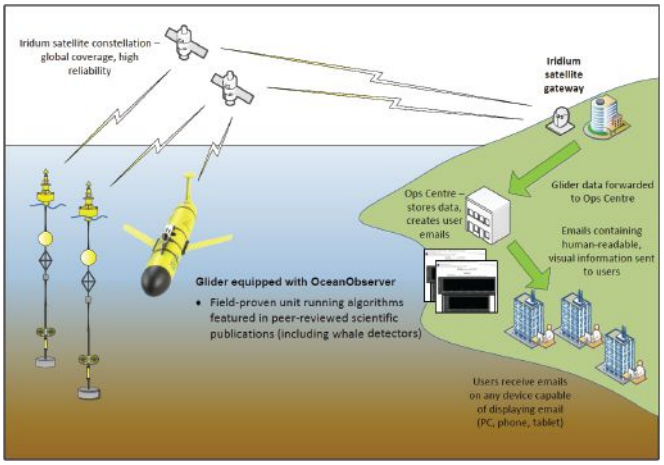
USVs PROVE SUCCESSFUL

Arguably more mundane in construction than airborne and underwater vehicles, though their apparent simplicity of design is deceptive, unmanned surface vehicles (USVs) are asserting themselves as strong contenders in the contest to the monitoring goal. Indeed, a USV from the start-up company Open Ocean Robotics (OOR) made the winners' circle in the Offshore Wind Challenge, a six-month technology accelerator program supporting innovations in responsible development of offshore wind energy.

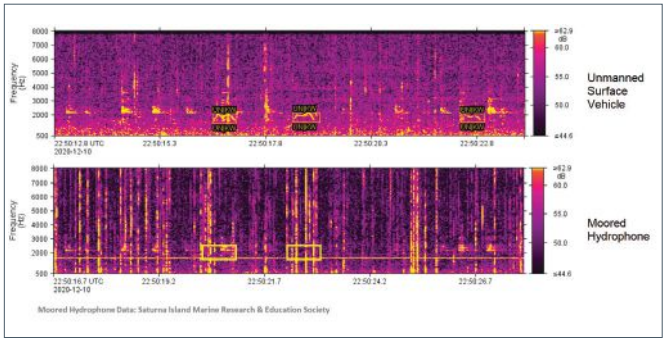
Co-sponsored by offshore wind project developer Vineyard Wind, the Challenge focused on advances in marine mammal monitoring, specifically for data collection and real-time transmission or data analysis. A JASCO OceanObserver payload, installed on the USV to collect and process acoustic data from a towed hydrophone array, detected whale calls in real-life ocean conditions with performance comparable, if not superior, to that of a moored installation. This early success paves the way for USVs to complement other types of acoustic sensor carriers in meeting the challenge of reliable environmental monitoring of the construction and operation of offshore wind farms.

The range of options offered by mobile platform technologies to deliver rapidly targetable monitoring solutions for ocean wind projects is considerable, and still expanding as current and new players bring advances to the field. By designing the OceanObserver system to be compatible with a wide selection of carrier types, JASCO aims at providing a consistent, high-performance data acquisition and processing framework across the technology spectrum. The choice of optimal sensor deployment platforms for a particular project can then be driven primarily, and rightly so, by operational considerations.

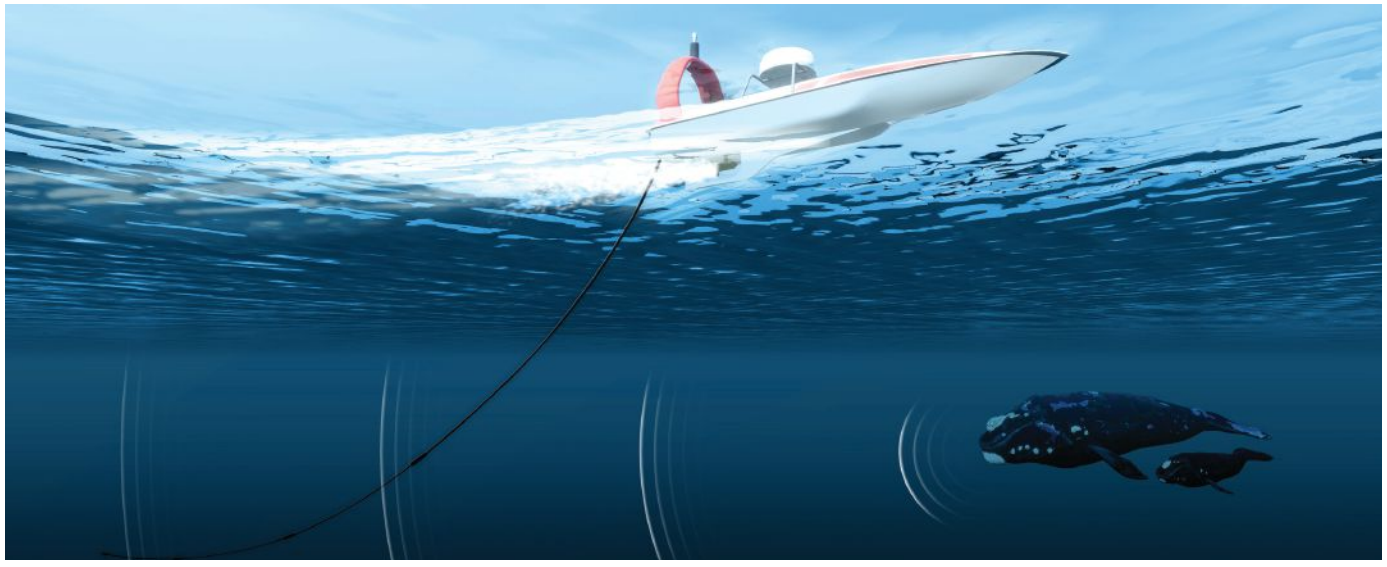
» *Prototype hydrophone-equipped unmanned aerial vehicle capable of landing on the water surface to perform acoustic monitoring. (Image credit: JASCO)*



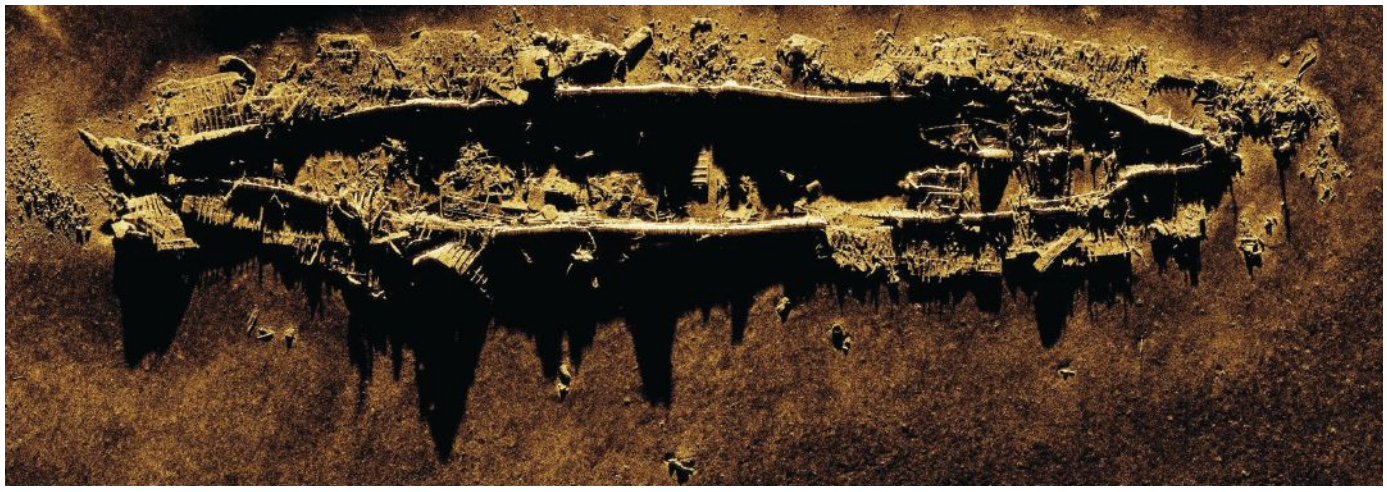
» *Conceptual diagram of communications network monitoring data from fixed and mobile acoustic monitoring platforms. (Image credit: JASCO)*



» *Comparison of acoustic signal quality and feature detection in spectrograms of whale calls captured from an unmanned surface vehicle and a moored hydrophone. (Image credit: JASCO)*



» *Rendering of an unmanned surface vehicle performing acoustic monitoring for whale calls with a towed array of hydrophones. (Image credit: JASCO)*



» *Kraken MINSAS image of the wreck of the USS Yankee, collected on the DIVE-LD. (Photo credit: Kraken Robotics)*

SUCCESSFUL SEA TRIALS WITH KRAKEN'S SONAR & PRESSURE TOLERANT BATTERIES

Kraken Robotics Inc. recently anounced that Massachusetts-based Dive Technologies Inc. recently completed successful sea trials of Kraken's Miniature Synthetic Aperture Sonar (MINSAS 120) integrated onto Dive's Large Displacement Autonomous Underwater Vehicle (DIVE-LD). The DIVE-LD is also powered by Kraken's pressure tolerant batteries.

Kraken's MINSAS is a commercially available off the shelf configurable Interferometric Synthetic Aperture Sonar (SAS) which replaces high end side scan sonar systems at an affordable price, while delivering significantly higher resolution, range, and area coverage rates (ACR). The increased range and resolution and associated higher ACR of SAS over traditional systems offers a powerful capability when combined with the long range and endurance of the DIVE-LD.

Sea trials were conducted from March 29 to April 8, held in Shallow Water and Very Shallow Water environments, in and around Buzzards Bay, MA and Narragansett Bay, RI. Due to COVID travel restrictions, Kraken personnel provided support remotely throughout the integration and sea trials with the DIVE-LD. Immediately following successful sea trials, Dive was also able to conduct a number of customer demonstrations for commercial and defense customers.

"We are excited to see Dive equipping their AUVs with Kraken's ultra-high resolution imaging and mapping capabilities, a milestone which also represents the 20th unique vehicle platform that has been successfully integrated with Kraken's Synthetic Aperture Sonar," said Kraken Senior Vice President of Engineering, David Shea. "Despite COVID limiting our onsite support, the speed and ease of integration of the MINSAS onto the DIVE-LD is a testament to the quality and experience of both the Kraken and Dive engineering teams. Within a short number of days, the Dive team had their vehicle in-water and collecting high quality sonar data, processed in real-time onboard the AUV. The high stability of the DIVE-LD has proven to be an excellent platform for the MINSAS 120 payload, and the open architecture and free flooded design allowed for simple and flexible payload mounting options."

» *The DIVE-LD with Kraken MINSAS120. (Image credit: Kraken Robotics)*

"Our team is incredibly excited to continue working with Kraken Robotics," said Bill Lebo, Dive Co-Founder. "Following our previous successful sea trials with Kraken's batteries, our team was keen to continue the positive momentum in our vehicle development with integration of Kraken's latest generation MINSAS 120 sonar system. Over 7 days we completed 30 missions and collected 1.3 TB of sonar data, processed in real-time onboard the AUV. The incredible imagery produced allowed our team to quickly locate and identify a variety of objects in the testing area, including abandoned lobster traps previously hidden amongst a boulder field, a number of shipwrecks and customer-specific targets of interest. The imagery collected of the wreck of the USS Yankee was particularly impressive (see attached image). The use of Kraken's removable data storage module, the DataPod, also enabled us to demonstrate time-critical data exfiltration at the conclusion of the test missions."

Kraken and Dive Technologies entered into an agreement in August 2020 whereby Kraken agreed to supply subsea batteries for the DIVE-LD. Under the terms of the agreement, Kraken also acquired a license to build two DIVE-LDs for use in Kraken's growing Robotics-as-a-Service (RaaS) business. Production of Kraken's first DIVE-LD is currently underway with the first unit being manufactured in the United States. Kraken expects that it will be delivered to Kraken's Unmanned Maritime Vehicle Facility in Dartmouth, Nova Scotia for sea trials this summer.

ECOCHLOR LAUNCHES ECOONE™- A REVOLUTIONARY NEW FILTERLESS BWMS

Ecochlor has announced the launch of EcoOne™, a revolutionary new ballast water management system (BWMS).

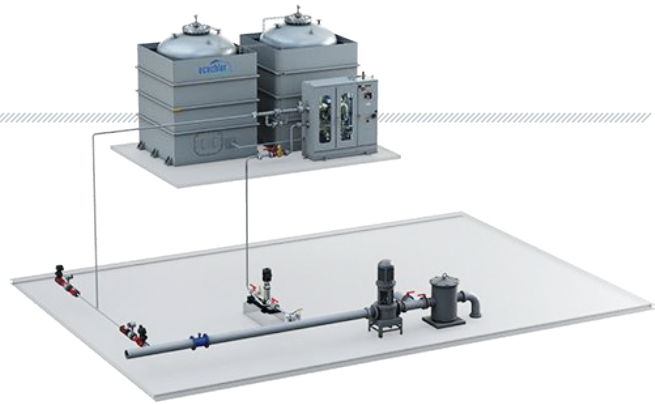
"By eliminating the filter, we have taken simplicity and reliability in ballasting operations to the maximum level. Whilst, at the same time, we have maintained the original Ecochlor® BWMS' high performance and service that customers expect from us," said VP of Business Development, Andrew Marshall.

"Comprehensive R&D and rigorous compliance testing of EcoOne™, along with a strong company philosophy focused on 'engineering for reliability', assures customers that every one of our products holds up to our strict ease of use and durability standards. Our powerful ClO2 treatment technology has been tested extensively to ensure that it works effectively as a single pass treatment under all operating conditions with no neutralization or retreatment prior to discharge. Plus, there are no problematic TRO sensors, electrodes or complex power supplies in either the new EcoOne™ systems or the Ecochlor® BWMS."

Having three systems to choose from helps the shipowner have more control in selecting the mode of BWMS operation that is best suited for their vessel. Ecochlor now offers:

- Ecochlor® BWMS (Filtration & ClO2)
- New EcoOne™ BWMS (ClO2 alone)
- New EcoOne™ Hybrid BWMS
  (Dual mode filtration & ClO2 or ClO2 alone)

The EcoOne™ BWMS recently completed extensive land-based testing, demonstrating compliance with the most recent, stringent USCG and IMO BWMS Code standards. Real-world shipboard testing is ongoing aboard an Aframax and a VLCC and is expected to be completed in May 2021.



» *EcoOne™ is a new ballast water mananagement system. (Inage credit: Ecochlor)*

As the leader of Ecochlor, Steve Candito, CEO, has implemented a number of new advances in the company over the past few years beyond EcoOne™ including improving the efficiency of the manufacturing processes and the expansion of Ecochlor as a "Green Marine" platform in collaboration with other innovative maritime environmental business providers.

Mr. Candito commented: "EcoOne™ and EcoOne™ Hybrid represent what a first class BWMS manufacturer can do when it listens to its customers, then shows a little initiative and a lot of innovation.

"We developed the new systems in direct response to concerns expressed by shipowners about how existing ballast water treatment processes are inflexible and may not be suitable for all vessels under all circumstances. Our newest BWMSs offer more options to the shipowner, allowing them to make informed decisions for the BWMS requirements for each of their vessels, all without sacrificing the reliability and 'best in class' service and support that Ecochlor is known for throughout the industry.

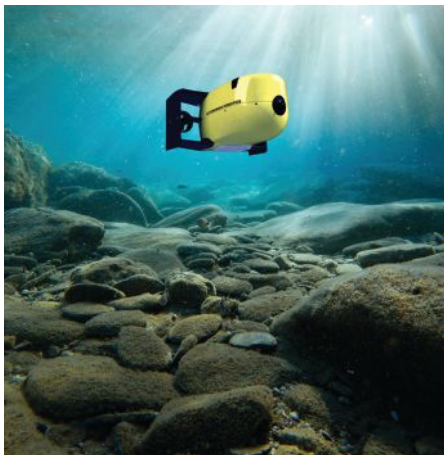
"With an eye to the future," Mr. Candito continued, "Ecochlor will continue to evolve and develop our core BWMS products as well as increase company growth through other environmentally and regulatory compliance focused products and services. We look forward to bringing many more of these exciting new products and services to you soon."

AUTONOMOUS ROBOTICS AWARDED GRANT FUNDED PROJECT

Autonomous Robotics Ltd (ARL) has been awarded a grant funded project from OGTC and two European energy companies who have a proven track record using ocean bottom seismic and are keen supporters of technology development. The project is to develop a bespoke seismic sensor to fit in the company's autonomous underwater vehicle solution, Flying Node, and is expected to last 15 months.

The grant was awarded as part of OGTC's strategy to work with partners as they transition to a net zero objective and their Offshore Energy 4.0 programme is focused on enabling remotely controlled operations, empowered by data, robotics and autonomous systems.

Duncan Soukup, Chairman of Thalassa Holdings Ltd, stated: "We are delighted that ARL has won this award and in particular the participation of the two European energy companies. We are continuing to make good progress in the development of our Flying Nodes solution which will address a number of opportunities in the Offshore Energy, Defence and Environmental markets".



» *The Offshore Energy 4.0 program is focused on enabling remotely controlled operations. (Image credit: ARL)*

» *T-CTV is also ideal for unmanned and remotely operated applications and can be configured with optional Wi-Fi capabilities. (Image credit: Oceaneering)*

OCEANEERING ROTATOR UNVEILS NEW TOPSIDE CHEMICAL THROTTLE VALVE

Oceaneering International's Rotator business has launched a new high-performance Topside Chemical Throttle Valve (T-CTV) for multiple industries including oil and gas, chemical processing, wastewater treatment, medical, and pharmaceutical. The T-CTV leverages existing field-proven technology to address operational requirements for efficient topside chemical dosing.

The T-CTV provides an innovative, cost-effective, and environmentally friendly solution for both greenfield and brownfield projects. The T-CTV is also ideal for unmanned and remotely operated applications across industries and can be configured with optional Wi-Fi capabilities. The valve is also the industry's only design that combines a full-flush position with an integrated mechanical scraper. This feature ensures superior contamination tolerance and delivers unmatched, long-term performance without the need for filters.

"Historically, Rotator's focus has been on subsea valves and we're excited about this opportunity to expand into the topside market with an industry-leading solution," said Tommy Tolfsen, T-CTV Product Manager at Rotator. "Our T-CTV delivers a fully automated chemical dosing package. It combines continuous and accurate flow measurement with automatic flow regulation in a modular, plug-and-play design.

"With the appetite for unmanned platforms growing, we wanted to make sure our T-CTV is ready for full, remote operation."

» *T-CTV uses continuous, live feedback from the Coriolis flow meter to automatically regulate and continuously display flow rates. (Photo credit: Oceaneering)*

The superior accuracy of the valve results in less chemical waste. The valve boasts ± 0.2% of reading via continuous Coriolis flow measurement. The T-CTV control system uses continuous, live feedback from the Coriolis flow meter to automatically regulate and continuously display flow rates. The valve's unique helical flow path provides stable, controlled flow throughout the entire operating range. A fully programmable deadband is set to further optimize flow performance. The superior accuracy and reliability of the T-CTV will ultimately reduce OPEX via lowered chemical costs and improved uptime.

Rotator's T-CTV builds on its over 60 years of experience in delivering best-in-class valves for subsea operations.

C-POWER AND BIRNS CONNECT ON SEARAY AUTONOMOUS OFFSHORE POWER SYSTEM DEMONSTRATION

A key aspect of succeeding in business is building meaningful connections. That's why BIRNS, Inc. and C-Power announces their new partnership in support of C-Power's demonstration of its SeaRAY autonomous offshore power system (AOPS) at the U.S. Navy's Wave Energy Test Site in Hawaii.

BIRNS is supplying BIRNS Millennium™ subsea connectors and cable assemblies for the SeaRAY AOPS being deployed in Hawaii in the summer of 2021.

C-Power has initiated commercial launch of the SeaRAY AOPS. The AOPS is an integrated offshore power generation, energy storage, data server, and communications system for support of unmanned mobile and static assets. It provides energy and bidirectional data transfer, which are essential for customers seeking to reduce costs, improve safety and unlock a wave of innovative capabilities for resident vehicles, sensor packages, and operating equipment.

BIRNS developed custom electro-optical high-voltage cable assemblies for energy transfer and charging of autonomous underwater vehicles and seafloor data-gathering systems, as well as real-time data delivery for the unique SeaRAY system.

"We are thrilled to be supporting C-Power's efforts in this groundbreaking project," said Eric Birns, President and CEO of BIRNS. "It's exciting to see the development of a sustainable energy solution that supports such a wide-ranging suite of offshore applications."

"The goal of the SeaRAY AOPS technology is to provide energy and data capabilities and services for our customers. Delivering this robust system requires the sophistication and expertise of partners like BIRNS," said Reenst Lesemann, C-Power CEO. "We're excited to work with BIRNS and our industry-leading partners to advance the future of the ocean economy toward a safer and less capital- and carbon-intensive tomorrow."

» *BIRNS connector for C-Power. (Photo credit: BIRNS)*

ENERGY MANAGEMENT: UNLOCKING THE OFFSHORE POTENTIAL OF MARINE ENERGY

By Paul Slorach
Business Development Director, EC-OG

Power where it is needed—this is the key challenge for decarbonization of the blue economy. It is at the heart of EC-OG's purpose; to deliver world class, innovative energy technologies and systems that change the offshore energy landscape towards a sustainable future.

The offshore environment is remote, harsh, and expensive. All too often, it is a dangerous place to operate. Furthermore, there is a diverse range of technical challenges and rarely a one-size-fits-all solution. As in most other sectors, there is a non-negotiable and accelerating requirement to decarbonise the blue economy, whilst concurrently, there is a desire to automate operations and remove the need for people to work in risky locations. This presents a perfect storm of challenges and opportunities for the use of innovative energy systems to electrify offshore assets, both at surface and underwater.

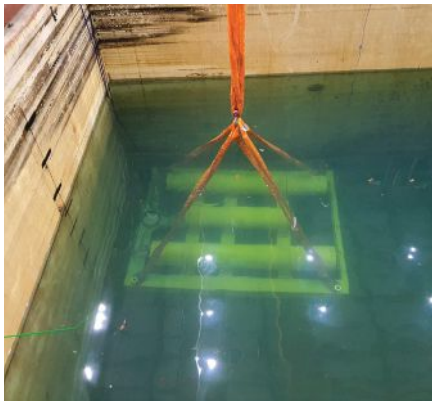
Connecting offshore equipment to the onshore grid may be feasible for larger applications like oil & gas platform electrification, but for many smaller systems, it is just not achievable or cost effective. Creating an offshore grid can be a viable alternative across the demand spectrum, using ocean energy and intelligent energy management to power remote offshore assets reliably and efficiently.

THE TIME FOR TRANSITION

EC-OG's core technology is in intelligent energy management, facilitating the use of renewable ocean power technologies to provide clean energy systems, by integration and intelligent management of energy storage. Based in Aberdeen, Scotland and with a historical customer base in the oil & gas industry, EC-OG has led the energy transition conversation and is actively diversifying into other sectors, such as offshore wind.

IEMS: A RENEWABLE ENERGY GATEWAY

EC-OG's Halo technology is the gateway for renewable energy and energy storage into offshore assets. Developed as a seabed-based Lithium-ion battery architecture, a fundamental basis of the Halo system is its Intelligent Energy Management System (IEMS). Designed specifically for the harsh marine environment, IEMS uses efficient and reliable electronics to monitor, control and protect the clean energy production, providing security to the end user and safeguarding the long-term operations of remote marine assets.



» *A recent wet test of a 100kWh Litihium-ion Halo subsea battery system with integrated Intelligent Energy Management Systems—IEMS. (Photo credit: EC-OG)*

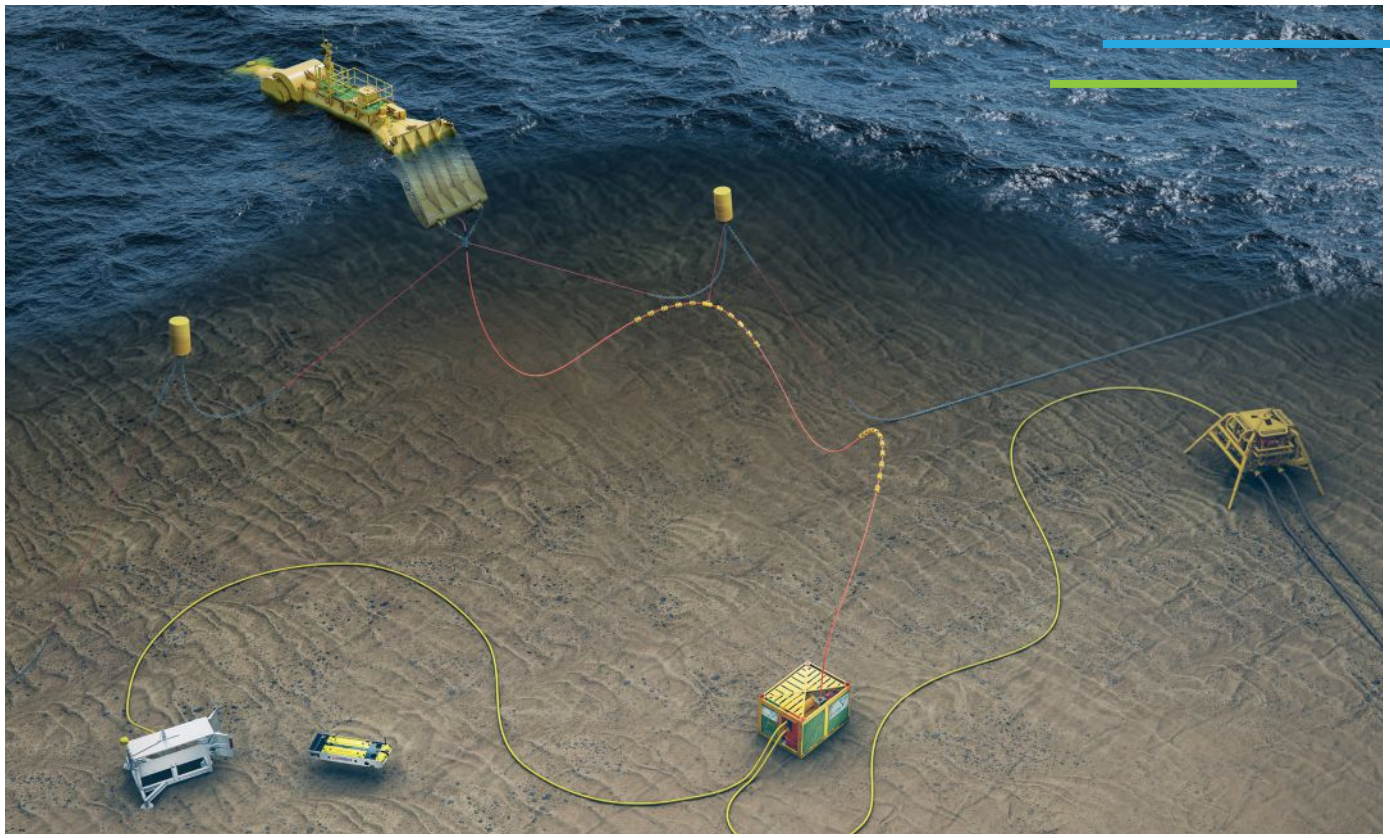
Energy management in this context refers to the entire energy value chain for a marine asset, from the efficient production of power, through storage, to use and re-use of energy by an asset. By using a well-designed and balanced energy management system, we can maximize the efficiency and flexibility of a non-utility scale offshore energy system.

The applications for IEMS are wide-ranging and important. From production control systems in the hydrocarbon industry, autonomous vehicle recharging for oil and gas, offshore wind, defence and aquaculture inspection activities, sensor packages which enable advancements in ocean science, microgrids for coastal communities or for powering aquaculture farms in far from shore locations. The challenge for all applications remains the same, to decarbonize existing marine operations whilst also providing sufficient clean energy for the burgeoning blue economy.

For ocean energy, efficiency means managing the intermittency of renewable marine energy so that sufficient energy is always available on-demand, whether from a regular and highly predictable resource like tidal energy, or something less regular.

CLEAN ENERGY SYSTEMS

Decentralized power generation technologies are exploding in number and exploitation of wave, wind, tidal and solar energy at remote offshore locations is now achievable with a choice of available technologies. EC-OG is power generation agnostic; its IEMS and Halo technologies are specifically designed to work



» *The Renewables for Subsea Power System, featuring EC-OG's Halo energy storage and energy management gateway for integrating wave energy to subsea systems. (Photo credit: EC-OG)*

with all the aforementioned energy sources, as well as others including geothermal, hydrogen fuel cells and even 'traditional' methods of generating power at remote locations, such as diesel and gas turbines, marine umbilicals and temporary vessel downlines.

This flexibility is paramount and places EC-OG uniquely as an integrator of clean energy systems tailor made for the application, accurately sizing power generation and energy storage according to the environmental conditions of a particular location and the duty cycle of the application. However, whilst the company is actively growing into surface and land-based applications, EC-OG continues to innovate in its core subsea market.

» *Halo configured as an umbilical termination assembly for wave energy integration, featuring 150kWh of seabed battery storage and IEMS. (Photo credit: EC-OG)*

RENEWABLES FOR SUBSEA POWER

The company has a number of active projects using its technology to help create offshore micro-grids for a host of blue economy applications and recently announced the second phase of the Renewables for Subsea Power project, a collaborative demonstration of a wave powered offshore micro-grid for operating hydrocarbon production systems and temporary or semi-permanent hybrid AUV's.

Working closely with Mocean Energy, Modus, Harbour Energy and part-funders OGTC, the project will utilise EC-OG's Halo technology as the gateway for wave energy into a subsea control system provided by Baker Hughes. With deployment scheduled for Q1 2022, the partners will demonstrate the potential of the technology for a range of subsea oil & gas applications, including remediation of faulty umbilical cables in existing developments, as a fast-track solutions for single well tiebacks and as an enabler for ultra-long step out distances, where local power generation could make these developments more environmentally and economically viable.

Later this year, the first commercial deployment of EC-OG's Halo technology will be realized. The Autonomous Offshore Power System, developed by US wave energy developer C·Power, features EC-OG's Halo battery storage and intelligent energy management system as the subsea gateway for innovative seabed sensor technology and AUV recharging. Deployment is scheduled for summer 2021 at WETS in Hawaii, where C·Power aim to achieve a number of world firsts in an exciting demonstration of the capabilities of a wave powered offshore micro-grid.

THE OPPORTUNITY

The offshore energy landscape is changing. With ambitious climate change targets driving the need to modify the way the blue economy operates; the time is right for offshore operators to widen their horizons and embrace innovative ocean power systems.

EC-OG's IEMS is the gateway for renewable energy into offshore assets, providing a flexible, scalable and efficient interface for power generation, energy storage and demand side management. IEMS is an integral part of EC-OG's Halo battery storage architecture—with imminent deployments of the technology with wave powered systems, the opportunity to build remote, autonomous and clean offshore power systems is now within reach.

EC-OG

» *Sonardyne's Gyro USBL completes the Ranger 2 package onboard the RV Atlantis. (Photo credit: Sonardyne)*

SONARDYNE'S RANGER 2 UPGRADE FOR RESEARCH VESSEL

Sonardyne's Ranger 2 Ultra-Short BaseLine (USBL) underwater tracking technology is to provide improved support to critical oceanographic work from the research vessel *Atlantis,* including science expeditions in the human occupied submersible Alvin. The most updated version of Ranger 2 provides greater precision, speed and range tracking and replaces the existing Ranger 1 system, which has been supporting research from the ship since 2009.

Additional upgrades include a new AvTrak tracking and telemetry instrument for Alvin, to support the increased depth rating of the submersible, from 4,500 m to 6,500 m. This bespoke 10,000 m-rated AvTrak meets the requirements for a 1.5 times safety margin for human-occupied submersibles.

The Ranger 2 system will support the *Atlantis*' work by enabling science teams to precisely monitor the position of submersibles and other underwater platforms deployed from the vessel, including remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), as well as tracking its CTD (conductivity, temperature and pressure sensor), towed sleds and dredges, in all water depths.

The team on the *Atlantis* will also be able to use Ranger 2 to communicate with scientists onboard the Alvin throughout every stage of a dive via the AvTrak using the secure Sonardyne Messaging Service (SMS) feature. The AvTrak can also act as a relocation beacon for the Alvin, as well as remotely operated vehicles (ROVs) deployed by the *Atlantis*.

The *Atlantis* is also upgrading its through-hull transceiver from a High Performance Transceiver (HPT) 5000 to a Gyro USBL 7000, complete with a new gate valve, flanges and sea chest.

Gyro USBL combines the vessel heading, pitch and roll data that's critical to USBL system performance, with an acoustic transceiver—all in one housing. *Atlantis* will be equipped with the latest generation Gyro USBL, which it 30% shorter and 40% lighter than its predecessor. That means it's easier to handle and install so more vessels, including small vessels of opportunity and unmanned surface vessels, can get the best performance from their USBL system.

Owned by the US Office of Naval Research and operated by Woods Hole Oceanographic Institution for the benefit of the US oceanographic community, *Atlantis* is one of the most sophisticated research vessels afloat. The vessel was specifically outfitted to act as a mothership for Alvin and can accommodate up to 24 scientists working in six labs for up to 60 days at sea.

Atlantis is part of a class of similar Navy-owned research vessels, which includes the University of Washington operated research vessel *Thomas G. Thompson*, which is also fitted with a Sonardyne Ranger 2 Gyro USBL system.

Kim Swords, Senior Applications Engineer, for Sonardyne in North America, says, "We're delighted with the through-life service that Ranger 1 has delivered to the *Atlantis*' marine and science. This upgrade sees the *Atlantis* join the *Thomas G. Thompson* and a global fleet of scientific research vessels in being equipped with Sonardyne's most up-to-date USBL technology available."

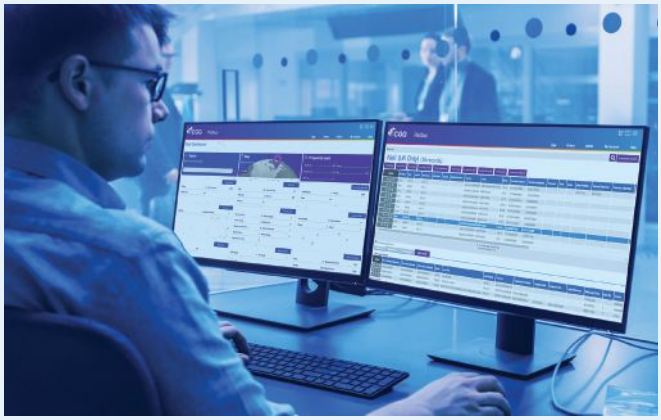
CGG'S SMART DATA SOLUTIONS RELEASES ENHANCED VERSION OF PLEXUS

Smart Data Solutions, part of CGG's Geoscience division, has released a significantly enhanced version of PleXus, its powerful cloud-based online data management portal. The new PleXus system offers today's E&P industry users a scalable, flexible and cost-effective solution for easy, fast and focused access to the important subsurface geoscience assets they need to perform their daily tasks.

New features and functionality in PleXus simplify the complexities of managing ever expanding volumes of different types of physical and electronic assets and associated meta data. Its enhanced interface enables users to easily search, order and view corporate data assets via a single, customizable dashboard, offering powerful search and reporting, easy data upload/download, GIS mapping and a convenient "Frequently Used" area to return to recent project work. Standardized data structures also meet industry requirements for long-term data continuity and integrity.

Designed and built for internet and cloud access, PleXus offers a variety of security features to protect data confidentiality, integrity and availability. These include the usual measures such as authentication credentials, time-based revision and non-use expiration, brute force attack lock-out, and encrypted password storage as well as more needs-based options for entitlements to allow more specific operational and data access.

Kerry Blinston, VP, Smart Data Solutions, CGG, said: "This PleXus release comes at a time when our industry needs to take control of its data with time-saving technology that will boost performance and mitigate costs. Its enhanced capabilities simplify access and eliminate unnecessary 'mouse-clicks', while securing long-term data governance and providing cloud-based flexibility and scalability. PleXus offers an intuitive solution to the challenges of today's corporate G&G data management, enabling companies to gain full value from their data."



» *The enhanced PleXus interface enables users to easily search, order and view corporate data assets via a single, customizable dashboard. (Image credit: CGG)*

RESEARCHERS TEST HARDENED UNDERWATER MODULAR ROBOT SNAKE (HUMRS)

Carnegie Mellon University's acclaimed snake-like robot can now slither its way underwater, allowing the modular robotics platform to inspect ships, submarines and infrastructure for damage.

A team from the Biorobotics Lab in the School of Computer Science's Robotics Institute tested the Hardened Underwater Modular Robot Snake (HUMRS) last month in the university's pool, diving the robot through underwater hoops, showing off its precise and smooth swimming, and demonstrating its ease of control.

"We can go places that other robots cannot," said Howie Choset, the Kavčić-Moura Professor of Computer Science. "It can snake around and squeeze into hard-to-reach underwater spaces."

The project is led by Choset and Matt Travers, co-directors of the Biorobotics Lab.

The submersible robot snake was developed through a grant from the Advanced Robotics for Manufacturing (ARM) Institute. The project aims to assist the Department of Defense with inspecting ships, submarines and other underwater infrastructure for damage or as part of routine maintenance, said Matt Fischer, the program manager at the ARM Institute working on the project.

The military has limited options for inspecting areas like a ship's hull. To do so, the Navy must either send a team of divers to the ship's location, wait until it returns to port to deploy the divers, or pull it into a dry dock—all options that take time and money.

A submersible robot snake could allow the Navy to inspect the ship at sea, immediately alerting the crew to critical damage or sending information about issues that need attention back to port for use when the ship docks.

» *Hardened Underwater Modular Robot Snake. (Photo credit: Carnegie Mellon University)*

"If they can get that information before the ship comes into a home port or a dry dock, that saves weeks or months of time in a maintenance schedule," said Fischer, who served in the Navy for three years. "And in turn, that saves money."

Fischer, who crawled into the ballast tanks of a submarine during his service, said many sailors would gladly pass that difficult and tight duty to a robot.

Steve McKee, a co-lead of the Joint Robotics Organization for Building Organic Technologies (JROBOT), a Department of Defense task force interested in technology like the submersible robot snake, said the project is a great example of a partnership between CMU, the ARM Institute, and the Department of Defense that will improve the readiness of equipment in the armed services.

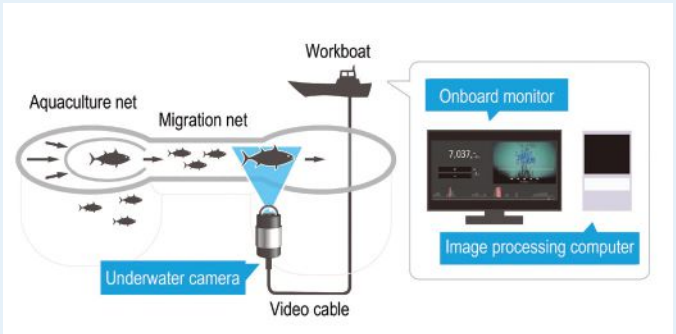
"The advancements being made hold great promise for helping not only the Department of Defense but also various industries around the world," McKee said.

AUTOMATED FISH COUNTING SYSTEM USING IMAGE RECOGNITION TECHNOLOGY

Yanmar Marine Systems is now accepting orders within Japan for a new automated fish counting system. The system is designed for tuna farming and utilizes image recognition technology to count the number of fish.

In fish farming, it is essential to know the number of fish inside each net in order to control production volume and the amount of feed used. Furthermore, in recent years as part of a drive towards more sustainable resource management, fishing vessels are required to accurately report the number of young pacific bluefin tuna caught in the wild, which end up being used for breeding at fish farms. Current methods are laborious and time-intensive requiring manual counting of the total number of fish caught, and visually counting underwater images when moving the fish to aquaculture nets.

To tackle this problem and support the aquaculture industry, YMS has developed the Automated Fish Counting System which significantly reduces the time needed to count fish. Yanmar's Research & Development Center developed image recognition and processing technology and an integrated system including hardware, such as a specially designed underwater camera and image processing computer, to realize real-time automated counting. Under optimal conditions, the system has succeeded in automatically counting tuna with an accuracy of more than 98%. In the future, YMS aims to contribute to greater efficiency and development of the fishing and aquaculture industry by reducing feed costs, cutting work time, and facilitating the accurate reporting of catches.



» *Diagram of the automated fish counting system. (Image credit: Yanmar)*

DIGITAL EDGE SUBSEA

A WORLD LEADER IN OFFSHORE DIGITAL VIDEO RECORDING (DVR) + INSPECTION SYSTEMS

Digital Edge Subsea supplies the oil and gas industry with their digital video recording system. The company, founded more than 12 years ago, boasts a team of hand-picked specialists who have been highly successful in establishing and nurturing strong customer relationships. Over the years, this industry partnership has been underpinned by a true sense of collaboration and open customer feedback, all of which has been incorporated into the development of the Version 5 Edge DVR software suite.

This constructive dialogue between developer and operator is the keystone to real-world innovation and, once again, has culminated in an exciting new product development at Digital Edge Subsea: Welcome to EdgeArchive.

EDGEARCHIVE

EdgeArchive is a breakthrough data storage and back-up solution that uses an exclusive proprietary app within the Edge architecture, and so means that operators can avoid using a 3rd party app.

EdgeArchive handles the transfer of data from the internal DVR drives to client storage, either on a NAS, a Raid, or a phased delivery to multiple external hard drives.

Being a native app, the data transfer ensures that the quality of live recordings is not impacted by a 3rd party program trying to access the same file that the DVR app is currently using, ensuring recorded data integrity and quality is of the highest importance.

DATA INTEGRITY

EdgeArchive can act as a simple data mirror of the correct internal drive data folders or can be used to create multiple simultaneous backups of client deliverables. This can be done in a continuous backup or a phased approach, i.e., after each dive.

Digital Edge's Operations Manager, John Scott, explains: "Clients transitioning to 4k or 4HD channels from SD has had an impact in data storage terms, previously they would be able to get months of data on the internal hard drives which Is no longer possible, as hard drive space becomes more of an issue. Responding to our client's needs dynamically, Digital Edge has invested the last year of development into creating an archiving application that allows clients to remove data from the DVR without threatening the integrity of the DVR Project. Using EdgeArchive ensures that access violations of "live recording" files do not occur when the data is transferred, which is especially beneficial for clients in the field on extended campaigns."

LIVE DEMOS

With a reputation for uncompromising product quality and second-to-none customer service, the Digital Edge team is pleased to offer demonstrations to all parties interested in finding out how EdgeArchive can benefit their particular project. And to help offset the economic difficulties of the last 12 months or so, Digital Edge is also making their DVR units available under flexible rental agreements. This is both for the rack mounted system and laptop version.

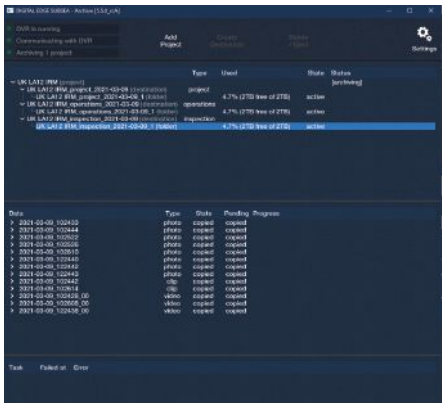
For more information or to schedule a demonstration, please contact:
info@digitaledgesubsea.com

www.digitaledgesubsea.com

» *Being a native app, the data transfer ensures that the quality of live recordings is not impacted by a 3rd party program. (Image credit: Digital Edge Subsea)*

V5 Software Suite

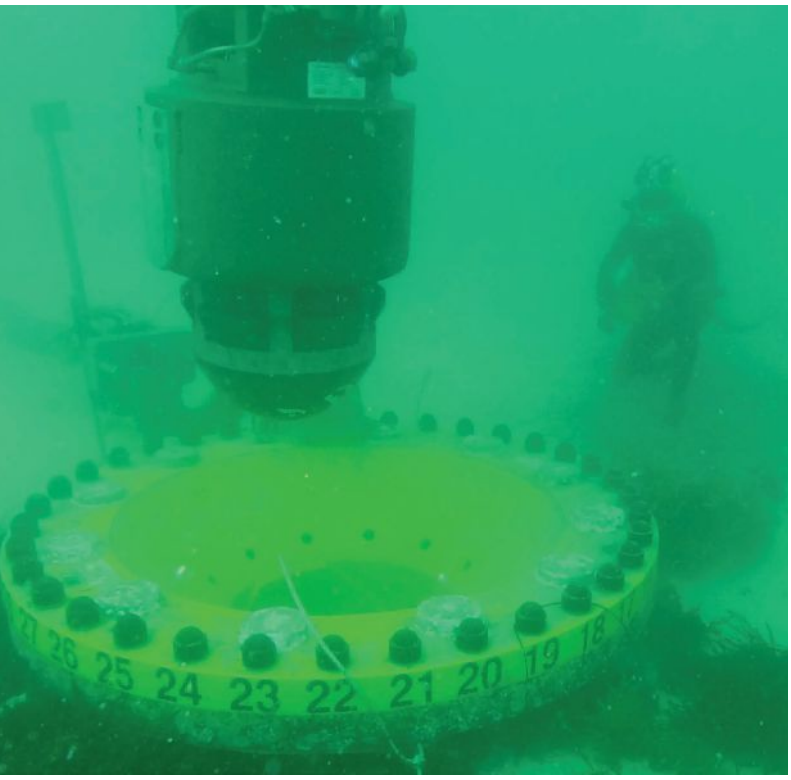
EdgeArchive
Edge DVR—3 versions:
Lite, Edge and Pro
Workpack Creator/Editor
Event Button Creator/Editor
Network Viewer (4 Channel)
Client Viewer
Offline Editor
Support Package



» *EdgeArchive can act as a simple data mirror of the correct internal drive data folders or can be used to create multiple simultaneous backups of client deliverables. (Image credit: Digital Edge Subsea)*

MAKING THE RIGHT CONNECTIONS FOR WAVE ENERGY INSTALLATIONS

By Johnny Shield
Technology Director, LDD (part of Acteon)



» *The Rocksteady connection system has a successful track record in offshore installation. (Photo credit: Acteon)*

Despite the global pandemic, wave and tidal energy projects have moved forward at pace, reaching significant funding, testing and deployment milestones over the last year. One such example is Acteon's patented Rocksteady connection system, an auto-latching subsea structural connector that enables wave energy operators to streamline installation processes and minimize costs.

Wave energy projects are, by their nature, located in challenging environments where installation operations must contend with rough seas and high winds. In these conditions, it is not feasible to install traditional pin-and-shackle connectors. Wave energy operators need simple, cost-effective systems that enable installation in rough conditions and can withstand the demands of the environment.

The Rocksteady connection system is designed to meet that challenge.

ROCKSTEADY DESIGN

Experience in testing and offshore deployment show that the Rocksteady connector enables high-speed latching (3 m/s) with a high angle tolerance (up to 25°) and that it will connect and release in all weather conditions. This means wider installation windows and far shorter installation times, reducing the expense and environmental footprint of offshore vessels.

Though smaller and lighter than other subsea mooring connectors, Rocksteady has full ABS and DNV qualifications. The system has been designed for and break-load, fatigue and durability tested to qualify capacities of up to 3,000-t minimum breaking load.

The Rocksteady locking mechanism was inspired by the wellhead collet connectors used in the oil and gas industry. It transfers the load to forged load shoulders to give excellent fatigue performance and, with a preloaded option (Gen-1), the unique ability to accommodate different types of load. This is important because, unlike traditional moorings where tension is the main consideration, wave energy connectors must also deal with bending, compression, shear and torsional forces. The preloaded option also overcomes the major issue of fatigue from these combined loads.

The combined loading capability also greatly simplifies offshore installation, as the Rocksteady connector can lock directly into a seabed foundation, such as a gravity base or pile, with a bearing unit integrated above the connector. This overcomes the need to install bearings on the foundation; these must be supported vertically during pull-in and installation, then released for operation, often an expensive and time-consuming diver or ROV operation.

In subsea applications, reliability is crucial. The Rocksteady locking mechanism is simple and all its moving parts are recoverable. The load path components are fully forged and have field-proven coatings and seals to protect the internal components from corrosion and debris.

BUILT ON EXPERIENCE

Even though the Rocksteady connection technology was developed with the oil and gas industry in mind, its initial deployment was for the Perth Wave Power Project, a demonstration system offshore

Western Australia on behalf of Carnegie Clean Energy. In that first application, the Rocksteady system significantly reduced the installation time and the amount of diver intervention needed to complete the project. Since then, there have been numerous refinements and three new generations of the product.

Rocksteady connectors are manufactured by Acteon. Having all aspects of the process in-house, from design drawings, specifications and procedures through to manufacture, assembly and system testing, simplifies the procurement process for operators, minimizes lead times and ensures that the product meets project specifications. However, for customers that want direct control, there is an option for operators to manufacture under license, which may also help them to meet local content requirements.

TAILORED SOLUTIONS

Recently, Rocksteady connectors were selected for use on wave energy demonstration projects offshore Portugal and Scotland (UK), both of which will install devices in 2021.

A key challenge in wave energy projects is making the electrical connection that takes power from the device to the grid and the data connection that enables the operators to control the device. Using the Rocksteady connection system, it is possible to make these connections at the same time as the mooring connection. This approach also enables same-time installation of structural integrity monitoring systems, if required.

CorPower Ocean (www.corpowerocean.com) has ordered a Gen-1 Rocksteady connector for a new wave energy converter (WEC) project where integration and deployment efficiency are key requirements. The Rocksteady connector will be deployed on a full-size demonstrator project that will generate power primarily from the heave motion of four buoys. The HiWave-5 project, located in Aguçadoura, Portugal, will be conducted in a 44-m water depth, with each of the buoys having a 300-kW rating.

The plan for this project is to make the electrical and data connections simultaneously using the Rocksteady's pull-in, capture, rotational alignment and latching features. Rocksteady connector control functions and sensors have been tied into CorPower's WEC control system and a bearing unit integrated with the retrievable connector and WEC assembly. This approach will dramatically shorten and simplify the installation process. Avoiding the need for separate bearing installation, power and data hookups will reduce the project footprint, lower environmental impacts and offer substantial savings by minimizing vessel and subsea intervention costs.

The AWS Ocean Energy Ltd (www.awsocean.com) Archimedes Waveswing is a submerged wave power buoy that reacts to changes in water pressure caused by passing waves and converts the resulting motion to electricity via a direct-drive generator. The first marine deployment will use a Rocksteady connector on a half-scale demonstrator unit to be installed at the European Marine Energy Centre in Scotland, UK.

The order for a Gen-4 connector was placed in December 2020.

» *Acteon's control all in-house processes, from design drawings, specifications and procedures through to manufacture, assembly and system testing, simplifies the procurement process for operators. (Photo credit: Acteon)*

» *A Rocksteady connector of the type that CorPower will install in Aguçadoura. (Photo credit: Acteon)*

The product was tested in March 2021 and delivered in April and is scheduled for installation over the summer. The Gen-4 Rocksteady device is relatively simple and has a stripped-down design that enables mechanical connection and disconnection from the surface, either from a connected line or mooring line chaser. This makes it a cost-effective and priced-for-commodity system that can be easily scaled up from demonstration units to large commercial projects.

THE FUTURE

The wave energy sector is in an important transition phase, during which some wave energy converter (WEC) technologies will be scaled up for full commercial operation. This presents a range of challenges, including finding efficiencies and controlling costs as the average project size increases; minimizing the environmental impact of installation projects by optimizing vessel usage; and finding ways to drive down the costs of installation in deeper water and more demanding environments.

At Acteon, we aim to help operators meet these challenges and build a marine green energy future.

For more information contact info@acteon.com or visit *www.acteon.com.*

» *Ocergy develops fit-for-purpose floating systems for energy production. (Image credit: Ocergy)*

OCERGY SECURES INVESTMENTS FROM MORELD OCEAN WIND AND CHEVRON TECHNOLOGY VENTURES

Ocergy, Inc. has secured investments from Moreld Ocean Wind (MOW) and Chevron Technology Ventures (CTV). The Series A round will fund Ocergy's growth and the commercialization of its sustainable offshore solutions, the OCG-Wind Floating Offshore Wind Turbine (FOWT) technology and OCG-Data environmental monitoring buoy.

Successful close of this round validates the industry's potential to grow offshore renewable energy. Ocergy's low-cost floating offshore wind turbine foundation has the potential to meet local supply chain and industrialization requirements with clear value, and the OCG-Data buoy technology enables integrated environmental data-gathering and support for biodiversity.

"We are delighted about this partnership as it will allow Ocergy to advance and commercialize its innovative technologies," said Ocergy CEO Dominique Roddier. "With MOW onboard we gain a trusted partner who will be able to provide an EPCI solution for OCG-Wind, a key requirement for many of our clients. We are excited to have gained Chevron's investment and look forward to potential opportunities for their guidance and expertise executing some of the most complex offshore projects in the world," said Roddier.

Chevron Technology Ventures has a 22-year history of investing in startups across a wide cross section of energy innovation and a track record of collaboration to bring innovation to scale. The Ocergy investment is made from CTV's Future Energy Fund which identifies technology solutions needed for the energy transition including, industrial decarbonization, emerging mobility, and energy decentralization.

"Offshore wind power is undergoing a period of rapid innovation in an effort to provide lower carbon energy at a substantial scale," said Barbara Burger, Vice President, Innovation and President of Technology Ventures at Chevron. "Ocergy has developed technology that could be part of the solution to enable more affordable, reliable, and ever-cleaner energy in a marine environment."

In addition to funding, Moreld today announces the formation of MOW, a company focused on delivery of engineering, procurement, construction, and installation (EPCI) contracts in the Floating Offshore Wind Industry. The Moreld Group is already a well-established player in the Offshore Floating Wind space, with leading competencies within FEED, marine services and product solutions. Moreld is owned by funds managed by HitecVision, a leading private equity investor in the European energy industry specializing in investments in renewable energy.

MOW has recently hired industry veteran Kristian Ravn to serve as the company's CEO. Mr. Ravn has held multiple C-level management positions in companies executing both green and brown field projects.

"MOW will be the spearhead of our combined knowledge within the Moreld group of companies," said MOW CEO, Kristian Ravn. "MOW will bring project execution and technical expertise to fully integrated and dedicated EPCI project teams to execute swiftly and flawlessly our EPCI contracts. Supported by our parent- and fellow subsidiary companies, MOW will be able to work with developers to ensure projects are delivered on schedule and on budget," said Ravn.

This investment positions Ocergy as a potential leader in advancing floating offshore wind to successfully compete for gigawatt-scale commercial projects. The Cooperation Agreement signed between Ocergy and MOW provides a strong platform for executing commercial-scale projects for Ocergy's OCG-Wind solution worldwide. This partnership integrates one of the most promising low-cost FOWT technologies with the necessary EPCI leadership to develop a fully industrialized FOWT supply chain in all regions of the globe.

"Closing this investment in the midst of the COVID-19 pandemic demonstrates the importance for our industry in bringing innovative solutions to further lower the Floating Offshore Wind levelized cost of energy, while focusing on local supply chain and industrialization requirements," said Roddier.

EQUINOR AND PARTNERS STRIKE OIL IN THE NORWEGIAN SEA

Equinor and partners Total E&P Norge AS and Vår Energi AS have struck oil and gas in a new segment belonging to the Tyrihans field in the Norwegian Sea. Recoverable resources are so far estimated at between 3.0 and 4.2 million standard cubic meters of recoverable oil equivalent, corresponding to 19 – 26 million barrels of oil equivalent.

"It is encouraging to prove new resources that can extend the life of producing fields in the Norwegian Sea," said Nick Ashton, Equinor's SVP for exploration on the Norwegian continental shelf.

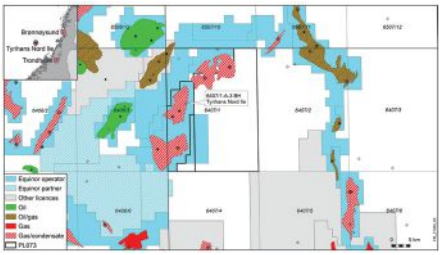
Exploration well 6407/1-A-3 BH in production license 073 was drilled from subsea template A at Tyrihans North. The Tyrihans field is located in the middle of the Norwegian Sea, some 25 kilometers south-east of the Åsgard field and 220 kilometers north-west of Trondheim. The licensees consider the discovery commercial and intend to start production immediately.

"Thanks to the location we are able to put the discovery on stream over the Tyrihans field immediately, which will both ensure good profitability and low CO2 emissions from production," said Ashton.

The purpose of the well was to prove petroleum in lower-mid Jurassic reservoir rocks (Ile and Tilje formations).

The well struck a gas column of about 43 meters and an oil column of about 15 meters in the Ile formation, including about 76 meters of moderate to good reservoir quality sandstone. In the Tilje formation moderate to good quality water-bearing reservoir was struck.

The well was not formation tested, but data acquisition and sampling took place. This is the sixth exploration well drilled on the Tyrihans field, and the fifth exploration well drilled in production license 73 awarded in the fifth licensing round in 1982.



The well was drilled to a vertical depth of 3,998 meters below the sea level and a measured depth of 5,332 meters. The well was completed in the Åre formation from the lower Jurassic period in 288 metres of water.

The pilot will be permanently plugged and abandoned.

Well 6407/1-A-3 BH was drilled by the Transocean Norge drilling rig, which will now continue drilling the producer 6407/1-A-3 CH on the Tyrihans field.

MARINE-i SUPPORTS MARINE RENEWABLE ENERGY PROJECT FOR THE ISLES OF SCILLY

Marine-i has agreed to support a year-long research program to identify the potential for wave, tidal and floating wind technologies to be deployed around the Isles of Scilly. It is expected that this will lead to long-term economic, societal and environmental benefits for the communities living on the islands.

The project will build a new databank of wave and tidal resource data from around the Isles of Scilly, including data sets on wind speed, wave height, wave period, tidal stream velocities and tidal range parameters. This comprehensive databank will enable the Isles of Scilly to engage with technology developers to scope new renewable energy projects for the Isles of Scilly.

Part funded by the European Regional Development Fund, Marine-i is designed to help the marine technology sector in Cornwall and the Isles of Scilly grow through harnessing the full potential of research and innovation. This new initiative is being led by three businesses: Isles of Scilly Community Venture, a not-for-profit company focused on developing projects that will help Scilly become fit for the future, Waves4Power and Planet A Energy.

Jim Wrigley of Isles of Scilly Community Venture said: "Being located nearly 30 miles off the south west coast of England, marine power is a natural choice for us and could make Scilly self-sufficient in energy. However, an obstacle to this is that the key data that developers need to assess its viability does not currently exist in the level of detail required. We are delighted that Marine-i has agreed to assist us in creating this new databank, which could be the key that unlocks some really exciting green energy solutions for Scilly."

Through its engagement with Marine-i, the consortium has gained access to leading research expertise at Marine-i partners, University of Exeter, University of Plymouth and the Offshore Renewable Energy (ORE) Catapult.

Neil Farrington of ORE Catapult said: "The new data repository will be used to underpin key decisions about marine renewable energy development on the islands, which could comprise locally-owned projects as well as commercial enterprises. It could be the springboard for a new era of green energy on the Isles of Scilly."

Prof Lars Johanning, Programme Director for Marine-i added: "This is a great example of the public sector, private enterprise and academia coming together to enable new developments to take place that will benefit the local community. This innovative databank will be a vital resource for developers and their stakeholders, helping them to assess the viability of marine renewable energy for the islands. This could be an important step in helping Scilly achieve its vision of a sustainable, net-zero carbon future. We hope that the project's research approach will become a role-model that will be adopted internationally. This would accelerate the rate at which other island communities could reap the benefits of marine energy, while also helping in the global battle against climate change."

» *The databank will enable the Isles of Scilly to engage with technology developers to scope new renewable energy projects. (Photo credit: Marine-i)*

FUGRO AWARDED JUMBO POSITIONING CONTRACT FOR DEEP-WATER MERO 1 OFF-SHORE BRAZIL

Fugro is providing positioning and construction support services for Jumbo Maritime, a leading offshore installation contractor, on the Mero 1 deepwater field development located approximately 180 km off the coast of Rio de Janeiro. Using their Starfix® Navigation Suite and augmented reality QuickVision® camera system, Fugro is supporting Jumbo in the safe and efficient installation of 35 subsea torpedo piles and 24 mooring lines down to water depths of 1,980 m. This critical infrastructure will be used to anchor the Mero 1 floating production unit and associated equipment.

The work is being performed onboard Jumbo's Fairplayer heavy lift crane vessel and is estimated to last 6 months. In addition to pre- and post-lay surveys of the piles and mooring lines, Fugro's Starfix and QuickVision solutions will provide real-time positioning for subsea construction and installation activities without needing any hardware mounted on the subsea infrastructure, an approach which reduces risk, increases spatial awareness and streamlines workflows.

Rogerio Carvalho, Country Manager for Fugro in Brazil, said: "Fugro's global reach and advanced technology, combined with our resources and experience from the Netherlands and Brazil, were key to securing this contract. Having overcome many challenges in planning the operations for this project amid the constraints caused by COVID-19, we're excited to now be supporting Jumbo on this important deepwater development."

ATLANTIC WIND TRANSFERS PARTNERS WITH DNV

Atlantic Wind Transfers (AWT), the Rhode Island-based owner and operator of crew transfer vessels (CTVs) for the offshore wind industry, has engaged the Classification Society DNV for the company's integrated Management System Certification. Through this partnership with DNV, AWT is pursuing international Safety Management Systems (SMS) certification and ISO 9001, ISO 14001, and ISO 45001 certification under DNV's Seamless and Fit for Purpose programs.

Positioned for the future

As the U.S. offshore wind industry expands, Atlantic Wind Transfers plans to be at the forefront in providing crew transfer services up and down the East Coast. According to Charles A. Donadio, Jr., the President of AWT, he sees the company's fleet of CTVs growing five-fold over the next five years, from its two-vessel fleet currently in operation and the business expanding to the West Coast as the industry grows. Donadio is keen that AWT maintain its position as a leader in technology and design in the sector and in growing the business through innovation and collaboration with their European counterparts. He sees the company's management system certification as an integral part of that growth plan.

"Looking ahead to the future of U.S. offshore wind, safety will be of utmost importance. Understanding the evolution of offshore wind in Europe and what the expectations are of European developers, we are readying ourselves to be on par with the European standard," said Donadio.

There is no current SMS certification requirement locally, but AWT seeks to ensure the company has a foundation for future growth. "After all, it's the same European developers that are planting roots here. Our voluntary efforts reflect our understanding of the industry's needs and our commitment to provide the sector's best turnkey operating model to benefit our clients and the industry."

Leading the way

"Having a strong Safety Management System and optimizing its effectiveness is business-critical, and our involvement in certifying those audit processes will result in continuous improvement and have a positive impact on AWT's operation," said Antony DSouza, Executive Vice President and Regional Manager, DNV Maritime Americas.

"It is a privilege for us to work with AWT in certifying their SMS and ISO systems. The U.S. offshore wind industry is positioned to take off in a big way, and as one of the leading operators in the space, their pursuit of voluntary certification is likely to set an industry standard."

» *The offshore wind farm support vessels of Atlantic Wind Transfers, ATLANTIC PIONEER and ATLANTIC ENDEAVOR, pictured together. (Photo credit: AWT)*

CWIND TRAINING TO RELOCATE

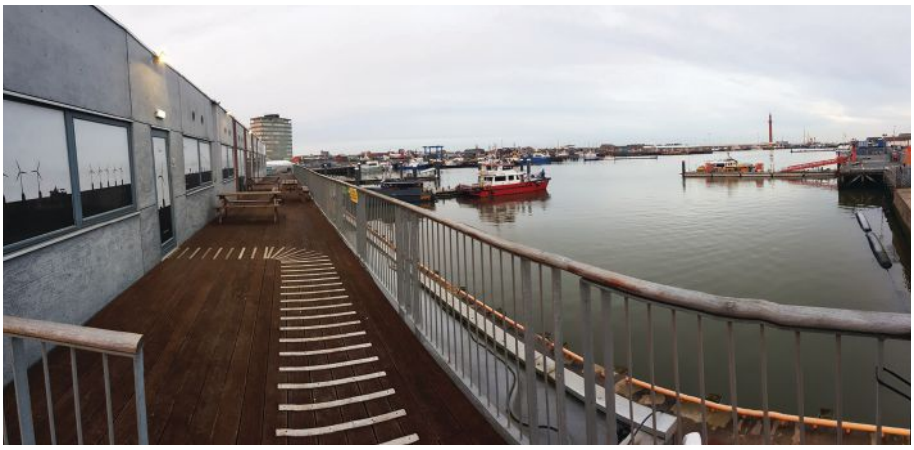
CWind Training, a leading provider of health and safety, offshore skills and GWO-accredited training courses to the offshore wind industry, and part of the Global Marine Group, has announced their plans for relocation to Grimsby.

Planned for May this year, the move from CWind Training's current base in Lowestoft to the Fish Docks, Port of Grimsby, North East Lincolnshire, will allow the company to widen its course offering. The relocation will also bring CWind Training closer to many of its customers and CWind's operational HQ in Grimsby, in the center of the East Coast's green energy hub.

The new location offers a suite of classrooms and training areas that will increase CWind Training's current capacity to allow over 3,000 course spaces per year for the essential training required to work in the growing offshore wind industry.

Tom O'Shea, Head of Training at CWind Training, said: "Moving near to CWind's operational hub enables us to benefit from insight directly from live projects, working more closely with our colleagues who are dealing with the daily realities of technical work at an offshore wind farm, giving our students the most realistic training experience possible.

"On the East Coast, Grimsby is at the heart of the UK's offshore wind industry, making it a more convenient location for our customers. With more impressive facilities, experienced instructors, courses that always reflect the latest industry requirements, modern equipment and an 18 m realistic training tower, we are able to ensure high-quality training opportunities for all students."



» *CWind Training is relocating to the Fish Docks, Port of Grimsby. (Photo credit: CWind Training)*

Martyn Boyers, CEO at Grimsby Fish Dock Enterprises Ltd, said: "CWind are an important existing customer at the 'GRO Centre' in the Port of Grimsby East, and we are delighted that they have chosen to relocate their CWind Training base with us. Not only is this good news for us, as the Port Operator, but also for North East Lincolnshire Council, the wider community and for local job seekers.

"CWind Training's decision to relocate to the area underpins the significance of Grimsby as a strategic base for offshore renewables and is great news for renewables in the Humber Hub and the wider region as more offshore activities develop. This move is an exciting opportunity and establishes a place of excellence within the offshore renewables industry, with Grimsby at the heart of it. We look forward to working with CWind Training and developing our facilities for some time to come."

In addition to the range of courses offered at their Grimsby location, CWind Training will continue to offer bespoke services at clients' locations across the UK. Throughout the COVID-19 pandemic and subsequent lockdowns, CWind Training remained operational, offering COVID-compliant face-to-face courses with additional safety precautions, as well as remote courses for those who could not travel. These safety measures will remain in place at their new site as necessary, enabling CWind Training to continue to provide essential training to the vital offshore wind industry.

TechnipFMC AWARDED A SIGNIFICANT SUBSEA CONTRACT FOR PETROBRAS' MARLIMAND VOADOR FIELDS

TechnipFMC recently announced that it has been awarded a significant subsea contract from Petrobras for the Marlimand Voador fields, located offshore Brazil.

TechnipFMC will supply up to eight manifolds for production and injection, utilizing the all-electric Robotic Valve Controller (RVC). The contract also includes associated tools, spares and services. The RVC is a unique robotic technology that replaces traditional subsea hydraulics, as well as thousands of mechanical parts, while providing real-time data and analysis on system performance. This results in a manifold that is smaller, less complex and less costly with a significantly reduced carbon footprint.

Moreover, the RVC's software can be remotely upgraded and maintained subsea, increasing the overall reliability and availability of the subsea system. Jonathan Landes, President Subsea at TechnipFMC, commented: "We are honored that Petrobras has selected us to support the ongoing development of the Marlim and Voador fields. We look forward to executing this project using our local capabilities in Brazil and contributing to another important development in the country.

"We are very excited to bring new technology and automation capabilities to this project through the use of the RVC to operate the manifolds. Our innovations in automation and electrification are helping our clients lower their operational expenditures and reduce the carbon intensity of their subsea projects."

TDI-BROOKS INTERNATIONAL TO SUPPORT US WIND'S MARWIN OFFSHORE WIND PROJECT

TDI-Brooks International, Inc. will be deploying two of their oceanographic research vessels to the East Coast of the US in support of US Wind's MarWin offshore wind project off the coast of Maryland. TDI-Brooks will engage in the seabed geophysical surveys to better understand the geological issues that may exist with project development to ensure safe and long-term operations and performance of the facilities.

TDI-Brooks research vessel R/V Brooks McCall will be deployed from the Gulf of Mexico in March with the R/V Miss Emma McCall joining her in April. Both multi-use oceanographic research vessels are equipped to acquire geophysical surveys for offshore hazard/site clearance assessments, pipeline/cable routing, seafloor mapping, port and channel conditions, fisheries habitat mapping and burial assessment studies.

US Wind was founded in 2011 and has established its position as a premier offshore wind energy development company in the United States. In 2014, US Wind obtained a federal lease for site control to develop approximately 1.5 GW of offshore wind power generation off the coast of Maryland. The MarWin project is expected to produce approximately 270 MW of power, which will help meet Maryland's offshore wind energy goals. The project is expected to come online in 2024.

US Wind has already begun an extensive outreach effort to local fishermen to inform them of these survey activities. Dedicated fisheries outreach specialists from Sea Risk Solutions will also regularly provide updates on the vessels' scheduled activities. There will be no restriction on fishing in the offshore wind lease area due to these survey activities.

» *TDI-Brooks' research vessels, R/V Brooks McCall and R/V Miss Emma McCall. (Photo credit: TDI Brooks)*

US Wind is also implementing extensive efforts to minimize impacts on marine life during survey operations. Expert Protected Species Observers will be aboard each vessel to monitor for the presence of protected species, such as the North Atlantic Right Whale, and ensure that appropriate measures are taken to protect these species.

In addition to the geophysical surveys, TDI-Brooks will provide laboratory analysis on all sediment samples collected via their state-of-the-art laboratory facility in College Station, Texas. The environmental laboratories will provide high-quality analytical services and scientific interpretation. All three laboratories are staffed with highly-skilled scientists and chemists who have worked in partnership with federal and state agencies, as well as the private energy and environmental industries, for over 25 years.

INNOVATIVE R&D AND TESTING FOR SUSTAINABLE MARINE ENERGY TECHNOLOGIES

By Jane-Ellen Delgado
Marketing Director, Ohmsett

The move from fossil fuels to renewable energy has many countries around the world pivoting to make the energy transition. With that pivot and the flow of investment in clean energy research and development, technology developers are looking at untapped hydrokinetic resources such as wave, current, tidal and riverine energy that hold the greatest potential to generate green energy.

To support these trailblazers with their research and development, Ohmsett—the National Oil Spill Response Research & Renewable Energy Test facility—collaborates with research institutions, industry, academia, and government agencies on bridging the gap in marine renewables through testing and evaluation of wave and current energy systems, as well as technology used for the Blue Economy.

NEXT-WAVE TEST FACILITY

Tucked away on the shores of the Sandy Hook Bay in central New Jersey, Ohmsett is managed by the Bureau of Safety and Environmental Enforcement (BSEE) and has been offering independent, objective performance testing of sensors, wave energy converters, containment booms and barriers, as well as skimming systems for over 45 years. The distinctive wave facility provides a platform for developers to validate engineering expectations for their products under varying flow, position and load conditions, and obtain quantitative data enabling them to improve their design.

According to marine energy developers, it may take 10-12 years to reach commercialization while going through all of the Technology Readiness Level (TRL) gates outlined by Department of Energy (DOE). These TRL gates range from low- to mid-stage analysis such as physical model scale testing wave tanks and basins, and flumes; to higher levels such as open-water and grid-connected testing.

Currently, industry struggles with the limited availability of marine energy testing infrastructure; which according to the DOE Waterpower Technologies Office, limits the ability to quickly assess the performance of devices and components, innovate solutions, and deploy the devices.

WAVE ENERGY CONVERTERS

Ohmsett bridges that disparity with the ability to test individual and coupled surface wave energy converters, subsurface wave energy converters (surge and ballast plate), surface current converters and near-shore tidal wash converters at-scale. The very first step for cost

effective development of wave, tidal, and current energy devices is through the use of computerized simulation tools that can predict the performance in a variety of operating conditions. "Using this information developers can then perform tank testing to verify the computer models by running experiments using different wave conditions in the controlled testing environment," according to Paul Meyer, BSEE's Ohmsett manager. "The various wave energies, wavelengths, and periods during at-scale testing provides valuable validation prior to open water trials. Additionally, physical modeling data can be used to calibrate the numerical models and ultimately optimize the design."

Ohmsett's wave generating capabilities include programmable amplitude, frequency and wave length, creating random waves that more closely approximate waves in the ocean, and waves that break at specific locations within the tank. It has a fully computerized control platform for collecting data from various sensors and video cameras for synthesis and analysis. The recorded information from tests performed on marine energy devices includes environmental conditions, wave data, electrical current output, accelerometer data, as well as tether load forces.

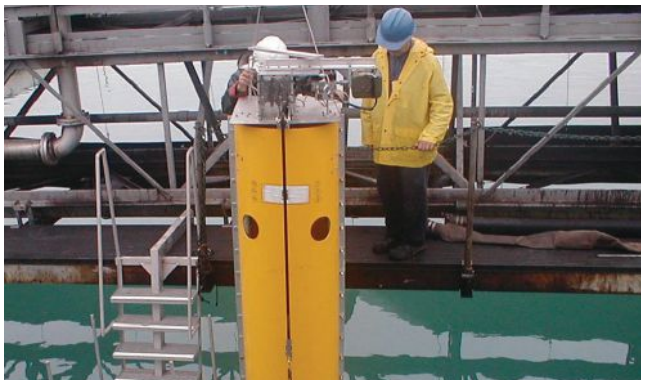
In addition to marine energy, Ohmsett conducts technology evaluations for the Blue Economy which includes remote sensing, systems for remote operation, ocean floor mapping, subsurface characterization, wave characterization, and the removal of dielectric fluids from the marine environment. Dielectric fluids are used in wind turbine generators and on centralized electrical service platforms.

FUTURE INVESTMENTS

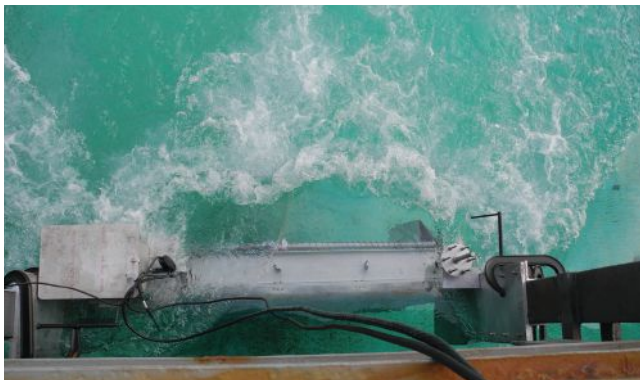
BSEE is continuously investing in and expanding Ohmsett's capabilities to develop and test state-of-the-art equipment. This includes infrastructure capital investments for a better and more repeatable test environment. Scheduled for the summer and fall 2021 tank refurbishment, infrastructure improvements will include structural and electrical upgrades, bridge repairs, a new and refined beach system, as well as expanded instrumentation capability. Future improvements include new main and vacuum bridges, an expanded bridge house, upgraded data acquisition, and tighter control over the tank's water level and salinity.

According to Meyer, BSEE is in the initial design stage of fabricating a small scale wave and flume tank (approx. 60 to 80 feet in length) to compliment the capabilities of Ohmsett's outdoor tank. "The flume tank would be ideal for smaller scale experiments that would allow researchers to fine-tune experimental methods for expanded tests in the main tank."

"Facility improvements are primarily focused to support our core mission of oil spill response R&D; however, many of these improvements also advance Ohmsett's capability for testing marine energy and technology for the Blue Economy. Similarly, marine energy and blue technology testing may help develop technologies, e.g., instrumentation/remote sensing/remote operation, which may be advantageous to the oil spill response community," stated Meyer.



» *A wave energy device fitted with probes and sensors that measure energy output was tethered to the main bridge and placed in the Ohmsett tank for testing. (Photo credit: Ohmsett)*



» *A device that extracts energy from ocean, river, tidal and currents was tested for current speed and electrical loading. (Photo credit: Ohmsett)*

» *The most notable feature of the Ohmsett facility is the above-ground outdoor concrete test tank measuring 667 feet long by 65 feet wide by 8 feet deep and filled with 2.6 million gallons of crystal clear salt water. (Photo credit: Ohmsett)*

» *The new SVA R2 Subsea satisfies Safety Integrity Level (SIL) 3 in accordance with IEC 61508 and IEC 61511. (Image credit: Bosch)*

BOSCH REXROTH INTRODUCES WORLD'S FIRST ELECTRIC SUBSEA VALVE ACTUATOR

At Hannover Messe, Bosch Rexroth will present a disruptive innovation for electrically actuating valves in the subsea process industry. The new SVA R2 Subsea Valve Actuator is the world's first electric actuator that can replace conventional hydraulic cylinders with field-proven safety technology and without taking up additional space. The integrated electric controller offers precise motion control. Thanks to condition monitoring and a safety spring, the SVA R2 satisfies Safety Integrity Level (SIL) 3 in accordance with IEC 61508 and IEC 61511. The use of internationally standardized interfaces throughout means even more standardization in the subsea process industry. The actuator minimizes energy consumption and is geared toward delicate ecosystems. At the same time, the installation and operating costs are reduced. The functions, operating life and safety of the actuator have already been successfully tested in accordance with international standards. When the SVA R2 is used in subsea factories at a depth of up to 4,000 meters, hydraulic pipes or power units are no longer required. The electric supply pipes which are already installed for sensors are adequate to ensure the reliable operation of the actuators.

Up until now, the operators of process systems have mainly relied on hydraulic cylinders in order to open and close subsea valves with a quarter turn and a defined force. With offshore installations, for example for oil and gas production, these cylinders are supplied by a central hydraulic power unit with hydraulic pipes several kilometers in length. This solution uses a great deal of energy in order to compensate for the cumulated losses and it cannot control the movement with precision. To date, plant engineers and operators have still relied on hydraulic cylinders because they are the only components to offer field-proven safety systems with a mechanical spring in a compact design. The electric actuators which are currently available do not have such a safety function as this is not possible given the size and weight requirements. Approaches designed to ensure safety using subsea batteries cannot guarantee the reliable closing of valves over the required operating life of up to 25 years.

For the agile development of the SVA R2, the Bosch Rexroth team worked closely with a number of suppliers and operators of offshore installations, as well as international universities. The new module comprises a pressure-compensated container that contains an electric drive, a motion control system and a safety device—and can replace the hydraulic cylinders previously used on a 1:1 basis. It requires only one cable for the power supply and communication. The SVA R2 is designed to actuate valves reliably with the power supply that is commonly used for subsea sensors. Switching to compact and safe electric actuators means that the hydraulic pipes several kilometers in length along with the associated power units and controllers are no longer required.

The Subsea Valve Actuator is designed for high volume production. The electronics for the motion control system are from the automotive division and offer proven robustness and reliability. The SVA R2 is protected by a number of patents and is designed to operate for 25 years. Bosch Rexroth relies on globally accepted interfaces throughout and supports plant engineers, operators and offshore service providers when standardizing equipment. The actuators for rotary adjustment complement the SVA L2 Subsea Valve Actuator for linear movements, which received the "Spotlight on Technology™ Award" from the renowned Offshore Technology Conference (OTC) last year.

Bosch Rexroth tests full scale prototypes on a specially built test stand in accordance with the most stringent international standards for subsea applications. Compared to other applications, they set the highest requirements in regards to the functions and safety of the components and modules used. As a result, the SVA R2 is suitable for other applications both below and above water such as hydrogen production, CO2 storage and general applications in the process industry. The first pilot tests are due to start in the third quarter of 2021.

The SVA R2 is nominated for the HERMES AWARD, the most important international industry award.

NICOLA OFFSHORE AND CYPRUS SUBSEA SIGN PARTNERSHIP AGREEMENT

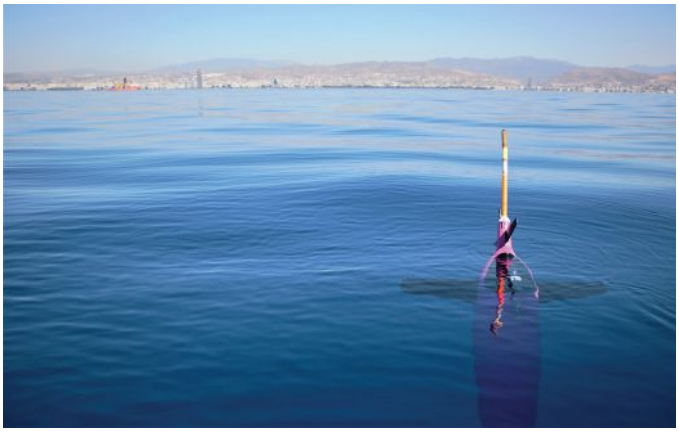
Hydrographic marine survey company Nicola Offshore GmbH and Cyprus Subsea Consulting and Services C.S.C.S. Ltd (C.S.C.S.) have signed a commercial partnership agreement with the goal of sharing knowledge and resources to unlock new efficiencies for acquiring marine data using multibeam echosounders, subsea gliders and ocean monitoring instruments.

Opened in March 2021 as a sister company to Nicola Engineering, a survey company operating since the seventies, Nicola Offshore will bring technical expertise on the more specialist aspects of marine data acquisition such as object and unexploded ordinance (UXO) search to the partnership. Established in 2012, Cyprus Subsea Consulting and Services C.S.C.S. Ltd will contribute its expertise in subsea glider surveys and oceanographic sensors for marine monitoring, as well as its experience in automating aspects of marine environmental surveying.

"The partnership helps to extend the reach of both companies, opening more opportunities to support clients in Northern and Southern Europe," said Daniel Esser, Managing Director, Nicola Offshore. "While the commercial potential is exciting, we're also keen to extend our service platform with glider capabilities and expertise, and be part of developing new methodologies and processes together with C.S.C.S. that will enable us to expedite and secure the precision of the data we acquire on behalf of clients."

"Nicola Offshore has demonstrated a unique focus on delivering high quality marine data for demanding ad-hoc campaigns, which we feel strongly complements our existing services and technology portfolio," said Cyprus Subsea Managing Director, Dr. Daniel Hayes.

» *Nicola Offshore's Nautical Explorer*



» *Cyprus Subsea Consulting and Services will contribute its expertise in subsea glider surveys and oceanographic sensors for marine monitoring. (Photo credit: Cyprus Subsea)*

"We're looking forward to developing the capabilities, technology and network of C.S.C.S. and Nicola Offshore, while at the same time providing new and extended capabilities to our established client base."

ASHTEAD TECHNOLOGY AND ZETECHTICS TO OFFER NEW ROV TOOLING TECHNOLOGIES

Integrated subsea technology and services provider Ashtead Technology has signed a deal with Zetechtics to offer customers a range of new ROV tooling technologies.

The agreement will see an array of torque tools, control systems and associated peripherals from the subsea control systems specialist made available to customers through Ashtead Technology's nine customer service hubs.

David Mair, Ashtead Technology's Business Development Director said: "We are continually developing and expanding our capability to meet the diverse needs of our customers around the world, who operate in all areas of the global energy industry. These new technologies offer improved performance, reliability and efficiency, as well as a greater level of user-friendliness.

"Zetechtics has 27 years of experience for us to draw on and this collaboration is set to add undeniable value to our customers operations."

The deal gives both organizations the scope to add further specialist equipment based on demand.

Alan Duncan, Commercial Director of Zetechtics, said: "Customers prefer to use modern, easily-supported equipment, with the type of technical features they would have access to if buying new.

"We are excited to collaborate with Ashtead Technology and by introducing a wide range of new equipment to the market in this way will enable their customers to unlock the potential of our market-leading solutions."

» *The deal gives both organizations the scope to add further specialist equipment based on demand. (Photo credit: Ashtead)*

OCEAN INFINITY AND GREGG DRILLING FORM JOINT VENTURE

Marine robotics company Ocean Infinity and geotechnical drilling experts Gregg Drilling, a subsidiary of Alaska Native Corporation Sealaska, have formed a Joint Venture (JV) to provide geotechnical services to offshore markets in traditional and renewable energy field developments and cables.

The JV combines the expertise and assets of the two companies and will see Gregg Drilling mobilize its seabed drills onto the Armada fleet of uncrewed and optionally crewed vessels ranging from 21-78 meters in size.

Pairing Gregg's deep-water geotechnical drilling capability with Ocean Infinity's Armada geophysical fleet, and recently enhanced data analytics capabilities following the acquisition of MMT, will expand capabilities for both companies to complete offshore investigations globally. The JV will enable more sustainable underwater development, including geotechnical data collection, needed to support offshore wind anchor and foundation design.

Oliver Plunkett, Ocean Infinity's CEO, said: "Partnering with Gregg Drilling to further expand the capabilities of our Armada fleet of vessels will enable us to provide full-service solutions to customers spanning geophysical and geotechnical tasks."

"Gregg Drilling and its parent company Sealaska share our vision for reducing the environmental impact of offshore activities. This agreement marks another step on our journey to transform marine operations, and we are excited to be doing so in partnership with another innovative team that shares our passion for sustainability."

John Gregg, President of Gregg Drilling, said: "We are pleased to partner with Ocean Infinity to provide an industry-leading geotechnical offering. Ocean Infinity's Armada fleet has revolutionized the outlook for marine operations through its uncrewed capability and its unmatched focus on sustainability. We look forward to working together to best use the expertise of both companies."

» *Ocean Infinity's Armada Fleet. (Image credit: Ocean Infinity)*

3D AT DEPTH DELIVERS SUBSEA LIDAR METROLOGY TO SUPPORT NORTH SEA PROJECT

3D at Depth, Inc., the world's expert in commercial Subsea LiDAR (SL) laser technology and leading provider of underwater survey support services and 3D data solutions, recently announced that they have completed a series of 31 metrologies at eight locations on the Equinor Snorre Expansion Project, for Subsea 7.

The Snorre Expansion Project is the largest project for improved recovery on the Norwegian continental shelf and will increase production from the Snorre field by almost 200 million barrels, extending the field life beyond 2040.

Subsea 7, a global leader in the delivery of offshore projects and services for the energy industry, contracted 3D at Depth's U.K. office to conduct metrologies as part of the company's installation campaigns for Pipeline Bundle systems. Each location required metrology measurements for multiple parallel spools which would be installed as single cassettes between the Pipeline Bundles to wellheads and manifolds. The flexibility of Subsea LiDAR (SL) technology and its workflow allowed for a smooth integration into the project, and every SL 3D data set was easily exported into standard formats for measurement, quality control, visualization, and analysis.

Throughout the project, Subsea LiDAR scans were completed in 8-10 hours providing operational cost savings compared with alternative technologies. In addition, multiple Subsea LiDAR 3D point cloud data sets were combined with terrestrial LiDAR scans using a workflow developed by 3D at Depth to provide robust quality control measures.

The combination of terrestrial and subsea point cloud data allowed the team to derive inferred metrology results for the production manifold hubs which would be installed subsea during later campaigns. 3D at Depth's SL point clouds were then subsequently used during the spool design process and for cassette spool clash assessments, providing confidence the installations would be successful.

Overall, 3D at Depth's SL technology generated 3D data sets that contributed to a smooth installation of the cassette spools. The client also received a high-quality digitisation of their subsea assets. This capability of SL technology provides additional value as the oil and gas industry continues to make offshore field digitalisation a priority.

"We were excited to be part of such an important project," stated Ian Ellis, Operations and Client Lead Europe, Africa and the Middle East, 3D at Depth, Ltd. "Our track record in the industry extends beyond the value of traditional metrology data collection survey programs. Subsea LiDAR's capabilities are built around the quality and repeatability of the 3D Data sets that the technology delivers on a consistent basis. Our patented systems produce information that empowers installation engineers to have the confidence in the measurements, so they can challenge the boundaries of new installation designs to reduce risk and production downtime."

FISCHER CONNECTORS INTRODUCES **THE FISCHER ULTIMATE™ CONNECTORS**

The global connectivity solution provider Fischer Connectors has extended its flagship series of ultra-rugged and harsh-environment connectors with two new products: the Fischer UltiMate™ 80, a field-ready NATO STANAG 4695-compatible connector offering unparalleled functionality and ruggedness in comparison with similar harsh-environment quick-release connectors; and the standard Fischer UltiMate™ connector now available in size 15 with various pin layouts of up to 27 signal and power contacts.

Intermateable with other NATO STANAG 4695 connectors, the field-ready Fischer UltiMate™ 80 connector comes in two layouts featuring 6 or 7 signal and power contacts (size 08) with up to AWG 22. Engineered in Switzerland, it offers an ultra-rugged, lightweight and IP68-sealed connectivity solution for any harsh environment, especially for defense and security applications and soldier modernization programs. Its design is exceptionally rugged by any market standards and compliant with MIL-STD-810 and MIL-STD-202, providing environmental and mechanical performance and endurance that outperform by far other suppliers' similar connectors:

- **Ruggedness:** high resistance to corrosion (500h salt mist), up to 10,000 mating cycles for the plug / 5,000 for the receptacle, random vibration 7.7 Grms, shock resistant (100 G), cable bending resistance (+/-90° for 5000 cycles), temperature (-55 °C to +135 °C), triple key coding
- **Light weight:** housing material in aluminum: 2,7 g
- **Environmental sealing:** connector Ingress Protection mated and unmated: IP68 sealing 2m/24h.

The Fischer UltiMate™ 80 connector comes as a pre-cabled plug, and a pre-cabled and/or panel receptacle.

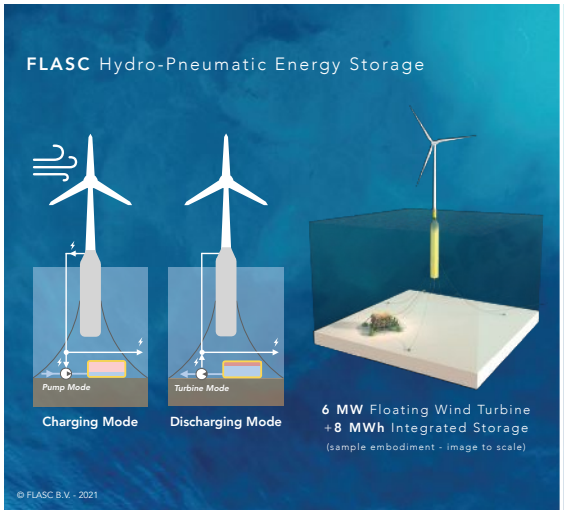
As for the new Fischer UltiMate™ connector in size 15, it meets special power and high-speed data requirements for further design and technology developments with various contact layouts (2, 4, 8, 4+12 or 27 signal and power contacts).

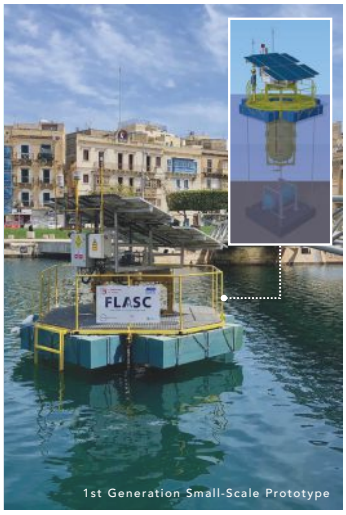
These new connectors are part of the world-renowned rugged, compact, and lightweight Fischer UltiMate™ Series used to ruggedize technology for field operations in extreme environments. Environmentally sealed to resist extreme shocks and vibrations, these durable and reliable connectors are ideal to interconnect devices, equipment, hubs and embedded electronic systems where weight matters, for example in defense and security, industrial, instrumentation, marine & underwater, as well as robotics and unmanned vehicles.

The Fischer UltiMate™ connectors' resin-sealed contact block offers extreme sealing (up to IP68 / IP69 even unmated, gastight, CBRN decontamination), high shock and vibration resistance, as well as superior cable resistance in terms of traction.

Fischer Ultimate™ 80 — Fischer Ultimate™ Series in size 15

With the new Fischer UltiMate™ 80, Fischer Connectors has been able to design a highly reliable and cost- effective product offering best value for money. The new Fischer UltiMate™ in size 15 features up to 27 signal and power contacts.





FLASC working principle (left) and proof of concept prototype (right). (Image credit: FLASC)

Sea Trials. (Photo credit: FLASC)

CHECK THE TECH

FLASC: OFFSHORE ENERGY STORAGE

THE CHALLENGE

One of the more complex challenges facing the offshore renewables sector is grid integration. In particular, how to address the mismatch between intermittent renewable energy production and consumer demand. Renewable energy sources deliver a power output that oscillates over time, but consumers demand stable and reliable power at all times. Enter FLASC, a novel energy storage technology designed to convert variable renewable energy supply into a stable output that facilitates seamless grid integration.

THE SOLUTION

FLASC's Hydro-Pneumatic Energy Storage (HPES) technology stores energy by pumping seawater to compress a fixed volume of pressurized gas. When in charging mode, electricity is used to pump water into this closed chamber, working to compress the pre-charged gas. In discharging mode, the compressed gas is allowed to expand, releasing the pressurized water through a hydraulic turbine to generate electricity. The unit can be integrated directly into a floating offshore platform or installed as an external plug-and-play solution. The technology is ideal for absorbing or dissipating energy to stabilize rapid changes in output, allowing operators to improve asset utilization and deliver renewable power on demand.

OFFSHORE APPLICATION

FLASC has been successfully prototyped and tested and has already received a Statement of Feasibility from DNV. This breakthrough technology has been engineered to help large offshore wind farms improve the quality of power production to consumer grids; to supply reliable power in remote locations; and to support decarbonization efforts of the offshore oil & gas sector. FLASC can also improve the performance and lifetime of electrolyzers when producing Green Hydrogen from wind.

The FLASC technology can also be used in applications requiring large volumes of cold pressurized seawater. These include:

- Offshore green H2 production
- Liquefaction of CO2 for carbon capture and storage
- Seawater desalination
- Liquefaction of natural gas (LNG)
- Water injection for oil extraction from subsea wells

FLASC leverages existing infrastructure and established supply chains, along with the marine environment itself as a natural heatsink, resulting in a safe, reliable and cost-effective solution.

A long service lifetime and no cycling degradation means that a FLASC HPES system can reduce total cost of ownership by 40-50% when compared to the equivalent lithium-ion battery bank. Finally, the system can be safely decommissioned and fully recycled at end-of-life.

INDUSTRY RECOGNITION

In 2020, FLASC secured a strategic collaboration with Subsea 7, a global leader in the delivery of offshore projects and services for the evolving energy industry. This collaboration leverages Subsea 7's world-class technical expertise in the development of offshore subsea solutions to accelerate the deployment of utility scale, low maintenance, offshore energy storage.

"This collaboration with Subsea 7, a global leader in the sector, is a major milestone in the process of taking our innovative energy storage solution from a proven concept to a versatile commercial product. Through this collaboration, we look forward to accelerating our path to market, in line with the growing demands of an offshore sector in the midst of an accelerating green transition." – Daniel Buhagiar, Co-Founder and CEO, FLASC B.V.

FLASC was also awarded the "Best Innovation Award" at Offshore Energy 2020, an award that recognizes best-in-class innovation across the entire offshore energy sector. In addition, FLASC has been awarded the "Solar Impulse Efficient Solution" Label, rewarding profitable solutions to protect the environment, and identifying it as one of 1000 Solutions to Change The World.

For more information, visit: *www.offshoreenergystorage.com*

AQUATERRA ENERGY SECURES LARGEST RISER ANALYSIS CONTRACT TO DATE

Aquaterra Energy, has secured the company's largest riser analysis contract to date, a five-year deal with a major Middle Eastern operator to provide green and brownfield riser analysis. Combined with other recent project wins in the Middle East, Aquaterra Energy will now deliver an estimated £1m of riser analysis work over the five-year period.

Acting as a primary riser analysis supplier, Aquaterra Energy will manage and deliver multiple scopes of long-term work using its in-house analysis teams. Located in Abu Dhabi and Qatar, the contracts incorporate a wide range of recurring brownfield riser analysis projects, with future greenfield opportunities. The brownfield platform modification projects include slot recovery, slot addition and assisting development of inspection program of existing conductors.

Martin Harrop, Riser Analysis Manager at Aquaterra Energy, commented on the projects delivered to date: 'With the region shifting its focus to aging infrastructure, there is a growing appetite for experienced riser analysts amongst operators. As the operations are often non-standard, we have been working closely with our client's engineers to find solutions to challenging operational concerns. Our analysis has generated many cost-saving, operational and decarbonization benefits for our clients in the region."

» *Andrew McDowell, Operations Director at Aquaterra Energy. (Photo credit: Aquaterra Energy)*

Andrew McDowell, Operations Director at Aquaterra Energy added: "The Middle East is embarking on its next stage as an oil and gas producing region. Operators are now continuing to invest in new projects but also finding themselves with a glut of legacy assets coming to end-of-life from earlier generations of investment. To safely and efficiently maximize output, our expert riser analysts are perfectly placed to support operators with both green and brownfield projects. With a long-term contract in place, I see this as the start of a major period of growth for us in the region."

CODA OCTOPUS INTRODUCES THE ECHOSCOPE4G® C500 INSPECTOR SYSTEM

Coda Octopus has released the new Echoscope4G®C500 Inspector system, designed as a modular, mobile platform designed to make sonar deployment simple and fast.

The Inspector comprises a bespoke, lightweight integrated sensor platform supporting the ISAR rotator and the C500 sonar. The Inspector platform can be suspended and lowered from a single lifting point for near-surface temporary deployments or can be placed directly on the seabed using the extendable tripod legs included with the system. A single integrated sensor cable (ISC) connects the ISAR and C500 sonar to the 3D Connect integrated topside unit providing power, control and data.

The C500 sonar is mounted on the ISAR rotator offering a wide range of pan motion. In addition, an adjustable tilt bracket allows simple adjustment of the vertical field of view to suit different applications and environments. A laptop running CodaOctopus® Underwater Survey Explorer (USE) or 4G USE®software completes the suite providing real-time 3D visualization including integrated pan control of the sonar via the ISAR rotator. The C500 Inspector system can provide relative positioning and real-time monitoring capability for scene awareness and diver 3D tracking. The C500 Inspector system can also be used to create relative 3D models instantly of the underwater scene, especially useful prior to dive operations to facilitate a safe, context rich environment for the diver.

US OFFSHORE WIND CABLE MARKET SET TO EXPLODE

Offshore wind in the United States has the potential to be one of the largest geographic markets for such cable in the world, but it has stumbled time and again in the face of an uncertain regulatory situation. It now appears, however, that with strong federal government support for offshore wind, along with the momentum already established in many coastal states, the US could finally reach its full potential.

Ocean News & Technology's sister publication, SubCableWorld, has been studying the US offshore wind cable market since its tentative beginnings and now sees the market poised to grow strongly throughout this decade.

"2021 could be a pivotal year for the offshore wind cable market in the United States," said John Manock, editor of SubCableWorld. "Cable contracts were being awarded in late 2019, but most of 2020 was a lost year due to uncertainty over federal government policy. Now, with the support coming from the Biden Administration, which set a goal of 30 GW of offshore wind power by 2030, developers and suppliers have more confidence that they will see a consistent government policy and that confidence already has shown up in a renewal of activity cable contracts."

In a soon-to-be-published report providing a forecast of the offshore wind cable market from 2021-2030, SubCableWorld presents three scenarios for development of the market:

1. A baseline scenario of only the state procurements already announced

2. A scenario that includes future procurements already under discussion and a modest deployment of floating wind technology

3. The most aggressive scenario adding a large-scale floating wind deployment, particularly in California

The most aggressive of these scenarios calls for a demand of nearly 14,000 kilometers of offshore wind cable over the course of the decade. In terms of dollars, this represents a market of over US$11 billion. SubCableWorld measures demand by the amount of offshore wind cable represented in contract awards announced during a given calendar year. As contract awards are, on average, signed about three years in advance of a wind farm coming online, this means that the forecast includes cable that will be deployed early in the next decade.

"Offshore wind in the US is a long-term proposition," Mr. Manock continued. "Offshore wind farms are technological and engineering marvels with a very long project development cycle. Forecasting that far in advance is challenging, but the conditions exist for the US cable market to be one of the top three markets in the world. Cable suppliers, both overseas and domestic, need to be aware of activities in the US market and plan ahead to take advantage of opportunities as they present themselves."

For more information about SubCableWorld's upcoming report on the offshore wind cable market, email jlewis@tscstrategic.com.

NKT CABLE BARGE READY FOR GROWING OFFSHORE WIND MARKET

NKT has christened its new energy-efficient power cable barge, being part of a larger investment program to support the growing demand in offshore wind industry.

The barge *NKT Agrippina* is now ready for her maiden trip transporting power cables for the German offshore wind project Ostwind 2.

NKT Agrippina is named after the founder of Cologne, Germany, and is specially designed to transport offshore power cables on the river Rhine from the NKT factory in Cologne to the offshore loading center in Rotterdam, the Netherlands.

Following the official christening, *NKT Agrippina* is now ready to set out on her maiden trip proudly loaded with a section of the power cables for the German Ostwind 2 offshore wind project. NKT has ensured to design *Agrippina* to be energy-efficient and while in harbor she is connected to the quay utilizing green energy from the grid.

"*NKT Agrippina* will support us in ensuring a stable and reliable path to the offshore harbor in Rotterdam where we also increase the capacity. With these investments, we strengthen our position as a leading provider of offshore power cables for the growing demand from the offshore wind industry," said Executive Vice President Mika Makela, who is heading the manufacturing site in Cologne.

With the positive market outlook and a strong order backlog, NKT is executing an investment program in its high-voltage facilities located in Cologne and Karlskrona to meet the growing demand for high-voltage power cables produced sustainable and with a minimal environmental impact from the transportation of the power cables. The two factories are strategically well-located for high-voltage projects in the North Sea and in the rest of Europe.

» *NKT Agrippina is now ready for her maiden trip. (Photo credit: NKT)*

» *The cables will be manufactured at JDR's state-of-the-art facility in Hartlepool, UK in 2022. (Photo credit: JDR)*

JDR WINS LEUCATE FLOATING OFFSHORE WIND PROJECT IN FRANCE

JDR, the global subsea cable supplier, has been awarded a contract to supply, test and terminate the 66kV dynamic cables in consortium with SDI, part of the DEME Group for the Leucate floating wind farm. The consortium was awarded the contract by Réseau de Transport d'Électricité (RTE) and Eoliennes Flottantes du Golfe du Lion's (EFGL), a consortium comprising Engie, EDP Renewables, and Caisse des Dépôts. Once completed, Leucate will be one of the largest offshore floating wind farms in France.

Located off the coast of the Leucate-Le Barcarès area, the demonstration floating wind farm will feature three V164-10.0 MW wind turbines, in water depths of 65 to 80 meters. JDR will design and manufacture the dynamic and static cables to connect the floating turbines to the shore, where they will connect to a grid at Saint-Laurent de la Salanque. SDI will undertake the overall delivery and installation of the cables provided by JDR.

JDR's 'wet design' 66kV cable removes the need for a lead radial water barrier—the component most susceptible to dynamic fatigue due to the movement of a floating turbine. In addition, the specially designed breakaway system will then protect the floating platform in the unlikely event of a mooring line failure in harsh weather conditions.

Wojtek Skoczylas, CSO at JDR Cables, commented: "The floating offshore wind market is accelerating at a rapid pace. As waters get deeper, innovations in 66kV dynamic cables like ours will be required to meet demand. It's an exciting time for the industry and subsea cable technology! We're delighted to have won this project and to be again working in close partnership with the DEME group, having collaborated on many previous projects."

The cables will be manufactured at JDR's state-of-the-art facility in Hartlepool, UK in 2022 before being shipped to France for installation in 2022.

The contract comes as part of France's target to have up to 12.4 GW of fixed-bottom and floating offshore wind capacity either in operation or under development by the end of 2028.

ROTECH COMPLETES CABLE WORK AT NORTH SEA WIND FARM

Rotech Subsea has successfully completed a major cable de-burial and post-lay trenching scope for an offshore energy market solutions leader at a key offshore wind farm in the British North Sea.

Rotech Subsea's state-of-the-art RS2 jet trenching tool was deployed to complete the works from its headquarters in the fourth quarter of 2020.

Rotech Subsea were contracted to carry out cable de-burial and post-lay trenching works on multiple sections of the offshore wind farm. The client requested Rotech's RS2 for the de-burial of cables in one section which were buried 1.5m below Mean Sea Bed Level. The jet trenching tool was also deployed for the burial work of cables in another sector of the OWF which were required to be buried to client specification of 1.5m top of cable.

The subsea spread of equipment was mobilised in Q4, 2020 with the Controlled Flow Excavation tool operating in water depths of up to 32m LAT. Soil conditions in the de-burial sector were loose with the presence of clay.

The project was a great success with the client delighted with the RS2's technical and performance capabilities which contributed to a saving on total project costs. The RS2 excelled in de-burial and burial operations, finding no issues in the harder areas where there could have been the presence of clay.

The RS2 reached client de-burial specification with ease, achieving it in one pass at a progress rate of 4.8m/min. In the post-lay trenching areas some sections were softer than expected resulting in rapid backfill of about 0.7m. This was no issue at a progress rate of 3m/min with the RSE Controlled Flow excavator achieving between 2.2m-2.5m BOT allowing for the cable to fall to its 1.5m TOC burial specification in just one pass.

» *The cables will be manufactured at JDR's state-of-the-art facility in Hartlepool, UK in 2022.(Photo credit: JDR)*

PLANNING BEGINS ON BORNHOLM ENERGY ISLAND CABLE ROUTES

As part of the Danish climate agreement of June 2020, it was decided that two energy islands would be built in the Baltic and North Seas, linking offshore wind farms that together can provide 5 GW and cover the electric consumption for approximately 5 million households in Denmark and nearby countries. The global engineering, architecture and consultancy company Ramboll has been awarded one of the first pilot climate and seabed studies for the energy islands.

Danes were recently introduced to a new concept, 'energy island,' which refers to an existing island, an artificial (physical) island or platform that functions as a hub for electricity production from nearby offshore wind farms, to be collected and distributed to one or more countries.

The energy company, Energinet, has now asked Ramboll to map and recommend possible submerged cable routes and landing locations for the export of power from the future energy island near Bornholm, to Denmark and an adjacent country.

"The project is of major strategic importance since the result will help form the basis for decisions about import and export of energy from the new energy island, as well as how renewable energy from the islands will interconnect the countries. This will be vital when all Europeans need green energy," said Mikkel Benthien Kristensen, Global Division Director for Environmental Impact Assessments at Ramboll.

The energy islands represent a completely new era for renewable energy and will make Denmark the frontrunner when it comes to the advanced utilization of offshore wind. These projects are crucial for Denmark, because the green energy from the islands can help meet the growing electricity consumption in a climate-friendly Danish society, while also accelerating Europe's green transition.

Ramboll's long-term and extensive experience with cable route planning and environmental feasibility studies internationally from projects such as the Viking Link electricity interconnector between Jutland and England, and the Baltic Pipe gas transmission system were among the reasons for choosing Ramboll. These projects are complex and cross-disciplinary in nature and require ongoing cooperation between many different specialists. Ramboll's project team therefore draws on 15 experts from Ramboll in Denmark, Sweden and Germany.

This work creates the groundwork for subsequent investigations and approval of the project. The next step in the project for the energy island Bornholm will be to carry out the environmental feasibility studies to ensure that the energy island has as few negative consequences as possible for the marine environment and surrounding nature.

VARD ORDERS RED ROCK FOR NEW CABLE LAYING VESSEL

Vard has contracted Red Rock Marine AS to deliver a Knuckle Telescopic Offshore Crane for the new build CLV ordered by Van Oord in The Netherlands.

The vessel will strengthen Van Oord's leadership position in the growing offshore wind market. Van Oord has a leading role in the laying and burying of offshore wind power cables. It highlights Van Oord's drive to continuously reinforce its market position by investing in state-of-the-art sustainable technology.

Red Rock Marine AS will deliver a purpose built Knuckle Telescopic Offshore Crane in 2022. The vessel is scheduled to be delivered from Vard Brattvaag in Norway in 2023.

JAN DE NUL ORDERS VERSATILE TRENCHING VEHICLE

Jan De Nul Group has signed an agreement with Osbit Ltd (UK) for the design and construction of a new subsea trenching vehicle, named Swordfish. Delivery is scheduled for the first quarter of 2022.

The Swordfish will be a high-powered state-of-the-art subsea trenching vehicle that can be fitted with either a jetting installation, a mechanical chain cutter or a combination of both to tackle a wide variety of soil conditions and bury cables up to 3 or even 3.5 metres deep.

Wouter Vermeersch, Manager Offshore Cables at Jan De Nul Group, said, "The Swordfish makes the perfect addition to our existing fleet of trenching vehicles providing excellent protection for cables installed by any of our Cable Laying Vessels. With its high power, the Swordfish will be able to bury the cables deeper and thanks to its hybrid mechanical chain cutting configuration the Swordfish can also tackle more challenging soil conditions, including hard clays up to 400 kPa. This new investment, together with the recent acquisition of our cable installation vessel Connector, arms Jan De Nul Group for the energy transition of tomorrow. We look forward to working together with Osbit Ltd (UK) on this project and to offer customers the best solution for their cable projects."

Robbie Blakeman, Joint Managing Director at Osbit Ltd (UK), said, "We are delighted that Jan De Nul has selected Osbit to supply the Swordfish trenching vehicle. We worked closely with Jan De Nul on specifications and drew from our in house trenching expertise and proven technology base to develop this market leading subsea vehicle. We pride ourselves on serving a global market and as a UK based company with a predominantly local supply chain, this projects allows us to continue to strengthen our exports of specialist equipment to mainland Europe. Furthermore, it allows us to continue to invest in our people, critically the development of highly skilled engineering roles at our home base in the North East of England. We look forward to collaborating closely with Jan De Nul throughout this exciting project and delivering the Swordfish on time and fully operational for its first campaign."

» *Jan De Nul Group's new subsea trenching vehicle, Swordfish. (Image credit: Jan De Nul Group)*

Swordfish specifications:

- The Swordfish will be powered by 2 x 300 kW hydraulic power units and 2 x 300 kW electric HP jet pumps.
- In jetting configuration, it will be capable of tackling soil strengths up to 125 kPa, thanks to its 1,120 kW of pump power. In mechanical or hybrid mode, it will be able to cope with soil strengths up to 400 kPa, using its 400 kW chain cutter tool and 420 kW additional jetting power.
- The main jetting tool is combined with front cutting nozzles and additional rear backwash swords to optimize trenching performance. Thanks to the modular buoyancy the underwater weight of the vehicle in jetting mode is less than 1 tonne, resulting in a ground pressure not exceeding 5 kPa which allows trenching vehicle operation in very soft soil conditions.
- The innovative chain cutter design and cable loading system minimize cable handling, plus it has the added benefit of a closed box depressor to guarantee first-time-right protection.
- The trenching vehicle will be launched with a dedicated A-frame and hoisting winch from one of Jan De Nul's offshore vessels.

Specifically for the Race Bank Offshore Windfarm Export Cable project in the UK, Jan De Nul designed and built two intertidal trenching vehicles Sunfish and Moonfish that achieved an environmental and industry first. Both trenching vehicles received several industry awards for their innovative design and have subsequently been modified and used in support of several cable installation and protection projects in Europe.

SAAB SEAEYE'S WATER POWERED SABERTOOTH CUTS CO2

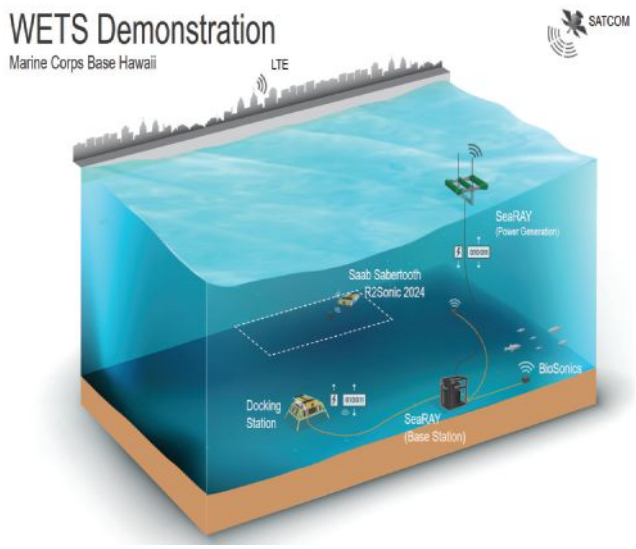
Converted energy from waves powering a Saab Seaeye Sabertooth autonomous vehicle operating in seabed residency mode is a major renewable energy breakthrough.

Significant savings in support vessel costs and CO2 emissions will result.

Pioneering the concept is C-Power's SeaRAY Autonomous Offshore Power System (AOPS), which provides offshore power, energy storage, and real-time data communications for resident marine systems.

Trials of the Sabertooth residency concept will take place at the U.S. Navy's Wave Energy Test Site (WETS) in Hawaii and last 20 days. The SeaRAY AOPS and other static assets will remain deployed for six months.

The Sabertooth, owned by Hibbard Inshore, and operated on behalf of C-Power, will repeatedly patrol pre-programmed areas to collect data, before returning to an underwater docking station for cloud upload and battery recharge.



» *Hawaii Wave Energy Test Site. (Image credit: WETS)*

Included in the studies will be seabed analysis, fish densities, infrastructure monitoring and water-column data gathering.

Many sectors will benefit

Many underwater sectors are seen to benefit from this innovative emission-free concept, including marine science and research, defence and security, aquaculture, and offshore energy.

The trials come in partnership with the U.S. Department of Energy's Water Power Technologies Office, together with the National Renewable Energy Laboratory and the U.S. Navy.

In particular, testing of the SeaRAY AOPS is included in the Navy's Coastal Trident 2021 program, which is the largest port and maritime security undertaking in the nation.

For the Navy, the conventional difficulty in conducting underwater infrastructure surveys leaves critical infrastructure vulnerable to sabotage and intelligence gathering threats in this hidden environment. Frequently refreshed high-definition sensor data can alert remote operators to possible intruder activity.

Operating the Sabertooth will demonstrate that subsea residence enables a sustained presence to secure underwater port infrastructure and its ability to support efforts to protect shipping against underwater explosive devices.

For the trials, the Sabertooth will be equipped with an R2Sonic Sonic 2024 multibeam echosounder, 2G Robotics ULS-500 PRO Laser Scanner and camera, and the ASL AZFP 70,120 & 200 kHz Acoustic Zooplankton Fish Profiler.

Uniquely Hovering

The success of the multi-role, 3000 m rated Saab Seaeye Sabertooth comes from it being the world's only roaming and hovering system that can operate in both fully autonomous (AUV) and tethered (ROV) modes, enabling fully flexible dual operations from a single platform.

Hibbard will deploy the Sabertooth for other significant projects this year including research at Lake Michigan by the National Oceanic and Atmospheric Administration (NOAA) concerning the invasive zebra mussel that adversely impacts the U.S. Great Lakes Region at a cost of $500 million a year.

The 3000 m rated Saab Seaeye Sabertooth is the world's only roaming and hovering multi-role vehicle that can operate in both fully autonomous (AUV) and tethered (ROV) modes.

» *The 3000 m rated Saab Seaeye Sabertooth is the world's only roaming and hovering multi-role vehicle that can operate in both fully autonomous (AUV) and tethered (ROV) modes. (Image credit: Saab Seaeye)*

DAMEN SHIPREPAIR AMSTERDAM READIES HNLMS EVERTSEN FOR VOYAGE TO JAPAN

After a six-week period of maintenance, Damen Shiprepair Amsterdam has this week handed the HNLMS *Evertsen* back to the Royal Netherlands Navy. The shipyard worked hard—together with its Dutch suppliers—to prepare the Air Defence and Command frigate for deployment on, among other things, the voyage of nearly 40,000 kilometers that she will soon be making to Japan together with the UK Carrier Strike Group.

HNLMS *Evertsen* is one of the four air defense and command frigates (LCF) of the De Zeven Provinciën class. Under the leadership of Damen Naval in Vlissingen, these advanced LCF frigates were built between 1998 and 2005 by the Dutch maritime industry. At the time, more than 80 percent of the production value was accounted for by Damen's Dutch maritime suppliers, mostly SMEs, which underlines the self-creative capabilities of this sector.

The maintenance works were carried out between 1 March and 13 April on behalf of the Royal Netherlands Navy's Naval Maintenance and Sustainment Agency (DMI). These activities also engaged various Dutch companies such as Braspenning Coatings from Amsterdam, installation company FMJ NW from Amsterdam, ARP Valve Repair from Middelburg, BUKO Algeco (Beverwijk) and RBC

» *HNLMS Evertsen will become part of the UK Carrier Strike Group. (Photo credit: Damen)*

Safety from Rotterdam. The maintenance of the propeller shafts was carried out by Damen Shiprepair Amsterdam under the supervision of Wärtsilä Nederlands, in collaboration with Wagenborg Nedlift and PMR Hydraulics, among others. Furthermore, various minor repairs and paintwork were carried out on the ship.

From May, *HNLMS Evertsen* will become part of the UK Carrier Strike Group. Under the command of the British aircraft carrier HMS *Queen Elizabeth*, this squadron has Japan as its final destination. The strike group will undertake a range of operations and training with allies and partners along the way, including maritime missions with NATO in the Mediterranean Sea and Coalition operations in the Middle East.

The following major planned maintenance program of the HNLMS *Evertsen* is expected to take place in 2022.

» *Seahawk can carry 14,000 gallons of fuel, enough to power the twin diesel engines for a substantial length of time. (Photo credit: Leidos)*

LEIDOS COMPLETES DELIVERY OF SEAHAWK VESSEL TO U.S. NAVY

Leidos has completed the delivery of a cutting-edge autonomous vessel to the U.S. Navy, known as Seahawk. The Office of Naval Research awarded Leidos the cost-plus-fixed fee contract to build the vessel, with an approximate value of $35.5 million, in December 2017. Work was principally performed on the Mississippi Gulf Coast.

"As technology continues to accelerate and adversaries become more sophisticated, our customers must constantly evolve," said retired Rear Adm. Nevin Carr, Leidos Vice President and Navy strategic account executive. "We are honored to provide this latest technological advancement to America's sailors who fight to keep the seas open and free."

Seahawk is a long-range, high-availability autonomous surface vessel with a composite trimaran hull. This medium-displacement unmanned surface vehicle (MDUSV) will enhance capabilities for naval operations. Like Leidos' MDUSV Sea Hunter, Seahawk is substantially larger than other U.S. Navy USVs and has significantly increased capabilities compared to smaller USVs in terms of range, seakeeping and payload capacity. Seahawk is designed to operate with little human involvement, thus providing a forward-deployed and rapid-response asset in the global maritime surveillance network.

"We didn't just put an autonomous navigation system onto an existing ship," said Dan Brintzinghoffer, Leidos Vice President for Maritime Solutions. "Every mechanical and electrical system on Seahawk has unique configurations designed to run for months at a time without maintenance or a crew."

The trimaran's displacement (fully loaded) is 145 long tons. This includes 14,000 gallons of fuel that can power the twin diesel engines for a substantial length of time. Seahawk's upgraded design follows an evaluation of over 300 lessons learned from Sea Hunter. These upgrades were based on joint evaluations by Leidos and the Navy and include upgraded electrical systems, a payload mounting system and test operator control station.

Seahawk will join SURFDEVRON in San Diego, California.

ELBIT SYSTEMS COMPLETES ACCEPTANCE TESTS FOR HELLENIC COAST GUARD COMBAT SUITES

Elbit Systems Ltd. recently announced that it has successfully completed the acceptance tests for new patrol vessels of the Hellenic Coast Guard (HCG). In March 2019, the Company reported that it was awarded a contract from Cantiere Navale Vittoria SpA to supply combat suites and perform systems' integration for the new patrol vessels of the HCG.

The acceptance tests were conducted in the Aegean maritime arena and included integration level tests of the combat systems and subsystems onboard the vessels as well as live firing tests from the onboard Remote Controlled Weapon Stations.

The systems supplied and integrated by Elbit Systems include the SPECTRO XR Electro Optical payloads, Radars, Navigation Systems, Warship Automatic Identification System (W-AIS) as well as Remote Control Weapon Stations (RCWS) with full integration into a Command and Control software. The combat suit is designed to support future "plug and play" integration of aerial and surface unmanned systems that will enable expansion of the operational envelop of the patrol vessels far beyond line of sight.

Its broad portfolio of maritime capabilities ranging from EW, sonars, EO and CMS, to autonomous platforms and weapon systems enables Elbit Systems to provide navies with enhanced situational awareness and deterrence capabilities, as well as integrated combat suites for new and in service ships.

» *The acceptance tests were conducted in the Aegean maritime arena. (Photo credit: Elbit Systems)*

AERONAUTICS' ORBITER 4 SMALL TACTICAL UAS FOR MARITIME PATROL MISSIONS

Aeronautics Group, a leading provider of integrated turnkey solutions based on unmanned system platforms, payloads and communications for defense and HLS applications, has launched its Orbiter 4 small tactical UAS, capable of performing long-range, long-endurance maritime patrol missions.

The Orbiter 4's high-performance EO/IR and MPR payloads are ideal for maritime monitoring, gas and oil rig protection, illegal activity tracking, and SAR. It has already been fully integrated into the operational environment of navy vessels, and meets the requirements of navy operations.

With the Orbiter 4, Aeronautics continues the evolution of its Orbiter product line of small tactical UAS, delivering top mission performance with the lightest, most versatile, and most advanced covert platform available today. Based on the successful aerodynamic structure and properties of the Orbiter 3 STUAS, the Orbiter 4's exclusive abilities include endurance of over 24 hours, and the ability to carry and operate multi payloads simultaneously.

"There is a growing need today for tactical drones capable of carrying out ISTAR missions in challenging marine environments," said Matan Perry, Vice President of Marketing & Sales at Aeronautics. "As pioneers in the field of small tactical UAS, we are proud to be able to provide a solution that has been adapted to meet these needs. Having been specifically tailored in this way, we believe it to be the best possible solution to meet all the requirements of the navy."

With advanced image processing capabilities, automatic takeoff and recovery system, and the ability to navigate with or without GPS/datalink, Orbiter 4 delivers superior performance capabilities, operational flexibility and cost-effectiveness in a small tactical UAS that is unique in its category. Airstrip independent, it is able to take-off and land on any type of vessel. Operated by only three personnel, it is easy to use, maintain, and carries a low logistical footprint.

» *The Orbiter 4 is capable of 24-hour missions and can operate multi payloads simultaneously. (Photo credit: Aeronautics Group)*

LEIDOS COMPLETES ACQUISITION OF GIBBS & COX

Leidos Holdings, Inc., a FORTUNE® 500 science and technology leader, has completed the acquisition of Gibbs & Cox, Inc. for approximately $380 million in cash. The transaction was previously announced on Feb. 23, 2021. Gibbs & Cox will operate as a wholly-owned subsidiary and will be combined with Leidos' maritime systems division.

Headquartered in Arlington, Virginia, Gibbs & Cox is the largest independent ship design firm focused on naval architecture and marine engineering. The company's world class naval architects, designers, engineers and program managers develop innovative vessel designs and naval capabilities. The acquisition positions Leidos to provide a broad set of engineering solutions to the US Navy and to an expanding set of foreign Navies.

"We are delighted to welcome the Gibbs & Cox team to the Leidos family," said Leidos Chairman and CEO Roger Krone. "Gibbs & Cox is widely regarded for developing the most talented and experienced naval designers in the world. We look forward to this new era of innovation while combining the best of both companies."

"We are excited to join Leidos, whose employee culture and history of innovation strongly mirror our own legendary 91-year history," said Gibbs & Cox President and Chief Executive Chris Deegan. "Gibbs & Cox will remain the nation's largest independent provider of maritime services. The combination of our world-class naval architecture, design and engineering services with Leidos' speed, security and scale will significantly enhance our combined offerings in the fast growing maritime undersea, autonomous and cyber security segments. We look forward to mapping a new Gibbs & Cox with Leidos for the next 90 years."

SPRINGTIME IN AMERICA: OIL AND GAS PRICES STEADY AS ECONOMY RECOVERS

BY G. ALLEN BROOKS | Author, *Musings From the Oil Patch* | www.energymusings.com

Crude Oil:

The U.S. economy continues to slowly reopen as the vaccination pace nearly hit three million jabs per day in April. Over 50 percent of the adult population has received one of the various vaccines, and now that the suspension of the Johnson & Johnson vaccine over questions about blood-clot reactions in a handful of recipients has been resolved the prospect of herd immunity for America is on the horizon. The campaign to convince reluctant adults to get the vaccine is shifting into high gear, although the idea of company mandates for employees to be vaccinated to continue employment is becoming a legal and moral question.

With vaccinations rising, states and cities that employed aggressive lockdown strategies to mitigate the spread of the virus are announcing reopening dates for their economies. New York City just said 100 percent open July 1st. This comes after Massachusetts and Boston, as well as California are announcing reopening dates. Office workers are returning—just how many and on what schedules remains unclear. But U.S. oil demand is now within a few percentage points of reaching pre-pandemic levels.

The Energy Information Administration reported that average jet fuel consumption for the four weeks ending April 23 was 1.2 million barrels per day, up 200,000 barrels over the four weeks ending March 26. The number of passengers processed by TSA at airports is establishing new highs. Moreover, major airlines are reporting sharply higher bookings for air travel for the upcoming summer. Colleges and universities are announcing plans for in-person fall semesters. All signs point to a strong second half 2021 economy, and higher energy demand.

The European Union announced it will allow vaccinated travelers to visit this summer, suggesting the continent is heading toward normalcy. With economic green shoots emerging, it is not surprising that OPEC has increased its global oil demand forecast. The 70,000-barrel-per-day boost, while small, marks a change in tone for the organization that now foresees a 5.95-million-barrels-per-day increase for 2021, after consistently cutting its forecast since March 2020, which then called for 7 million barrels more. By slowly adding additional oil supply to the market, OPEC has been able to keep oil prices steady in the upper $60 per barrel range for Brent.

In the U.S., WTI started 2021 at just under $48 a barrel, but then steadily rose, reaching $60 by mid-February. Since then, other than during a brief foray above $65 in late March, WTI has traded in a $60-$64 range. Strong first quarter GDP growth numbers is buoying oil prices. Prices are likely to continue trading in the mid-$60s a barrel range, as traders eye OPEC's next move on supply and how America's oil producers react to higher demand and prices. A steady recovery is what everyone wants, and with OPEC sitting on 8 million barrels of idle capacity (9 percent of global demand), stable pricing is likely.

Natural Gas:

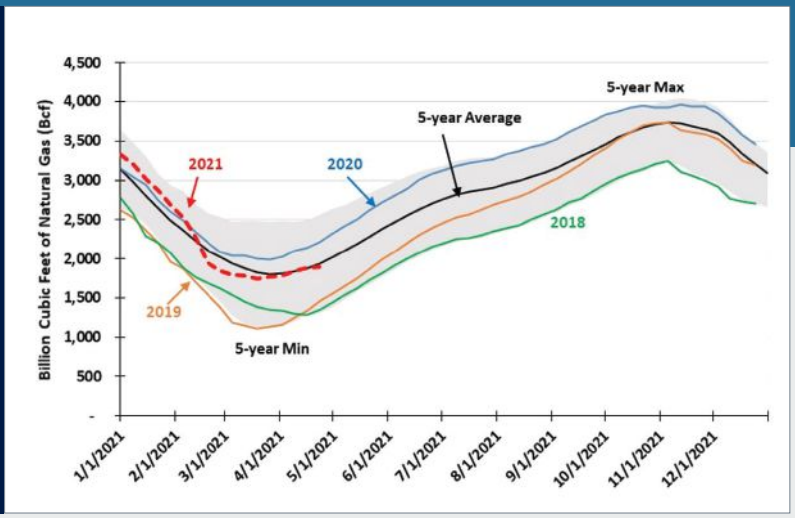
Much like the crude oil market, natural gas prices have traded for extended periods of this year in narrow ranges other than rising sharply in mid-February in response the Arctic vortex that pushed temperatures to record lows and felled the Texas power grid, while also causing short-term power blackouts in other mid-continent and Southeast states. April, however, has proven to be different.

After dipping to $2.46 per thousand cubic feet early in April, the near-month gas futures contract steadily rose to within hailing distance of $3 by the end of the month. In the face of unsettled spring weather that saw bouts of winter conditions returning to various portions of the country at different times, natural gas storage injections have been on the low side of the forecast ranges. This implies that either supply is struggling, or gas for power consumption and/or export is stronger. As U.S. oil production has fallen by 2 million barrels per day over the past year, associated natural gas output has suffered, too. Gas volumes are somewhat less impacted than oil. As shale oil production declines, well output tends to become gassier that helps sustain total gas volumes, slowing the industry's supply decline.

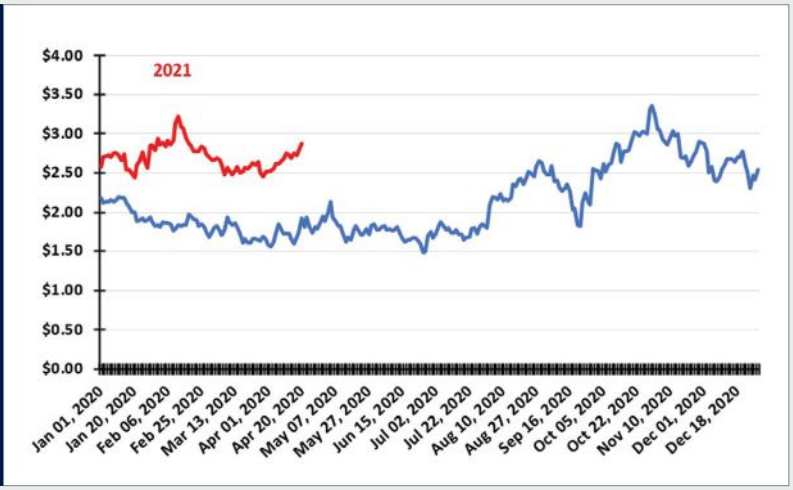
The bigger issue for U.S. natural gas markets is the demand side of the equation. The colder weather that causes gas prices to rise allows cheaper coal to capture more demand. Utilities have recently talked about shifting to cheaper coal in generating power. The primary demand influencer for natural gas is higher LNG exports, as terminals are operating at peak capacity and a new terminal is firing up. The cold winter in Europe depleted its gas storage, helping LNG arbitrage pricing with the U.S. Gulf Coast.

The latest development, for which there is no history, is that a handful of LNG shipments have been converted into "clean" cargoes using carbon-offsets. Presently, one should view these trades as experimental. Whether substantial volumes can be converted into clean gas cargoes remains unknown. We also have no idea how many buyers may be persuaded to purchase such cargoes, as we believe the logistics adds to their cost. Does the attractiveness of clean gas change when prices move from $2.50 to $3.00? We have no idea, and suspect neither do the traders, yet. This is an interesting development to track as it could add a new dynamic to the global gas market.

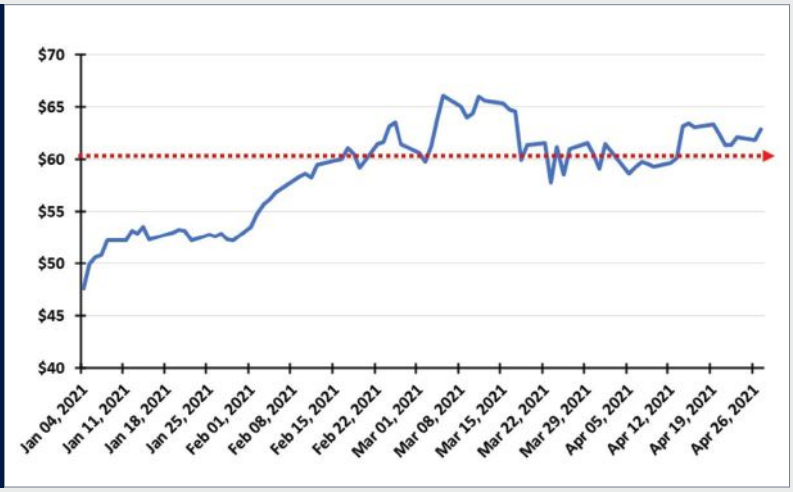
Gas Storage Helped By Extreme Cold Is Now Tracking 5-Year Average Storage



2021 Gas Prices - Better Than Last Year; Not As Strong As In 4Q2020 But Heading There



Oil Price Stability Since Mid-February Points to $60 Floor



AMERICAS

H2O Conference
Virtual » June 7-10
www.h2oconference.ca

Int'l Conference on Ocean, Offshore & Arctic Engineering (OMAE)
Virtual » June 21-30
https://event.asme.org/OMAE

Floating Wind Solutions
Houston, TX » June 28-29
www.floatingwindsolutions.com

AUVSI XPONENTIAL Atlanta
Atlanta, GA » August 16-19
www.xponential.org/xponential2021

Offshore Technology Conference (OTC)
Houston, TX » August 16-19
http://2021.otcnet.org/

International Partnering Forum (IPF)
Richmond, VA » August 24-26
www.offshorewindus.org/2021ipf

International Telecoms Week
Washington D.C. » August 29 - September 1
www.internationaltelecomsweek.com

Offshore Well Intervention LATAM
Rio de Janeiro, Brazil » September 8-9
www.offsnet.com/latam

Global OCEANS
San Diego, CA » September 20-23
www.global21.oceansconference.org

SIPEX
Virtual » October 5-7
https://surinameoilexpo.com

ACP Offshore Windpower
Boston, MA » October 13-15
https://cleanpower.org/events/offshore-windpower-2021-conference-exhibition/

EUROPE

Seawork
Southampton, UK » June 15-17
www.seawork.com

Underwater Technology Conference (UTC)
Virtual » June 16-17
www.utc.no

All-Energy
Glasgow, UK » August 18-19
www.all-energy.co.uk

Deep Sea Mining Summit
London, UK » August 25-26
www.deepsea-mining-summit.com/

Submarine Networks EMEA
London, UK » September 1-3
www.terrapinn.com/conference/submarine-networks-world-europe/index.stm

SPE Offshore Europe
Aberdeen, UK » September 7-10
www.offshore-europe.co.uk

Seanergy
Nantes, France » September 21-24
https://www.seanergy-forum.com/en/seanergyforum

Ocean Business
Southampton, UK » October 12-14
www.oceanbusiness.com

Offshore Energy
Amsterdam, The Netherlands » October 26-27
https://www.offshore-energy.biz/offshore-energy-2021/

Undersea Defence Technology (UDT)
Rostock, Germany » December 14-16
www.udt-global.com

OTHER REGIONS

Telecoms World Middle East
Virtual » June 15-16
www.terrapinn.com/conference/telecoms-world-middle-east/index.stm

PHILMARINE
Manila, Philippines » June 23-25
www.philmarine.com

Gastech
Singapore » September 13-16
www.gastechevent.com

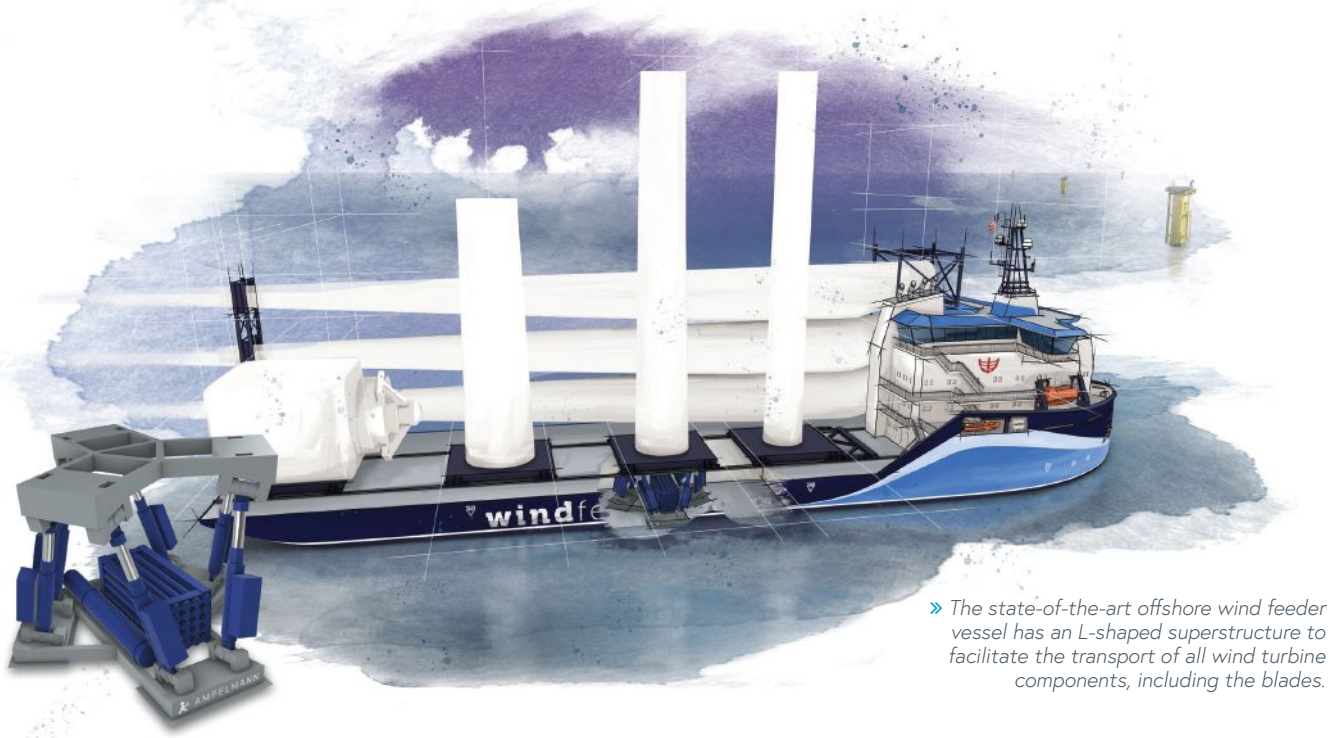
Submarine Networks World
Singapore » September 29-30
www.terrapinn.com/conference/submarine-networks-world/

Mediterranean Offshore Conference
Alexandria, Egypt » October 12-14
www.moc-egypt.com

ADIPEC
Abu Dhabi » November 15-18
www.adipec.com

Telecoms World Asia
Bangkok » November 16-17
www.terrapinn.com/conference/telecoms-world-asia/index.stm

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	TECHNOLOGY & INDUSTRY FOCUS	2021 EDITORIAL CALENDAR
JANUARY **Editorial:** Dec. 28 **Ad:** Jan. 14	» **The Essential 2021 Offshore Toolkit**	**Technologies:** ROV tooling & control, Subsea cables, Remote inspection, Supply vessels, turbines, tethers, and more. **Industry Focus:** Offshore Energy & Renewables, Marine Survey, Scientific, Defense	
FEBRUARY **Editorial:** Jan. 25 **Ad:** Feb. 11	» **Ocean Observation**	**Technologies:** Buoys, ADCP, Data Software, Sensors, Drifters, Gliders, and more. **Industry Focus:** Marine Survey, Scientific, Offshore Energy & Renewables	
MARCH **Editorial:** Feb. 22 **Ad:** Mar. 11	» **Unmanned Vehicles & Marine Robotics** » **Distribution:** GIPEX 💻 / June 28-30	**Technologies:** USVs, AUVs, ROVs, Aerial drones, Control systems, Seafloor residency, and more. **Industry Focus:** Offshore Energy, Marine Survey, Defense, Academic, Subsea Infrastructure	
APRIL **Editorial:** Mar. 22 **Ad:** Apr. 08	» **Defense & Security**	**Technologies:** Autonomous Navigation, Comms & Telemetry, Magnetometers, GIS, Sonar, and more. **Industry Focus:** Subsea Defense, Government, Offshore Energy, Subsea Infrastructure	
MAY **Editorial:** Apr. 19 **Ad:** May 06	» **Marine Renewables** » **Distribution:** SIPEX 💻 / June 1-3 Floating Wind Solutions / June 28-29 Int'l Partnering Forum / Aug. 24-26 H2O Conference 💻 / June 7-10	**Technologies:** Turbines, Subsea Cables, Inspection Drones, Subsea Batteries, Grid Integration, Connectors, and more. **Industry Focus:** Offshore Wind, Wave Energy, Tidal Energy, Alternative Offshore Energy	
JUNE **Editorial:** May 17 **Ad:** June 03	» **Bathymetric Mapping & Hydrographic Survey**	**Technologies:** Oceanographic Equipment & Instrumentation, Sensor Suites, ADCP, Buoys, ROVs, and more. **Industry Focus:** Marine Survey, Academic, Geotechnical Services	
JULY **Editorial:** July 01 **Ad:** July 15	» **Unmanned Vehicles Buyers' Guide** 💻	**Technologies:** ROVs, AUVs, USVs, Towed & Bottom Crawling Vehicles, and Gliders. **Company Focus:** Exclusive company/product spotlights and editorial features available	
AUGUST **Editorial:** July. 26 **Ad:** Aug. 12	» **Deep-Sea Exploration** » **Distribution:** Global OCEANS / Sept. 20-23	**Technologies:** Seabed samplers, Mining machines, Geotechnical tooling, Seafloor imaging equipment, and more. **Industry Focus:** Offshore Energy, Marine Mining, Scientific	
SEPTEMBER **Editorial:** Aug. 23 **Ad:** Sep. 09	» **Offshore Build, Inspection & Maintenance** » **Distribution:** Ocean Business / Oct. 12-14 Offshore Energy / Oct. 26-27 ACP Offshore Windpower / Oct. 13-15	**Technologies:** Inspection drones, Turbines, Subsea cables, Power substations, Battery technology, Grid integration, Connectors, and more. **Industry Focus:** Offshore Operations & Maintenance, Offshore Energy & Renewables	
OCTOBER **Editorial:** Sep. 20 **Ad:** Oct. 07	» **Submersibles** » **Distribution:** Ocean Energy Europe / Dec. 6-7 UDT / Dec. 14-16	**Technologies:** Manned submersibles, Navigation systems, ROVs, Submarines, Resident Subsea Vehicles, and more. **Industry Focus:** Offshore Energy, Defense, Academic, Marine Mining	
NOV./DEC. **Editorial:** Oct. 18 **Ad:** Nov. 11	» **Subsea Engineering & Infrastructure**	**Technologies:** Subsea drills, Prospecting tools, Deck handling equipment, and more. **Industry Focus:** Offshore Energy, Defense, Marine Mining, Government	
SPECIAL ISSUE **Editorial:** Nov. 18 **Ad:** Dec. 1	» **The Future of Ocean Technology**	**Tech and Industry Focus:** Our Special Edition unites an exclusive roll call of industry thought leaders to discuss the innovative breakthroughs set to redefine how we work in marine environments over the coming decade.	



» *The state-of-the-art offshore wind feeder vessel has an L-shaped superstructure to facilitate the transport of all wind turbine components, including the blades.*

OFFSHORE WIND FEEDER VESSEL DESIGN REVEAL
BY AMPELMANN AND C-JOB NAVAL ARCHITECTS

Ampelmann and C-Job Naval Architects have joined forces to develop a one-of-a-kind offshore wind feeder vessel concept with motion compensation technology, specifically suited for the rigorous demands of operating off the east coast of the United States of America.

The concept design combines the knowledge of Ampelmann, the Dutch offshore access provider, and independent ship design company C-Job Naval Architects. Together they have created a viable solution in response to the need to support the construction and logistics of offshore wind farms in the United States under the Jones Act.

Todd Allen, VP Business Development at C-Job Naval Architects, said: "The United States is ambitious in its plans to grow the installed offshore wind power. The only viable way to realize this goal while complying with the Jones Act is utilizing offshore wind feeder vessels. Together with our strategic partner Ampelmann, the experts in motion compensation, we have created an innovative ship design ready to support construction of US wind farms today and into the future."

The state-of-the-art offshore wind feeder vessel has an L-shaped superstructure. This enables the transport of all wind turbine components, including the blades, while keeping the ship itself relatively compact minimizing construction and operational costs. To maximize workability and allow for safe lifting of the components, the feeder vessel features a specially designed motion compensation system by Ampelmann.

The system uses Ampelmann's core technology to stabilize the components of the wind turbine generator (WTG) in six degrees of freedom and is designed for safe lifting operations in sea states up to 2.5 m significant wave height. The compensator is positioned close to the vessel's center where it can compensate all vessel motions and allows for continued operations—even in adverse weather conditions—throughout the year.

Gus DeOliveira, Ampelmann's Business Development Area Manager for the Americas, commented: "We see a lot of potential for the offshore wind market in the US and believe that we can add some unique value based on our decades long experience in the offshore wind market. Our partnership with C-Job is crucial if we are to design and deliver just the right solution for this growing market."

The wind turbine components are arranged on the ship with a quick connect grip-and-glide system. Cargo pallets are placed on deck quickly thanks to the quick connect system. Once the feeder vessel is at its destination, the system slides the components into place to connect to the motion compensator. The Ampelmann system then compensates all vessel motions, so the crane operator can lift turbine components in a similar fashion to an onshore lift.

The motion compensated wind feeder vessel is designed to provide maximum efficiency and workability during the construction of an offshore wind park. The conventional way of working is that the installation vessel would transport the components and then do the installation of the turbines. However, this is an inefficient use of the WTIV and in the case of foreign vessels not allowed by the Jones Act.

With this feeder concept—which is envisioned to be a series—the turbine components are brought to the installation site by the feeder vessel. With two or more vessels per project, this allows the WTIV to focus on the installation of the turbines and ensures operations can continue at all times.

OCEAN OBSERVATIONS

SeaState
THE ON&T PODCAST
SEASON 2 / EPISODE 5

By Ronda Moniz, Host of SeaState

In our May episode of SeaState, we chat about ocean observation with the new Executive Director of Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) Dr. Jake Kritzer, and Dr. John Trowbridge who is Principal Investigator of the Ocean Observatories Initiative. The Ocean Observatories Initiative is funded by the US National Science Foundation and operated and maintained by a partnership of the Woods Hole Oceanographic Institution (WHOI), the University of Washington, Oregon State University, and Rutgers University.

Dr. Trowbridge serves as President of the Board of Directors of the Northeastern Regional Association of Coastal Ocean Observing Systems, a component of the Integrated Ocean Observing System. He is a Senior Scientist and has served as Chair of the Department of Applied Ocean Physics & Engineering at the WHOI. His research interests include coastal physical oceanography, coastal engineering, and ocean observing. He has authored or co-authored numerous publications in professional scientific and engineering journals. He is registered as a professional engineer in the Commonwealth of Massachusetts and has bachelors, masters, and doctoral degrees in engineering from the University of Washington, the Massachusetts Institute of Technology, and the Woods Hole Oceanographic Institution.

Dr. Jake Kritzer joined NERACOOS in June 2020. Prior to NERACOOS, he served in a series of progressively senior positions over a 16-year career with the Environmental Defense Fund. There, his primary focus was fisheries science and policy in the U.S., Cuba, China, and elsewhere, with additional work on marine protected areas, watershed management, and other issues. Jake has also served on a number of technical, advisory, and regulatory bodies working with fishery management agencies, municipal governments, environmental organizations, and industry associations. Jake earned a bachelor's degree in biology from Middlebury College and a Ph.D. in marine biology from James Cook University and completed a post-doctoral fellowship at the University of Windsor in Ontario, Canada. He is the author of more than 40 peer-reviewed publications in marine ecology and policy, and senior editor of the milestone ocean science text Marine Metapopulations. He lives in the seacoast of New Hampshire with his wife, seven-year-old daughter, and three dogs.

» *Dr. Jake Kritzer*
Executive Director of Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)

» *Dr. John Trowbridge*
Principal Investigator of the Ocean Observatories Initiative

AAE TECHNOLOGIES LOOKS FORWARD WITH A FRESH NEW LOOK

aae technologies, an award-winning manufacturer of specialist subsea equipment, has refreshed its brand and website as it looks to accelerate business growth in the UK and overseas.

Complementing the launch of its groundbreaking Easytrak Pyxis INS + USBL tracking system, the rebrand also underpins recent company expansion and the formation of aae's dedicated geophysics and renewables divisions.

Originally founded as applied acoustics in 1989, aae technologies was launched in 2016 as a parent company for applied acoustics and sister company, modulus technology. Through its two sub-brands, the company designs and develops innovative hydro-acoustic solutions for customers in the marine, defence, oil & gas and renewable energy industries worldwide.

applied acoustics has twice won the Queen's Award for Enterprise in the International Trade category, in recognition of its technical innovation and export growth.

Adam Darling, chairman of aae technologies, first launched the company from a goat shed in his back garden. A talented engineer himself, he now heads a team whose products are used extensively around the globe and in ways that genuinely transform the world for the better—whether it's playing a vital role in the development of offshore renewable energy installations, keeping marine traffic safe from underwater threats and hazards, or helping the scientific community gain a better understanding of the oceans.

The company's rebrand encompasses contemporary new logos for aae technologies and its two sub-brands—applied acoustics and modulus technology—as well as a new website that incorporates the refreshed branding and effectively consolidates the three companies.

"Lockdown gave us an opportunity to refocus the business and find even better ways of connecting with our customers," said Adam Darling, chairman of aae technologies. "Our new website reflects a changing industry, and indeed a changing aae technologies, as we continue to develop new products and enhance our expertise in a number of areas, not least geophysics and renewables, which are vital industries both now and in the future."

applied acoustics' products range from sophisticated underwater positioning and tracking systems to acoustic equipment for sub-bottom profiling and geophysical surveys. modulus technology provides technical support for applied acoustics products, as well as custom engineering services for customers in need of bespoke solutions for one-off projects.

» *Adam Darling, chairman of aae technologies*

» *Easytrak Pyxis INS + USBL tracking system*

SUBSEA INDUSTRY LEADER TAKES THE HELM AT DECOM NORTH SEA

Decom North Sea (DNS), the only membership organization dedicated to the oil and gas decommissioning sector, has announced the appointment of Fraser Moonie as Chief Executive Officer.

Well-known across the international marketplace, Fraser brings over 25 years' experience to the role, including 15 years with Bibby Offshore where he was instrumental in growing the company into one of the global subsea industry's key players.

His decommissioning-specific experience includes some of the sector's highest profile campaigns; from Technip's Phillips Maureen platform re-float project in 2001 through to 2015's ConocoPhillips MacCulloch and 2017's CNR Murchison, with international experience in the Gulf of Mexico decommissioning for Shell Pipeline (Shell Oil US) in the same year.

Commenting on his appointment, Fraser said: "I join Decom North Sea at what continues to be an extraordinary time for society and a challenging time to be in business. I believe that the next five years are critical to our industry, and that Decom North Sea has a key role to play in facilitating domestic and international success for its members.

"Continuing the sterling work of my predecessor and his board of directors, my aim is to consolidate DNS' position as a key voice within the decommissioning arena. Operator, supply chain and regulator communities share a joint vision to provide safe, cost-effective and environmentally-sound decommissioning as the energy transition accelerates—and DNS exists to provide a vital link between each group, facilitating their joint success."

Jinda Nelson, Chair of DNS' board of directors, added: "We are thrilled to welcome Fraser to Decom North Sea, knowing that his global decommissioning experience, entrepreneurial spirit and engaging manner make him a perfect candidate to drive the DNS strategy.

"Highly respected and with outstanding, well-documented leadership skills, Fraser's passion for this industry is clear and we are convinced that he will play an important part in the future of the organization and wider decom sector."

DNS' interim Managing Director, Will Rowley, who has led and developed the organization during the past 12 months, will support a smooth transition before continuing his long-standing involvement with DNS.

» *Fraser Moonie, CEO, Decom North Sea. (Photo credit: Emma Lawson Photography)*

NEW INMARSAT REPORT ON SINGAPORE'S VIBRANT MARITIME START-UP SECTOR

A new study sponsored by Inmarsat, the world leader in global, mobile satellite communications, offers the most comprehensive overview ever of Singapore's vibrant maritime start-up sector.

The *Trade 2.0 Singapore Maritime Start-up and Innovation Ecosystem Report*, published through the Inmarsat Research Program, is the second country-specific study of start-ups and their impact on maritime digitalization. It builds on a global Trade 2.0 report launched in 2019 and the Japan Trade 2.0 report published in April 2020. Once more, the report is authored by Leonardo Zangrando, Founder of Startup Wharf, and Nick Chubb, Managing Director of maritime innovation consultancy Thetius.

With one-quarter of the world's goods passing through the Singapore Strait each year, the report identifies the island city-state as 'The Startup magnet'. Singapore's maritime IT market alone is forecast to generate US$2.4 billion in 2021 and reach US$4.8 billion by 2030.

Two Singaporean accelerators are driving innovation for the shipping and offshore sectors. Pier 71, founded by the Maritime and Port Authority and NUS Enterprise, has matched start-ups with backers including BP, Wilhelmsen, Pacific International Lines, Ocean Network Express, Cargotec, Wärtsilä, Vopak, and Bernhard Schulte Shipmanagement. Meanwhile, the Techstars/Eastern Pacific Shipping 'MaritimeTech Accelerator' has provided a home to 18 emerging technology companies.

"Singapore is a maritime technology 'David' in a world of 'Goliaths' with a unique, agile and rapidly expanding innovation ecosystem for start-ups," said Ronald Spithout, President, Inmarsat Maritime.

» *The Trade 2.0 Singapore Maritime Start-Up and Innovation Ecosystem Report identifies Singapore as 'The Startup Magnet'.*

The *Trade 2.0 Singapore Maritime Startup and Innovation Ecosystem Report* captures some rising start-up stars, with several showing how the approach can bring or adapt solutions quickly to markets.

Greywing was originally a platform aimed at making it easier for ship operators to access security resources by matching suppliers with clients, for example. The COVID-19 crewing crisis led to its repositioning as a tool to get crews safely home by analyzing data and controls from 100,000 ports, including immigration restrictions, visas and flight availability.

COVID-19 also encouraged Aeras Medical to expand its digital platform to include remote video 'Fit-to-Travel' services, allowing doctors to certify crew without physically boarding the vessel.

"Enabled by the Fleet Data IoT platform, Inmarsat's Certified Application Provider (CAP) program has grown dramatically in Singapore," added Spithout. "We have five Singapore companies already in the program, four of which are in scaleup mode. They cover vessel performance, video monitoring, fuel optimization, crew wellbeing and more, and are among the maritime digitalization pioneers. We have also been working with start-up accelerators such as Rainmaking which signifies the importance of the country.

MARLINK GROUP TO ACQUIRE ITC GLOBAL

Marlink Group, backed by Apax Partners sas, has obtained final regulatory approvals to acquire 100% of ITC Global from Panasonic. The Marlink and ITC Global management teams are preparing for a swift closing of the transaction in the coming weeks, while remaining fully focused on providing best-in-class services to their customers across the world.

Both the Federal Communications Commission (FCC) and the Committee on Foreign Investment in the United States (CFIUS) have given their approval to the deal. All is now on track for ITC Global to join the Marlink Group on April 30, supporting the expansion of the Group's global leadership in the energy and enterprise markets.

As part of the Marlink Group, ITC Global will mainly focus on energy and high-end customers who demand specific and complex managed network solutions. Furthermore, ITC Global will extend and complement Marlink Group's global footprint with a strong presence in the US, the UK and Australia.

Erik Ceuppens, CEO of the Marlink Group, said: "We are pleased to welcome ITC Global as part of the Marlink Group. ITC Global will become a cornerstone of the Group as we expand our global leadership position beyond our Maritime and Enterprise businesses. Our customers will benefit greatly from the combined Group's enhanced capabilities and strengths; and from an industry-unique portfolio of innovative and fully managed smart network solutions that is enabling the digital transformation of their remote operations."

Ian Dawkins, CEO of ITC Global, said: "There has been a lot of disruption and uncertainty among the providers in our sector recently, but ITC Global has all the way demonstrated expertise and stability to provide best-in-class managed satcoms services across the world. Being part of the Marlink Group will only enhance this position as we build on the synergies across the Group to deliver better and better services."

Marlink Group has very strong momentum in all its businesses and has in recent years outperformed the market both commercially and financially. With the support of its investors, Marlink Group will continue its selective and successful M&A strategy to further develop and exploit its growth potential.

» *As part of the Marlink Group, ITC Global will mainly focus on energy and high-end customers who demand specific and complex managed network solutions. (Image credit: Marlink)*

» *C-Kore team receiving the Queen's Award for Enterprise (Innovation) in 2019. (Photo credit: C-Kore)*

C-KORE CELEBRATES SECOND QUEEN'S AWARD

C-Kore Systems Limited from Escrick, York, UK have been honoured with a Queen's Award for Enterprise for the second time in 3 years. Following their award for Innovation in 2019, they have now been recognised for their contribution to International Trade.

Now in its 55th year, the Queen's Award for Enterprise is the most prestigious business award in the UK recognising outstanding achievement, with Her Majesty Queen Elizabeth II personally approving all winners. This year C-Kore is one of only 122 companies across the UK who are to receive an award for their contribution to International Trade.

Tim Overfield, Managing Director, commented "Having had a tremendous 2019, winning both the Queen's Award for Enterprise for Innovation and Subsea UK's Innovation and Technology Award, news spread globally on how our innovative products are changing the industry practice on how subsea testing is conducted. This resulted in an increase in international trade of over 600%! With C-Kore's automated technology it is no longer necessary to use traditional error-prone manual measurement techniques."

Mr. Overfield added: "Following on from 2019, the last 12 months has made all businesses look differently at how they work and has brought the C-Kore testing tools to the attention of even more operators. Whether it's cost savings, ease of use, or not requiring the use of additional specialised offshore personnel, our tools have become the "go to" testing solution when installing, fault finding and decommissioning oil fields worldwide."

MAERSK DECOM INTRODUCES COST-FREE DECOMMISSIONING COST CALCULATING TOOL

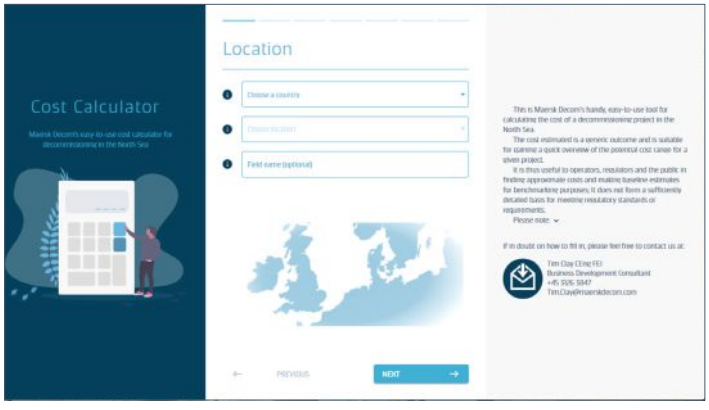
Maersk Decom's cost calculator is the first free tool in the industry, enabling stakeholders to estimate project costs by providing a baseline forecast for decommissioning projects in the North Sea. The aim of the tool is to better qualify and quantify forecasting for operators and regulators.

The online tool calculates based on information provided by the user from a series of questions regarding the wells, potential platform(s), FPSO and subsea equipment that require removal. It gives the user a cost overview of all aspects of a decommissioning project, and the estimated output is to be used solely for benchmarking purposes and further planning. The cost calculator does not form a sufficiently detailed basis for meeting regulatory standards or requirements. However, Maersk Decom can provide help based on the information the user inputs in the cost calculating tool in order to provide estimates meeting regulatory requirements.

"The benefit of the cost calculator is that users can gain a quick overview of the potential cost range for a given decommissioning project. We hope that Maersk Decom can, in this way, help the industry to more easily take the necessary decision by having a better overview," said Jens Klit Thomsen, Chief Commercial Officer of Maersk Decom.

Maersk Decom's vision is to have 'no resource wasted' and material and waste management is often a significant bottleneck in decommissioning projects. Maersk Decom seeks to increase transparency within the industry by providing a tool that helps users account for these costs. It also allows for a more transparent process for the user to report on or demonstrate their compliance with UN Sustainability Development Goals.

"Using a cost calculating tool that looks at the liability of a decommissioning project, including the management of materials and waste, is a new way of planning the project. By enabling a more transparent process, we see this as a step forward for the industry," added Jens Klit Thomsen.



ORCA AI RAISES $13 MILLION IN SERIES A FUNDING

» *Orca AI has proven to reduce collisions and save lives at sea. (Image credit: Orca AI)*

Orca AI, the industry leading AI-based navigation and collision avoidance solution, has raised $13 million in Series A funding, taking its total raised to over $15.5 million. Orca AI's solution is the first step in introducing autonomous features to vessels already on the water.

The round was led by OCV Partners, with Principal Zohar Loshitzer joining Orca AI's board. Mizmaa Ventures and Playfair Capital also featured.

This latest raise will be used to support the company's investment in technology, international expansion and growth.

Orca AI was founded by naval technology experts, Yarden Gross and Dor Raviv, and is trusted by many of the major shipping and oil companies including Kirby, Ray Car Carriers and NYK to prevent some of the 4,000 annual marine incidents, causing loss of lives, environmental hazards such as oil spills and billions of dollars in damages. These incidents are largely due to human error, which has contributed to 75-96% of collisions, and continues to rise, as the Coronavirus pandemic makes it harder for regular crew changes.

Orca AI provides an AI-navigation and vessel tracking system to support ships in difficult to navigate situations and congested waterways by supplementing its existing onboard sensors with vision sensors, thermal and low light cameras, as well as AI-powered algorithms which constantly analyze the environment and alert crew to dangerous situations. The data collected provides risk insights to shipping and insurance companies.

NEW YORK READY TO ADVANCE BIDEN'S CLIMATE GOALS

Years' worth of coordinated planning and engineering advancements by the State of New York have positioned it to advance the ambitious offshore wind goals of the Biden Administration.

In March, President Biden announced a national goal to deploy 30 GW of offshore wind energy by 2030. This has sparked significant interest among many newcomers to this emerging market but achieving this bold and courageous goal will only be possible by the efforts of states such as New York in preparation for this moment.

"For many years, the New York State Energy Research and Development Authority (NYSERDA) has been charging New York to capitalize on this moment, leading by example as a forerunner for innovation and investments to combat the adverse impacts of climate change," according to Michael P. Lee, President of AKRF, Inc., a New York-based planning, engineering, and environmental consulting firm

NYSERDA has been working with a diverse mix of public- and private-sector stakeholders, businesses, and institutions to procure 70 percent of New York's electricity from renewable sources by 2030, 9 GW of offshore wind energy by 2035, and full decarbonization of the state's energy grid by 2040. Metrics and goals that for any state would be ambitious. This started with the New York Energy Plan in 2015, which began the planning for large-scale offshore wind energy.

The success of the Biden Administration's plan depends on these three key factors—cross agency support, engineering, and robust data collection—as proven by the New York model. As part of the federal government's cross-agency support of offshore wind energy, the New York Bight will be a new priority wind energy area that will be leased over the coming year. NYSERDA has led pre-development planning and engineering work to reduce risks for future lease bids and support the assessment and development of the New York Bight. These studies include one full year of data collection and deployment of FliDAR buoys in the Hudson North and Hudson South, and a three-year digital aerial survey of the Bight. The nearly 13,000 square miles of aerial surveys showed that 98 percent of the pictures were blank—although 200,000 animals were documented and need to be accounted for—and many more research studies are underway.

"New York's most recent offshore wind award resulted in over $600 million in private/public port investments," Mr. Lee continued. "The USDOT will be advancing grants of at least $205 million for coastal and Great Lakes ports with much of this expected to target offshore wind port development. Tailoring this with $3 billion of more flexible loan guarantee financing from the Department of Energy to support offshore wind along with a commitment for timely permitting, these federal actions mirror the successful New York model and will accelerate the development of the US offshore wind industry in the early 2020s well above and beyond even the most optimistic of past projections."

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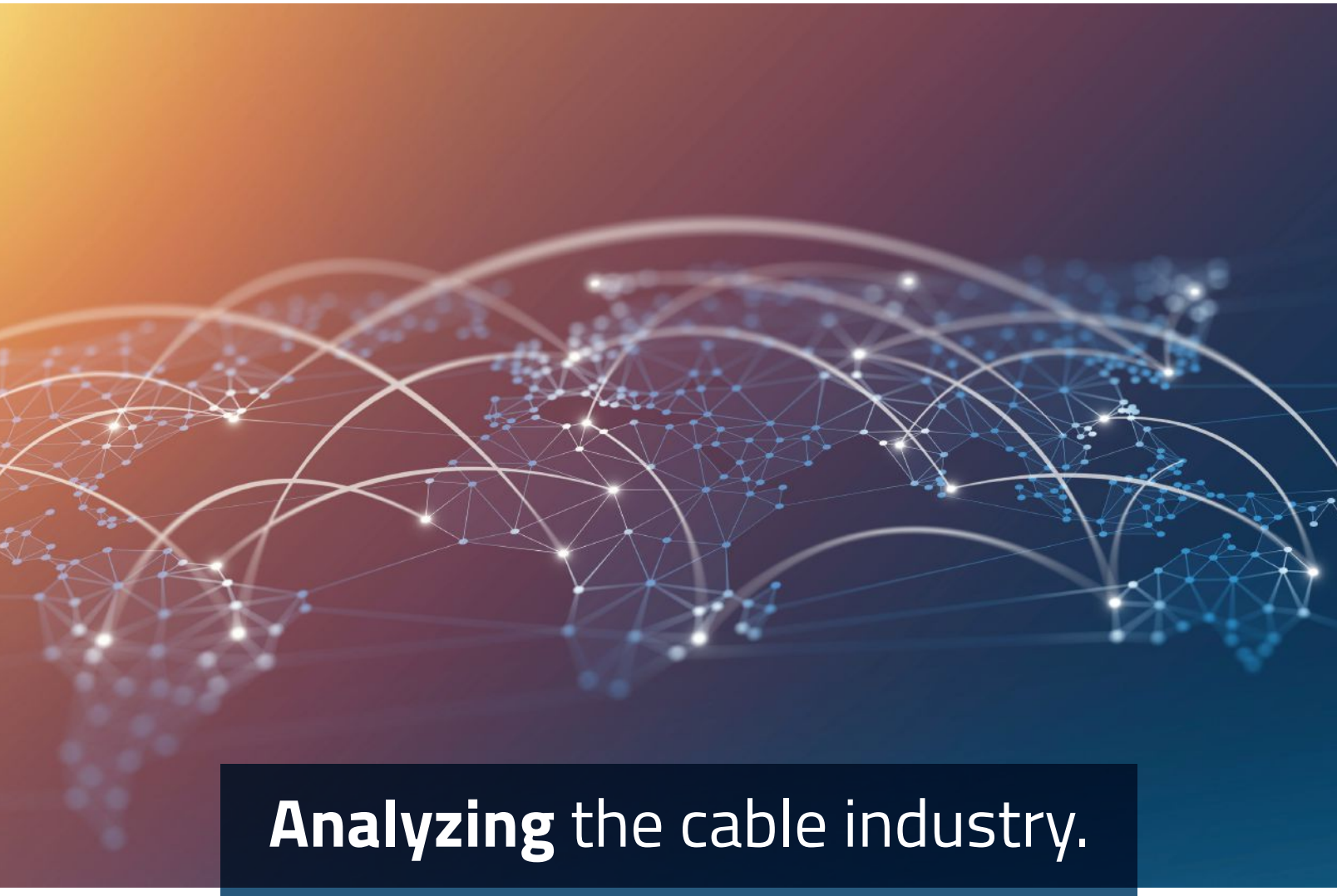

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