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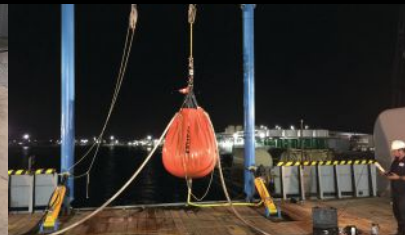

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FEATURES & SPOTLIGHTS

DEPARTMENTS

IN EVERY ISSUE

ON THE COVER:
AROWIND Project—Voyis' revolutionary technology demonstrator for remote and autonomous subsea offshore wind inspection, reducing vessel costs, and number of personnel on-board. (Image credit: Voyis)

[WITH THANKS - Ed.]

With commodity prices roiling amid geopolitical uncertainty (see ON&T's latest Energy MarketWatch on page 28), European countries are scrambling to sure up supply from non-Russian sources. For most, there is no shortcut to energy security—let alone independence—but the capture and storage of Green Energy from offshore renewables, such as offshore wind, solar, and wave resources, is sure to play a long-term strategic role in any path to net zero.

In April's ON&T we showcase some of the leading projects, technologies, and opinions helping to fuel this complex transition towards an ever carbon-conscious global energy mix.

Our thanks to a formidable cast of protagonists operating in this space, including the Business Network for Offshore Wind, Voyis, INGINE, Verlume, Digital Edge Subsea, and Bristol Harbor Group, for sharing their technical knowledge, insights, and expertise.

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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

ALL EYES ON THE GULF OF MEXICO: OFFSHORE WIND OFFTAKE OPTIONS ABOUND

By Liz Burdock,
CEO & Founder of The Business Network for Offshore Wind

Momentum in the U.S. offshore wind industry reached a new level in 2021, and by all accounts 2022 is building on those successes. This year we've already seen a successful New York Bight auction and the Carolina Long Bay auction is scheduled for May 11. Looking ahead to 2023, industry observers would be wise to keep an eye on the Gulf of Mexico. The Bureau of Ocean Energy Management has scheduled a lease sale for early 2023 in the region, and the Gulf may present the most interesting opportunities for alternative energy offtake pathways. Rather than connecting directly to the grid, a unique combination of factors in the Gulf of Mexico come together to allow offshore wind to power a wide range of functions—from the decarbonization of heavy industry to carbon capture and beyond.

OFFHSORE WIND-POWERED HYDROGEN

The first and perhaps most exciting of these offtake pathways is green hydrogen production. Just last week, ClassNK awarded an Approval in Principle to a concept for a floating offshore hydrogen production plant, which may be deployed off the coast of Scotland. This comes on the heels of an award of 17 offshore wind leases by the Crown Estate of Scotland, and last year's publication of a broader strategy to position Scotland as an exporter of green hydrogen. Taken together, Scotland's offshore wind-powered hydrogen production could serve as a model for the Gulf of Mexico.

The Gulf has long been a leader in energy production, and according to two studies by the National Renewable Energy Lab (NREL), the Gulf is "well position for offshore wind development." With its extensive port infrastructure, existing pipelines, and heavy industry along the coast, the Gulf is perfectly positioned to be a major producer and consumer of green hydrogen. As industrial facilities decarbonize their operations, any excess hydrogen could be exported. Global demand for hydrogen is expected to reach unprecedented levels over the next decade, and the Gulf's robust infrastructure would allow it to serve as a major export hub. The International Energy Agency projects that global demand for hydrogen will grow by 44 percent by 2030, as industry around the world seeks to meet the Zero Emissions by 2050 target.

PAIRING CCS WITH OFFSHORE WIND

Another clear opportunity for offtake in the Gulf is to power carbon capture and storage (CCS) operations. David Goldberg, a research professor at Columbia University, recently pointed out the clear advantages of pairing CCS with offshore wind, overlaying East Coast lease areas with estimated carbon carrying capacity. While these opportunities are certainly promising, they pale in comparison to the vast geologic holding capacity of the Gulf. A recent study by the University of Texas' Gulf Coast Carbon Center found an exceptional confluence of factors to position the Gulf of Mexico as an ideal carbon storage hub.

These technologies, just over the horizon, appear to be ready to mature just in time for offshore wind development to take off in the Gulf of Mexico. Keen observers ought to follow next year's BOEM auction in the Gulf for a preview of which developers see these opportunities, and who will seek to fit the pieces of this puzzle together.

The Business Network for Offshore Wind is the only non-profit dedicated solely to growing the offshore wind industry and it's supply chain. Follow Liz Burdock on Twitter *@lizburdock1*.

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AROWIND PROJECT: AN AUTONOMOUS INSPECTION SOLUTION FOR OFFSHORE WIND THAT DRASTICALLY REDUCES COSTS, RISK, AND EMISSIONS

By Chris Gilson,
CEO, Voyis

The ocean sector is rapidly evolving as green energy demand fuels incredible growth in offshore wind. It is becoming evident that the technologies and methodologies historically used in the offshore industry to monitor and maintain assets must also evolve to address new inspection challenges and tighter cost constraints. Moreover, a global pandemic has catalyzed survey operators to begin adopting approaches that enable remote operations and reduce reliance on human factors. Together these trends will drive radical innovation in autonomy and platform miniaturization that has the potential to drastically reduce the operational costs associated with subsea survey.

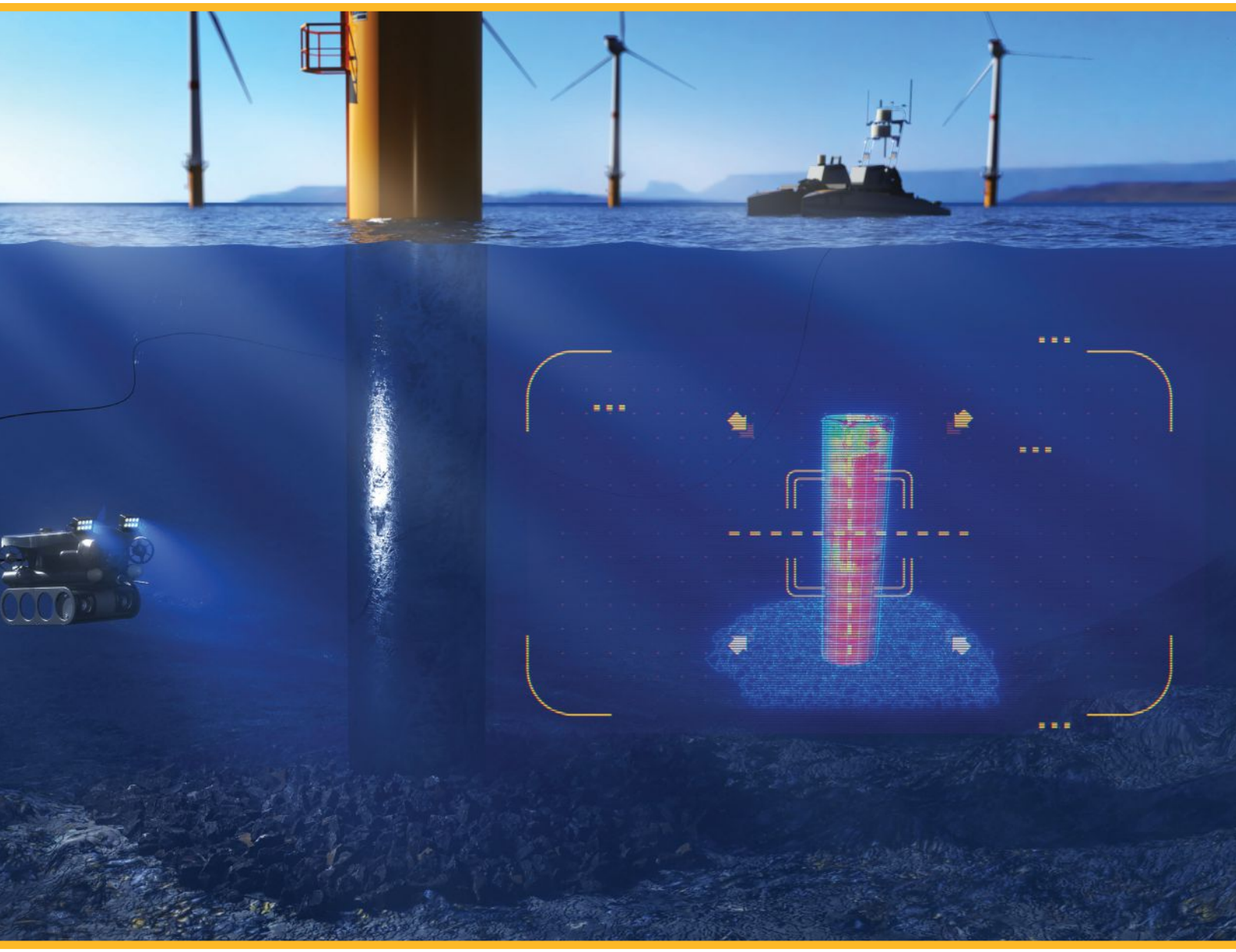
These changes are paramount in the manner offshore wind operators will need to manage their subsea assets, which are projected to grow ten-fold over the next decade and require the annual inspection of up to 60,000 wind turbines. With 25-30% of lifecycle costs spent on operation and maintenance, it is unacceptable that 70% of this is currently allocated to vessel charters alone. Operators desperately seek innovative methods to achieve low-cost shore-based operations.

This paradigm shift is what inspired the AROWIND project—a technology demonstrator led by Voyis and funded by Canada's Ocean Supercluster, that will define a new standard for offshore windfarm inspection using a fully remote survey solution to reduce cost, carbon emissions, and human exposure.

BACKGROUND

The offshore wind industry has historically employed large work-class remotely operated vehicles (ROVs), deployed from expensive service operation vessels to complete general video inspection (GVI) of subsea assets, gaining only a qualitative risk assessment. Costly vessel charters and offshore personnel has driven high operation and maintenance (O&M) lifecycle costs, and a limited understanding of predictive failure models to drive preventive maintenance. The introduction of improved robotics solutions for qualitative measurements using new 3D optical sensors has seen some limited adoption, however, the use of large, crewed vessels continues to keep O&M costs stagnant.

Illustration created for the AROWIND project, shows the Voyis' laser scanner collecting data in real time of the inspected offshore windfarm. (Image credit: Voyis)



The recent introduction of smaller commercial uncrewed surface vessels (USVs), from companies like HydroSurv, creates a new opportunity to address these challenges and improve offshore windfarm viability. Initial adoption of these USVs has been limited to surface-based hydrographic surveys, current modeling, and above water laser mapping, but this technology has only seen partial adoption for more complex offshore inspection tasks due to the inability to deploy ROVs.

The offshore wind inspection industry provides the perfect opportunity for adoption given the relatively close proximity to shore of wind farms, many less than 20 km (0-60 km) and shallow depths (<40 m), and the observational inspection scopes which can be accomplished with small platforms. A USV solution with a moderate endurance, paired with a capable small ROV and compact 3D sensors, would be able to address these inspection requirements from shore at a significantly lower cost.

PROJECT SCOPE

In February 2022, Canada's Ocean Supercluster announced the launch of the Autonomous Remote Offshore Wind Inspection, Navigation and Deployment Project, also known as AROWIND. This $6.7 million project will be led by Voyis, a provider of subsea optical inspection technologies, and will seek to demonstrate a fully remote USV based inspection solution for offshore windfarms.

» *Deep Trekker Revolution ROV that will be used in the project. (Photo credit: DeepTrekker Inc.)*

As a technology demonstrator, the project will develop a range of new independent technologies that can be integrated into existing survey frameworks, while also proving their synergistic application as a complete solution for remote offshore wind inspection.

HydroSurv's commercially available REAV USV platform will be the mobilization method for the project, expanding its current capability to autonomous deployment of the Deep Trekker Revolution ROV. This compact ROV simplifies the USV deployment challenges and will be essential in performing localized visual and quantifiable survey of subsea structures such as monopiles, foundations, cables, chains, and anodes. To address inspection requirements and drive qualitative preventative maintenance, Voyis' 3D optical sensors (Insight Laser Scanners and Observer Cameras) will be miniaturized and intergrated with a Sonardyne navigation system to deliver both forward and downward survey capability. Enhanced with autonomous navigation, data analysis, and sensor aiding from EIVA, the solution will achieve operational viability.

» *The AROWIND Project will utilize a HydroSurv USV, similar to the model pictured. (Photo credit: HydroSurv)*

INNOVATIVE TECHNOLOGY

Project AROWIND focuses on three areas of innovation: developing new capability for remotely controlled inspection and navigation, the miniaturization and performance enhancement of existing products, and the integration and optimization of existing technologies into a complete package for subsea windfarm inspection.

HydroSurv and DeepTrekker will collaboratively integrate the Revolution ROV onto the REAV USV, while developing a novel deployment system that autonomously and reliably deploys the ROV once the survey site is reached. Remote control technologies will initially be employed for manual shore-based control, and vehicle autonomy will be slowly introduced to reduce human interaction, in particular for automating survey trajectories.

Voyis' Insight laser scanner and imaging systems will be miniaturized and integrated into a compact ROV skid for horizontal inspection scopes, such as foundation scouring, structural integrity, cable route mapping, and anode depletion modeling. In partnership with EIVA, the Observer camera will be extended into a forward-looking 3D modelling solution using EIVA VSLAM software. This package will enable vertical inspection scopes, such as corrosion modeling, marine growth mapping, chain/cable integrity, and structural as-built inspection, along with enabling autonomous vehicle piloting with navigational aiding. Machine learning software will be developed

to improve the robustness of survey reporting, accurately evaluating the asset's current conditions, without cumbersome manual analysis of point cloud data and stills images.

WIDER POTENTIAL

Looking forward, the emerging floating offshore wind segment is expected to increase significantly to nearly 10 GW of installed capacity by 2050, and will require additional subsea inspections with respect to mooring lines, anchors, floating cables, etc. This segment can be addressed with the same core technology deployed on larger platforms. But looking past offshore wind, AROWIND will have follow-on applications across the ocean sector.

Defense Mine Countermeasures is a sector that is actively investing in uncrewed autonomy and small ROVs, but without a commercial off-the-shelf (COTS) solution to achieve their vision of fully remote operations. The industry currently employs ROVs deployed from small human operated vessels, a practice which does not fully remove the operator from the high-risk minefield.

Many underwater civil infrastructure applications already employ small ROVs for general video inspection, but their effectiveness is constrained by deployment challenges and low-quality inspection data. Harbor wall and bridge pile inspections for example are currently complicated by limited ROV tether lengths, requiring many deployments to achieve full coverage—an application that will significantly benefit from a USV deployed solution.

Project AROWIND will seek to accelerate the ocean sector's shift towards remote operations by demonstrating a complete inspection solution for offshore windfarm inspections that clearly aligns technological goals with the objectives of offshore windfarm operators—that is reducing inspection costs, limiting human exposure, and minimizing carbon emissions. If successful it is estimated that remote survey operations from small USVs have the potential to reduce subsea asset inspection costs by up to 90%, while also slashing carbon emissions by close to 1,232 metric tons per month deployed.

For more information, visit: *www.voyis.com* or *www.oceansupercluster.ca/arowind-project*.

VOYIS

» *Machine learning software will enhance the accurate evaluation of seabed assets without cumbersome manual analysis of point cloud data and stills images. (Image credit: Voyis)*

3D AT DEPTH CONTINUES EXPANSION OF MARINE ROBOTICS SOLUTIONS

3D at Depth has announced the launch of the newly engineered and renamed Cuvier DEEP. This automated underwater solution combines class-leading sensors and high-end system performance with operational efficiency and unparalleled data quality.

Neil Manning, CEO, stated: "Our fully integrated marine robotics solution allows us to not only expand our service offering but also continue to offer high data quality from the SL4 Subsea LiDAR and other geophysical, electromagnetic measurement and inspection sensors used across the marine energy and inland energy generation facilities. We have developed the new service delivery and application by evolving the trusted and highly stable hovering unmanned 3,000 m deep-water dual-hull SAAB Sabertooth Underwater System.

The system design has then been modified to enable greater endurance and more diverse sensor payload integration, meaning both greater in water operational time and higher data capture accuracy for our clients. Our innovation has been heavily influenced from years of marine design and operational experience to unlock an operationally unique platform with incredible agility.

The result is a highly adaptive work platform that greatly reduces the on-deck turnaround time due to a modular power solution. The increased endurance of up to 30 hours (depending on the mission requirements) exceeds all market comparable solutions currently operating in the marine AUV/UUV market. Cuvier DEEP is supported by impressive communication options including fully untethered supervised autonomy. Small fiber optic or powered cabled solutions means the system is configurable to meet all asset integrity work scopes covering deepwater offshore energy.

Cuvier DEEP will deliver a new level of efficiency alongside the data quality standards expected by the clients of 3D at Depth. 3D at Depth continues business growth through innovation and a focus on lowering carbon and vessel time savings, from crewed and uncrewed surface vessels.

KONGSBERG MARINE LAUNCHES NEW EM 712 USV MULTIBEAM ECHO-SOUNDER

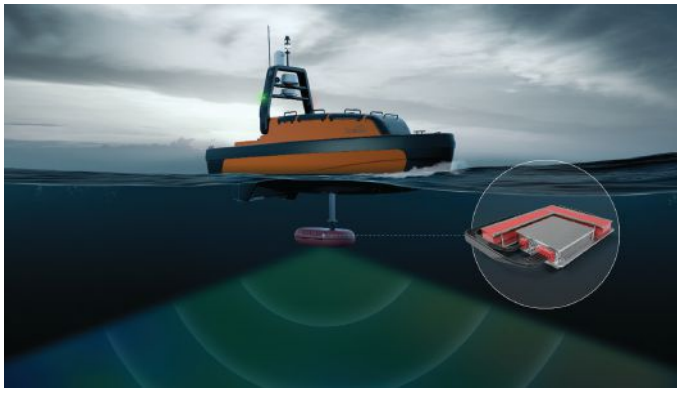
Kongsberg Maritime (KM) is pleased to announce the launch of the EM 712 USV, a new multibeam echosounder for use with Unmanned Surface Vehicles (USVs). The latest addition to KM's market-leading EM 712 family of shallow- to medium-water multibeam echosounders for seabed mapping applications, the EM 712 USV has been specifically designed to be easily integrated with and operated from any USV. It features a subsea container housing redesigned electronics, which would normally be located on the topside of a standard EM 712. The container fits inside the same footprint as the transducers and can therefore be easily installed in a gondola, thereby reducing the number of cables protruding through the USV's hull to a bare minimum.

The EM 712 USV is operated using KM's SIS (Seafloor Information System) software, delivered via SIS Remote which enables users to remotely control the echosounder from an onsite location. SIS Remote can also be operated through KM's Blue Insight platform, the company's next-generation, cloud-based solution for securely collecting, storing and processing data received from a survey vessel. Operators have the option of easily controlling the amount of data transmitted to suit the available bandwidth.

The EM 712 USV is fully frequency-agile between 40 and 100 kHz, allowing for long-range and swath coverages by utilizing CW and FM chirp pulses, in combination with being a high-resolution sonar. It represents an ideal solution for platforms such as USVs which are subject to rapid movements as the swath coverage is fully stabilized for roll, pitch and yaw.

This guarantees 100% coverage of the seabed even under harsh weather conditions.

"The new EM 712 USV is the outcome of a close collaboration between key customers, USV manufacturers and KM's innovative product development team," said Helge Uhlen, Vice President of Sales in Kongsberg Maritime.



» *The EM 712 range of multibeam echosounders is ideal for USVs. (Image credit: KM)*

THE FUTURE OF LONG ENDURANCE LOW CARBON SURVEY IS HERE: SULMARA INKS SERVICES AGREEMENT FOR 10 SAILDRONE VOYAGER USVs

Sulmara has signed a contract with Saildrone to globally deploy and operate 10 Saildrone Voyager uncrewed surface vehicles (USVs). This is one of the largest single orders for unmanned vehicles in the survey sector and will be operated from remote operation centers in Glasgow, UK, San Francisco, CA, and St. Petersburg, FL, in the US and Singapore.

Sulmara and Saildrone have established a joint working group to drive the adoption of low carbon USV based survey and inspection across the global offshore energy sector, removing the reliance on manned vessels and ultimately lowering the carbon footprint of energy generation offshore.

This contract between Sulmara and Saildrone marks a new era for USV operations. The Voyager's operational endurance of up to 90 days, without a crewed support vessel, is unprecedented for any IHO-compliant survey USV and further innovation in data acquisition and reporting systems will deliver improved efficiency and real time QC far beyond what is currently capable from unmanned survey platforms in the sector.

The Saildrone Voyager is 10 meters long and carries an impressive payload for survey operations including high resolution MBES and Innomar SBP systems. It is the only survey USV that can deliver long-duration IHO-compliant multibeam mapping surveys and ocean data collection at depths up to 300 meters. The systems are also configured for acoustic and atmospheric ocean data and maritime security payloads. The Voyager, the newest model in the Saildrone lineup, joins the 7-meter long Saildrone Explorer and 22-meter long Saildrone Surveyor, which is capable of IHO-compliant multibeam mapping down to 7,000 meters.

Speaking of the announcement, CEO of Sulmara Kevin McBarron said: "We aim to change what the future will say about offshore energy, because environmental impact doesn't stay offshore. Collaboration is key in advancing technologies and reducing costs to both our clients and the planet. Having Saildrone as a likeminded partner on this journey is key in enabling Sulmara to meet our commitments to the Carbon Pledge and beyond."

"We are thrilled to announce our collaboration with Sulmara," added Saildrone founder and CEO Richard Jenkins. High-resolution maps of the seabed are essential to help protect and grow the blue economy and facilitate sustainable aquaculture and offshore energy. Uncrewed systems can do far more, at far lower costs than traditional approaches. We are very excited to operationalize our new Voyager fleet, with Sulmara, in the energy industry."

» *Saildrone Voyager USV. (Photo credit: Saildrone)*

CSA OCEAN SCIENCES CONCLUDES ENVIRONMENTAL BASELINE SURVEY OFFSHORE TRINIDAD

CSA Ocean Sciences Inc. (CSA) recently announced the successful completion of a shallow water Environmental Baseline Survey (EBS) in waters 3.8 km offshore the West Coast of Trinidad. The EBS is part of a larger multidisciplinary marine environmental study carried out by CSA on behalf of a major oil and gas operator. In addition to providing the client with a comprehensive environmental baseline assessment, CSA subject matter experts also worked on hydrocarbon spill and drilling discharge modelling, environmental impact assessments, and a stakeholder engagement report to facilitate the application of a Certificate of Environmental Clearance from the local environmental regulator, for the drilling of exploration wells in the surveyed area.

A local field team from CSA's Trinidad and Tobago office in Port-of-Spain was able to mobilize quickly due to the Group's extensive survey resources in the region. They also capitalized on information gathered during a previously completed ecological risk assessment project to assess onshore, coastal, and nearshore environmental conditions off Trinidad's southwest peninsula.

"Having a detailed working knowledge of the waters offshore Trinidad's west coast certainly helped our field operations team expeditiously design a robust and fit-for-purpose sampling campaign," said Candice Leung Chee, CEO of CSA's Trinidad and Tobago operations. "This consequently aided the rapid mobilization of the equipment and personnel needed to implement the EBS and deliver the validated data to the client ahead of schedule."

The EBS survey characterized the existing physical, chemical, and biological marine resources within a study area of approximately 145 km² and included the collection of hydrographic profiles in water depths ranging between 10 and 30 m and other sediment and water samples. Oceanographic instrumentation deployed from the research vessel included a conductivity temperature depth profiler, Go-Flo water bottles, and standard ponar grab samplers.

"We are delighted to report the safe and efficient completion of this important EBS offshore Trinidad, even amid the operational disruption caused by the COVID-19 pandemic," said CSA CEO Kevin Peterson. "Certain hard bottom features and installations make working in these shallows notoriously challenging, but our in-house Geographical Information Systems experts were able to pore over existing geophysical data to precisely map any potential hazards of concern, such as pipelines and abandoned well heads, and ultimately ensure the careful planning and timely execution of the survey."

HYDROMEA LAUNCHES A NEW UNDERWATER WIRELESS OPTICAL MODEM LUMA X-UV

Hydromea has released its new patent-pending subsea wireless communication modem LUMA X-UV. The LUMA X-UV can beam data at up to 10 Mbit/s in the presence of other light sources in the environment, enabling real-time streaming of HD-quality video and 4K images wirelessly through water. It will be a critical tool for wireless control of underwater vehicles that have their lights on during missions or for deployments in shallow waters.

Felix Schill, co-founder and CTO of Hydromea, said: "LUMA X-UV is another big step forward in providing unlimited access to subsea data. It is a tool with a lot of versatility built in. It can be used as a modem and as an access point in subsea infrastructure. Moving the data stream into the UV wavelength with LUMA X-UV, this modem will work in the presence of other light sources, such as ROV lights. It will also be the best communication tool in shallow waters where there is still a significant amount of ambient light."

Igor Martin, co-founder and CEO of Hydromea, added: "Our LUMA modems are getting increasingly used across various setups and environments underwater. LUMA uses light to exchange data wirelessly, which means other light sources can create interference and reduce the effectiveness of such communication. Our new LUMA X-UV provides our customers with a perfect solution to this problem."

Hydromea focuses its development on affordable, autonomous and miniaturized devices that can be used at any ocean depth for unprecedented data access. LUMA X-UV comes in a titanium housing with a serial and ethernet connection and will be pressure-rated to 6,000 meters depth.

» *LUMA X-UV. (Photo credit: Hydromea)*

SUPERIOR SUBSEA VIDEO WITH OCEANTOOLS C6 COLOR ZOOM CAMERA

OceanTools, global supplier of underwater technology, has released their high performance C6 Colour Zoom Camera.

The expertly engineered OceanTools C6 has been designed to produce superior video imagery at resolutions up to 1080p. The camera has a wide range of subsea applications including the main navigation camera on ROV systems, military /defense projects as well as scientific research.

Boasting a standard depth rating of 6,000 m and manufactured from titanium with a sapphire viewport, the C6 is a rugged and dependable camera available with SD, HD or IP video outputs.

Brian Hector, Technical Sales Manager of OceanTools, said: "The game-changing C6 is not just another underwater color zoom camera. Fitted with very low distortion proprietary optics and a 32x zoom, the C6 outputs the highest quality video. It is also the first underwater camera to allow the user to switch between PAL and NTSC output in the field, making the C6 the most versatile color camera on the market. Our product development team is dedicated to producing superior underwater products and we have achieved this with the C6 Color Zoom Camera."

» *OceanTools C6 High performance subsea color zoom camera. (Photo credit: OceanTools)*

The C6 product launch follows a series of innovative releases for OceanTools including the smallest subsea IP camera currently available, the C3-30, and the advanced C9-GigE camera.

» *One of the first registers of the Endurance shipwreck. (Photo credit: Falklands Maritime Heritage Trust and National-Geographic)*

VOYIS UNDERWATER TECHNOLOGY AIDS IN MAPPING THE ENDURANCE SHIPWRECK

The Falklands Maritime Heritage Trust has confirmed that the Endurance22 Expedition has located the wreck of *Endurance*, Sir Ernest Shackleton's ship which has not been seen since it was crushed by the ice and sank in the Weddell Sea in 1915.

One hundred years after Shackleton's death, *Endurance* was found at a depth of 3,008 meters in the Weddell Sea, within the search area defined by the expedition team before its departure from Cape Town, and approximately four miles south of the position originally recorded by Captain Worsley.

The team worked from the South African polar research and logistics vessel, S.A. Agulhas II, owned by the Department of Forestry, Fisheries and Environment and under Master, Capt. Knowledge Bengu, using Saab's Sabertooth hybrid underwater search vehicles. The wreck is protected as a Historic Site and Monument under the Antarctic Treaty, ensuring that whilst the wreck is being surveyed and filmed it will not be touched or disturbed in any way.

Laser Data and Stills Images

Now that the wreck has been successfully located, the search team is using Voyis' advanced underwater technology to digitally recreate the *Endurance* and surrounding debris field. Voyis' technology makes this possible by using highly accurate 3D models, and extremely crisp photography generated by the Insight Pro laser scanner, Observer Pro stills cameras, and Nova LED panels.

Using the Insight Pro laser scanner, the survey team will be able to accurately map the *Endurance*. The Voyis system broadcasts the ultra-dense point cloud model in real-time to the crew, digitally building up the shipwreck as they "fly" over the wreck with the Sabertooth vehicle.

Complementing the Insight Pro system on this expedition is the Observer Pro imaging system, a long range, highly sensitive digital stills camera, and two extremely high output Nova LED panels to deliver crisp, evenly illuminated stills images.

The Observer Pro imaging system works seamlessly with the Insight Pro laser scanner, providing gapless laser data with interlaced stills. Additionally, images taken by the Observer system are automatically color corrected using Voyis' machine learning "True-Color" correction, an onboard improvement that replicates the exact color of the shipwreck if it were brought ashore, along with additional undistortion and light leveling algorithms to improve the image quality in real-time. Therefore, it will be possible to create photomosaics and photogrammetric models of the *Endurance*, to further compliment the highly accurate 3D point cloud model generated by the Insight Pro.

» *The electric-drive Okeanus ECO2000 was used to lower sampling instrumentation through the Ross Ice Shelf. (Photo credit: Arctic Science Platform)*

OKEANUS WINCH COMPLETES ANTARCTIC FIELD SEASON

Okeanus Science & Technology, LLC (Okeanus), an established provider of turnkey marine survey systems and oceanographic equipment, has revealed details of the first season-long deployment of a custom Okeanus ECO2000 winch which was commissioned by the Antarctic Science Platform to support the study of ice dynamics at the Kamb Ice Stream camp on the Siple Coast of Antarctica.

The Okeanus ECO2000 was chosen by Antarctic Science Platform—a $49 million research program funded by New Zealand's Ministry of Business, Innovation and Employment—to support ongoing research into Antarctica's impact on the global earth system, and ultimately understand how this might change in a warmer world.

Most recently, the Okeanus ECO2000 played a central role in *Project-1 'Antarctic Ice Dynamics'*, and more specifically the deployment of a new hot water drilling technology designed to grant researchers access to previous records of ice sheet dynamics in West Antarctica. The winch was initially used to set the well-pump assembly, a critical component of the drill system, at a depth of 115 meters below the surface. Once the drill hole was open, the electric-drive winch was able to lower sampling instrumentation—including a gravity corer, a hammer corer, a geothermal probe, and a Niskin bottle for water sampling—through 500 meters of the Ross Ice Shelf and to depths of 240 meters below the ocean surface.

"Attempting precise and efficient sampling in Antarctic conditions not only relies on robust hardware, but also dependable equipment that affords operators a certain degree of dexterity and flexibility in the field," explained Darcy Mandeno. "Not only did the ECO 2000 prove instrumental to a wide range of day-to-day tasks but the ability to control the winch remotely—effectively giving us the opportunity to observe what was happening 'down the hole' in real time—was a genuine breakthrough in terms of operational efficiency and HSSE mitigation."

While the standard Okeanus ECO2000 is designed for a variety of oceanographic applications such as water sample profiling, CTD, towing, bottom grab sampling and other such operations, Antarctic Science Platform's model called for Okeanus engineers to adapt the design to withstand the hostile conditions found in the Antarctic, including exchange of appropriately rated components and materials and a custom-built electrical panel fit for the extreme cold.

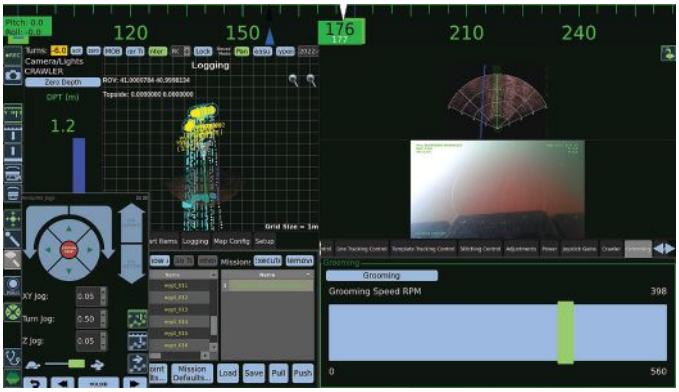
'We were delighted to hear that the Okeanus ECO2000 was able to perform as designed in one of the most challenging field environments on the planet," said Okeanus Chief Commercial Officer Benton LeBlanc. "This ongoing body of research is critical to garnering a data-led understanding of how a receding Antarctica—the largest reservoir of freshwater on the planet—could potentially contribute to sea level rise and disrupt global ocean circulation, so the team at Okeanus is enormously proud to be part of this important scientific initiative."

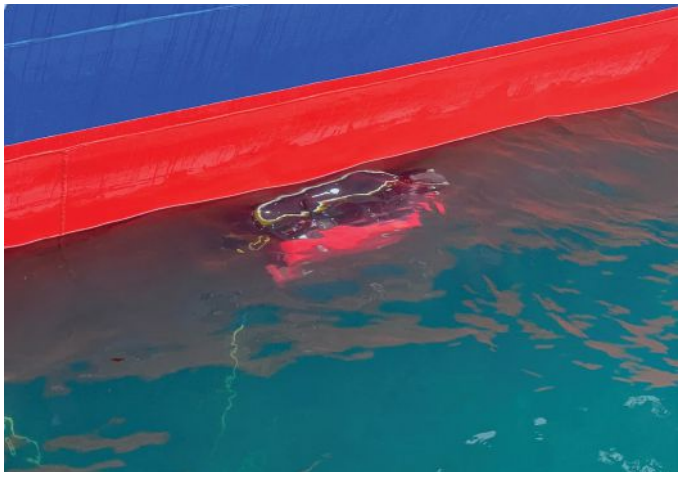
PROACTIVE IN-WATER HULL CLEANING SOLUTION LAUNCHED

Greensea Systems Inc. has launched Armach Robotics (Armach) to offer a subscription model robotic hull cleaning system using autonomy, intelligence and data fusion.

Keeping ships' hulls clean of biofouling and its subsequent drag and performance penalties has challenged humanity since humans took to the seas. Armach Robotics offers a significant leap forward in this long-fought battle by offering an autonomous hull cleaning solution capable of 100% coverage of the hull surface excluding niche areas.

Armach, while a new name in the industry, began the journey several years ago through the development of the novel technology required to change the paradigm of ship husbandry. The hull cleaning robot has some distinct advantages such as its small platform to get it into tighter spaces on the hull and make it one-man-portable, caterpillar tracks which are kinder to hull coatings and a nonmagnetic adhesion to the hull, suitable for military vessels and non-steel hulls.





» *Armach's bespoke on-hull navigation system is key to its promise of near to 100% hull cleaning coverage. (Photo: Armach Robotics Inc).*

But the real game changing aspects of the Armach system are around the navigation and hull intelligence systems. With accurate navigation, robots can be autonomous, data can be referenced to the hull, and 100% coverage can be assured.

While Armach's technology is what makes it stand out in an industry that has been doing things the same way for a long time, Armach is not a technology company and does not sell robots. Armach provides a subscription service for clean hulls and hull intelligence. Armach is a service provider.

As the company was born out of Greensea Systems, it uses Greensea's industry-leading navigation systems to ensure that the robot cleans the hull in the quickest and the most efficient way possible.

As the robot cleans, the software operating it builds up an inch perfect 'mental map' of every feature of the hull so it can be more efficient next visit and it does so without the human input of divers or operators.

Because the Armach system is so scalable and efficient, cleanings can be performed more regularly, so it's only ever slime that the robot has to tackle. The use of a thoroughly tested brush system that is nondestructive to the hull coating with the built-in system intelligence means it won't overwork the coatings—adding yet another cost benefit.

The system also saves costs by reporting back to the shipowner with valuable information, effectively creating a hull condition survey every time it cleans a hull. Any damage or corrosion is picked up early by the robot's cameras and sensors, so a decision can be made on whether rectification is necessary or whether ongoing monitoring will suffice.

Armach is currently in the 'Build it prove it phase'. This key phase will allow Armach to build, develop and iterate the robotics platforms and prove that the technology and model work in the real world.

Ben Kinnaman, Greensea Systems and Armach Robotics CEO says: "You can't offer shipowners 100% hull cleaning coverage using an autonomous, robotic solution unless you have a very accurate navigation solution. We (Greensea) began working with the Office of (US) Naval Research back in 2018 on just a system to make proactive in-water cleaning with a robotic solution a reality for the first time. But we couldn't find a manufacturer or vehicle partner that would enable us to enter this industry and achieve the level of potential that we saw. So, we have spun the Greensea technology out into this new entity, Armach Robotics."

Rob Howard, VP Growth and Strategy at Armach Robotics says: "Hull drag is time and money in the shipping business. The system we have devised represents the closest any company has got to fully autonomous hull cleaning. With our navigation solution, the robot's route across the hull is optimized to within inches ensuring no areas are missed or over cleaned, so we can be efficient and fast in performing our service."

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

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Able to conduct both remote-controlled and supervised autonomous operations the DriX USV offers outstanding seakeeping and speed capabilities.
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REAL-TIME ACOUSTIC MONITORING OF OFFSHORE WIND FARMS

By Pierre-Alexandre CAUX,
Business Director, RTsys

Buoys equipped with hydrophones and acoustic recorders are used to evaluate the level of underwater noise on offshore wind farms. In recent years, the presence of certain species of marine mammal during offshore infrastructure works (pile driving, drilling, etc.) has been a major environmental concern. By way of example, one such species is a certain porpoise endemic to the German coast that is very sensitive to sound waves; this mammal mainly uses its hearing for positioning in lieu of its very limited sight. In order to safeguard the species and its natural habitat, German legislation since 2018 has imposed a cap on sound levels caused by all offshore activities.

Offshore wind farms developers, therefore, are required to measure, monitor, and restrict noise caused by building work, and, today, underwater noise monitoring (UNM) regulations are enforced in most countries as a means of protecting aquatic life.

CALCULATION OF ACOUSTIC DESCRIPTORS IN REAL TIME

Since 2014, RTsys has been providing offshore developers with buoys equipped with acoustic recorders able to analyze data in real time. Users on offshore wind farms, whether local regulators, planning boards or construction companies, can measure real-time audio levels and carry out live monitoring when sound levels exceed regulation limits. The results are transmitted using 4G or iridium to a specific internet platform developed by RTsys. This algorithm is embedded on every RTsys underwater acoustic buoy, like REMHY and RUBHY, both used by companies like Jan de Nul, Boskalis, Ailes Marines (Iberdrola France), Gardline, Deme, and Geosea to monitor offshore piling activity.

A specific human-machine interface (HMI) has been developed to facilitate user analysis and understanding of several indicators such as SEL, SPL, 1/3 octave bands, as well as ambient noise. The HMI also allows real-time display of FFT and spectrograms. Therefore, users have a tool to manage construction work, enabling them to make quick and reliable decisions. Moreover, the real-time acoustic data interface has been developed in collaboration with end-users to provide them with an interface which better meets their needs, but which is also easy to understand for non-acoustic specialists. Thanks to this intuitive interface, offshore construction companies and regional acoustic planning boards are able to access and exchange data more freely.

WHEN INNOVATION PARTNERS REGULATION

In order to develop reliable and fit-for-purpose tools for our end-users all over the world, RTsys relies on—and adheres to—the in-country underwater acoustic recommendations and standards set by local agencies, like the German Federal Maritime and Hydrographic Agency (BSH,

» *Offshore wind farms developers are required to measure, monitor, and restrict noise caused by building work to help protect aquatic life. (Photo credit: Tomas Kotouc/Shutterstock)*

» *RTsys buoys equipped with acoustic recorders are deployed during offshore wind construction to analyze acoustic data in real time. (Photo credit: Georgina Kelly/RTsys)*

» *RTsys' intuitive HMI gives offshore developers and planning boards access to real-time data and the capacity to exchange data more freely. (Image credit: RTsys)*

Bundesamt für Seeschifffahrt und Hydrographie), which authorizes offshore wind farm development projects in German waters.

Thanks to RTsys' commitment to these standards, innovative technology developed by RTsys is now officially recognized by many authorities around the globe. In addition to calculation calibration, the methods used in acoustic buoys are transparent throughout the measurement chain, an initiative that enables measurements taken to be monitored and validated.

Ten years after the initial product testing, RTsys acoustic buoys are now deployed on offshore wind farms throughout America, Northwest Europe or Southeast Asia.

BEYOND OFFSHORE WIND

Founded in 2010, RTsys is part of the Sea Vorian Group and designs and manufactures a comprehensive range of ocean equipment and marine robotics for the defense sector (MCM and ASW), the marine science community (IFREMER, KIOST, SHOM, DSO…), and the offshore energy markets.

All RTsys equipment is equipped with an electronic board reference SDA® (Synchronous Data Acquisition), a proprietary technology that enables complete operator control of all hardware and software features. SDA® is a result of significant year-on-year investment in R&D and ultimately means that RTsys works fully independent of any third-party IP supplier.

Further R&D led RTsys to the design and supply of world-renowned AUVs and diver-held sonar systems. While RTsys continues to grow, the company now focuses on four core lines of business:

1. AUTONOMOUS UNDERWATER VEHICLES (AUVs)

RTsys' range of AUVs includes two-men-portable units as well as ultra-compact micro AUVs. These powerful, long-endurance vehicles support a wide range of interchangeable payloads—including SSS (both 2D and 3D image data), CTD and any other water quality sensors. The integrated INS and DVL, combined with a surface communication module, enhance navigation capacities to an accuracy of less than 5 meters independent from the distance covered.

2. PASSIVE ACOUSTIC MONITORING (PAM)

RTSYS is world leader in the design and manufacture of acoustic recorders, buoys and software for both post-processing analysis (up to 180 days autonomy) and real-time assessment.

The acoustic monitoring and recording combined with multiparameter sensor logs offer the best answer to a wide community of users, from Marine Renewable Energy for noise and environmental impact assessment, to scientific users in marine biology, ambient noise and water quality monitoring.

3. MINE COUNTERMEASURES (MCM)

RTsys provides EOD Divers and Special Forces with a complete range of AUVs and diver-held navigation and sonar systems to upgrade divers' efficiency and safety during MCM operations. The SonaDive handheld sonar is especially designed to assist military and professional divers in navigation and underwater object detection.

The contribution of native acoustic communication offers the most improved navigation thanks to the Sparse-LBL technology and allows a constant accuracy during the mission (less than 5 meters like the AUV range). Divers can communicate among themselves and with the surface unit in real-time via the acoustic modem, sharing contacts and text messages within a 2 km range, which extends to 5 km using RTsys relay beacons.

4. ANTI SUBMARINE WARFARE (ASW)

Finally, RTsys is a world leader in the design and manufacture of ASW sonar characterization and ASW target training. The SIERA system offers the most reliable solution for the characterization and calibration of underwater acoustic systems (hull-mounted sonars, dipping sonars, variable depth sonars, and buoys), while SEMA can act as an autonomous and recoverable acoustic target for ASW training. It is operable for all kinds of platforms such as surface vessels, submarines, helicopters, and ASW aircraft.

For more information, visit: rtsys.eu.

RTsys
Underwater Acoustics & Drones

EQUINOR AND BP TO TRANSFORM SOUTH BROOKLYN MARINE TERMINAL INTO CENTRAL HUB FOR OFFSHORE WIND INDUSTRY

Equinor, and its partner bp, have agreed to turn the storied South Brooklyn Marine Terminal (SBMT) complex in Brooklyn, New York into a major regional hub for offshore wind.

Under the agreement, the terminal will transform into a world-class offshore wind port capable of staging and assembling the largest, most sophisticated offshore wind technology components for the Empire Wind and Beacon Wind projects and for the growing U.S. offshore industry on the East Coast.

The agreement was co-signed by terminal operator Sustainable South Brooklyn Marine Terminal (SSBMT) and New York City Economic Development Corporation (NYCEDC).

The offshore wind projects on the US east coast are key building blocks to accelerate profitable growth in renewables and Equinor's ambition to install 12-16 GW of renewables capacity by 2030.

Equinor and bp will create an operations and maintenance (O&M) hub and staging area at SBMT, with a total investment of USD 200 – USD 250 million in infrastructure upgrades, while also pursuing the development of SBMT as a low-emissions facility. The port will become a cutting-edge staging facility for Equinor and bp's Empire Wind and Beacon Wind projects that will supply 3.3 GW of energy—enough to power nearly two million New York homes—as well as become a go-to destination for future offshore wind projects in the region.

The redevelopment will inject the Sunset Park waterfront with substantial investment from the new renewable energy economy, creating new jobs and providing an economic boost to the community. Equinor and bp's activities at SBMT are anticipated to support over one thousand jobs annually in the region.

"This agreement marks a major step forward in our commitment to New York State to both provide renewable power and to spark fresh economic activity, while creating enduring jobs," said Siri Espedal Kindem, President of Equinor Wind U.S.

"With the support of NYCEDC, SSBMT and our partners in the community, Equinor and bp are ready and eager to invest in the revitalization of SBMT, an historic port that will soon become a major part of New York's energy future. New York has shown unflagging determination to become a focal point of the region's offshore wind industry, and this agreement offers tangible evidence that this vision is quickly coming to life."

"We are enormously proud to lay the groundwork today for our vision of making New York City a nation-leading hub for the offshore wind industry. This agreement builds on the City's $57 million commitment to reactivate SBMT as a key manufacturing and operations base and will help make New York a leader in climate resiliency as well as air quality through clean energy investments," said NYCEDC Chief Strategy Officer and Executive Vice President Lindsay Greene.

"Working together with our partners at Equinor, bp, and SSBMT, we are also advancing economic recovery and increasing diversity in waterfront construction, by helping local minority- and women-owned business enterprises benefit from the growing offshore wind industry and take advantage of the green jobs of the future."

Felipe Arbelaez, bp's senior vice president for zero carbon energy, added: "Today marks the first of many positive ripple effects from this project—and we want them to reverberate far and wide. As we reinvent energy, we also want to help reinvent the communities that help deliver it by investing in the skills and capabilities needed. By creating this regional hub, we are able to do just that and it brings us all one step closer to delivering this incredible offshore wind development."

At approximately 73.1 acres, SBMT will be one of the largest dedicated offshore wind port facilities in the United States. It is the only industrial waterfront site in the New York City area with the capacity to accommodate wind turbine generator staging and assembly activities at the scale required by component manufacturers.

Equinor recently announced the opening of the New York offshore wind project office, adjacent to SBMT in Industry City, to serve as the hub for Equinor and bp's regional offshore wind activities. The office will also be home to an offshore wind learning center that will provide New Yorkers an opportunity to learn about this growing new industry.

» *Wind turbine staging operations with the Manhattan skyline in the background. (Image credit: Equinor/bp)*

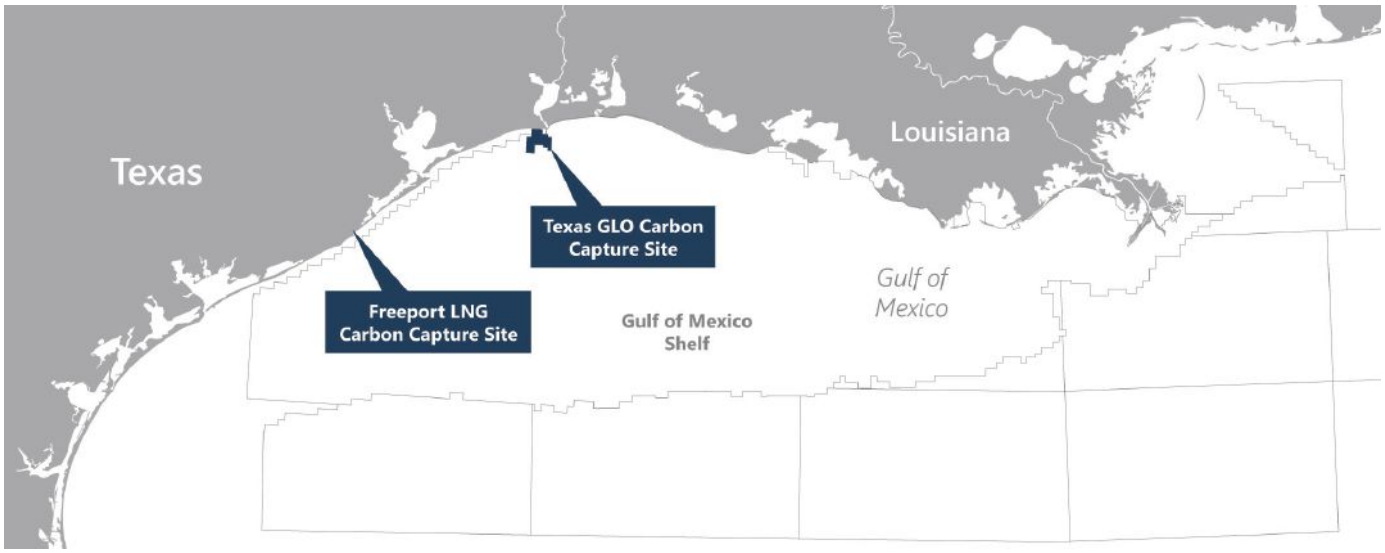
ACTEON'S DRILLING AND DECOMMISSIONING SEGMENT ACQUIRES OCEANEERING DECOMMISSIONING PERSONNEL AND ASSETS

Claxton, the lead brand for Acteon's drilling and decommissioning segment, has signed an agreement with Oceaneering to acquire decommissioning personnel and assets from them. From the anticipated closure date of 30 March 2022, certain Oceaneering staff based in Norway will transfer to Claxton, along with decommissioning assets including well and pile abrasive cutting and recovery systems and associated tooling. Conductor drilling, pinning and cutting systems, diamond wire saws, dredges and various ancillary equipment items are also included in the deal. The equipment will initially be deployed from Acteon's bases in Norway, Dubai (UAE) and Aberdeen (UK).

Oceaneering is also establishing a master services agreement through which Claxton will provide services to support the company's wider scopes, potentially including its multi-client Rig Chase™ decommissioning campaigns.

"The deal will increase our capacity, the range of technologies at our disposal and our decommissioning expertise and reinforce Claxton's position as one of the leading global suppliers of offshore cutting services," said Sam Hanton, Acteon Drilling and Decommissioning Segment Managing Director.

"This deal enables us to strategically focus on our integrated vessel solutions offering, which include our multi-client Rig Chase and vessel-based well plugging and abandonment campaigns, while ensuring access to decommissioning services through a partnership and new master services agreement with Claxton," added Luke Pirie, Director, Offshore Projects Group, Oceaneering.



TALOS ENERGY MOVES FORWARD WITH TEXAS CARBON CAPTURE PROJECT

Talos Energy Inc. has announced that Bayou Bend CCS LLC, Talos's venture with Carbonvert, Inc. (the "Venture"), executed definitive lease documentation with the Texas General Land Office (GLO), formalizing the previously announced carbon capture and sequestration (CCS) site located offshore Jefferson County, Texas, near the Beaumont and Port Arthur, Texas industrial corridor. Talos separately announced that it had established a CCS strategic alliance with Core Laboratories N.V. to provide technical evaluation and assurance services for CCS subsurface analysis, including the Company's upcoming 2022 stratigraphic evaluation wells.

Texas GLO Lease

On March 11, 2022, the Venture jointly executed lease documentation with the GLO establishing the first ever major offshore carbon sequestration site in the United States. The lease comprises more than 40,000 acres immediately adjacent to the Beaumont and Port Arthur, Texas industrial corridor and maintains an estimated sequestration capacity of 225 – 275 million metric tons of CO2. The project will be known as Bayou Bend CCS. Talos will be the operator and holds a 50% equity interest.

Talos President and CEO Timothy S. Duncan commented: "We are pleased to reach definitive agreements with the State of Texas and look forward to making significant progress on this important CCS hub opportunity in 2022. In the coming months we hope to identify anchor industrial partners for the Bayou Bend CCS project as well as a midstream transportation solution in the region. Our bid for the large-scale permanent sequestration site was selected from a highly competitive process in August last year. Since the GLO bid and subsequent award announcement, the team has moved rapidly to build out one of the premier CCS project portfolios in the United States, which has now all been organized under Talos Low Carbon Solutions LLC (TLCS), the Company's CCS subsidiary. We are dedicated to continuing to scale TLCS to become an industry-leading CCS platform and a meaningful business for Talos in the future."

Core Lab Strategic Alliance

Separately, on March 5, 2022 the Company established a technical alliance with Core Lab to advance CCS site characterization, including stratigraphic evaluation wells, reservoir core sampling, geological assessment and rock and fluid sample analysis, all of which are critical inputs for EPA Class VI permit applications. The alliance also provides a framework for future collaboration around transparent CO2 stream monitoring and verification. Core Lab is a leading global provider of reservoir description and enhancement products and services and currently partners with Talos on numerous upstream subsurface activities.

Talos Executive Vice President Low Carbon Strategy and Chief Sustainability Officer, Robin Fielder, commented: "We are pleased to announce this strategic alliance with Core Lab to deliver technical assurance for our growing portfolio of sequestration sites and, ultimately, for our customers. Capitalizing on our respective subsurface expertise, this alliance strengthens our technical capabilities leading up to the filing of CO2 injection well permits this year and advances TLCS's ability to deliver high-quality, end-to-end CCS solutions to customers across the Gulf Coast."

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GEOPOLITICS AND INFLATION MOVE COMMODITY MARKET: FOR BETTER OR WORSE

By G. Allen Brooks
Expert Offshore Energy Analyst & ON&T Contributor

CRUDE OIL:

Unless you are actively involved in the crude oil trading pits, you can guess daily oil price moves by just following the news. Oil prices have become more volatile in the past month given the war between Russia and Ukraine. Who would have thought when it started in late February that a month later it would still be going on?

News about the war is driving oil prices. Russian troops are bogged down. Ukraine troops scored a major victory. Russia to pull back troops, but rockets keep coming. Peace discussions are underway. Negotiators are making no progress. Each headline will move oil prices. With a 24-hour news cycle, it is not surprising oil price volatility has increased. War means less Russian oil, while peace signals Russian oil might soon be welcomed back onto the world stage. Traders read the headlines to judge whether global oil markets will remain tight and prices high and react accordingly.

» *Geopolitical news is driving continued price volatility*

Adding to war news is economic news. What is happening with inflation? How high will interest rates rise to squash rising prices? Final 2021 fourth quarter data confirmed a 6.4 percent year-over-year increase for the Federal Reserve's favorite inflation measure—a 40-year high! Taming rising living costs means the Federal Reserve will be boosting short-term interest rates six more times this year. Substantially higher interest rates translate into reduced economic activity and lower energy consumption.

Other global issues are roiling the oil market. Will U.S.-Iranian nuclear talks lead to its oil gaining access to the world's market, easing tightness? But China is now battling a new COVID outbreak, and it has locked down Shanghai, the nation's largest and wealthiest city. COVID and China equates to slower economic growth, and that means oil use will be lower for the foreseeable future. Elsewhere, governments are struggling to reduce energy and power bills for their citizens, as security of supply is supplanting climate change worries. Politicians are trying everything from increased financial subsidies to cutting fuel taxes, let alone trying to find cheaper fuels. The U.S. government will release one million barrels of oil a day for 180 days from its Strategic Petroleum Reserve to counter rising gasoline costs, but the reprieve may be transitory. States are granting gasoline sales tax holidays—another short-term fix. Elections and unhappy consumers drive political stunts, rather than serious structural solutions.

We have no idea when or how the Russia/Ukraine conflict will end. We also have no idea whether Russian energy, currently a pariah in the world market, will suddenly be desirable. Will major countries experience recessions—or possibly the entire world? Will oil producers abandon the financial discipline demanded by their shareholders under government pressures for more supply and sink prices by creating a glut? Strap yourself in and get ready for continued price volatility.

NATURAL GAS:

Right now, the natural gas market is all about helping Europe avoid a human disaster. The continent is captive to Russian gas supply and haunted by the threat of a supply cutoff, possibly due to the demand for payment in rubbles and not dollars. For several months, an armada of LNG tankers have hauled U.S. gas to Europe, nearly abandoning the Asian market. Choosing where to sell LNG is easy when Europe pays more than Asia and seven-times Henry Hub prices. We will see how long Asian buyers are benevolent, especially when the calendar dictates time to refill storage for next winter.

The U.S. and Europe have pledged to get an incremental 15 billion cubic meters of

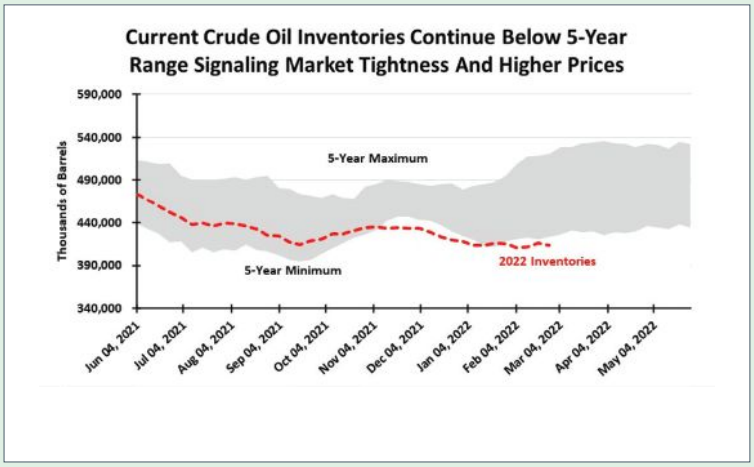
» *LNG tankers continue to haul U.S. gas to Europe*

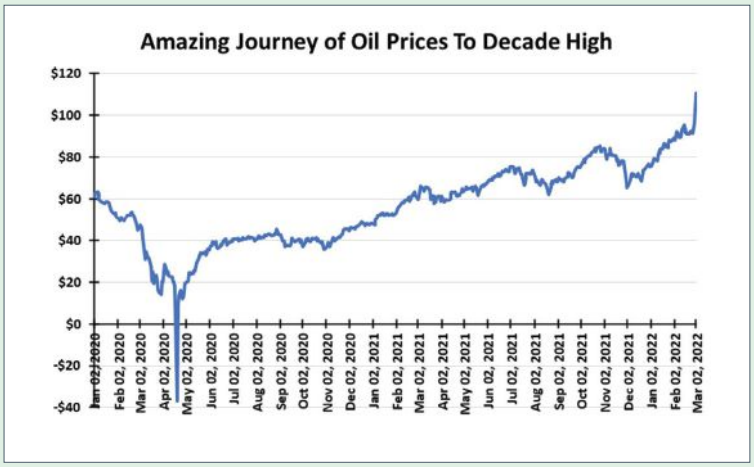
gas to the continent by the end of the year and an incremental 50 bcm by 2030. No one knows how it will get done or where the extra supply will come from. U.S. LNG exporters are running at capacity, although the industry was able to ship 4.3 bcm to Europe in January, a hefty increase over year-ago shipments.

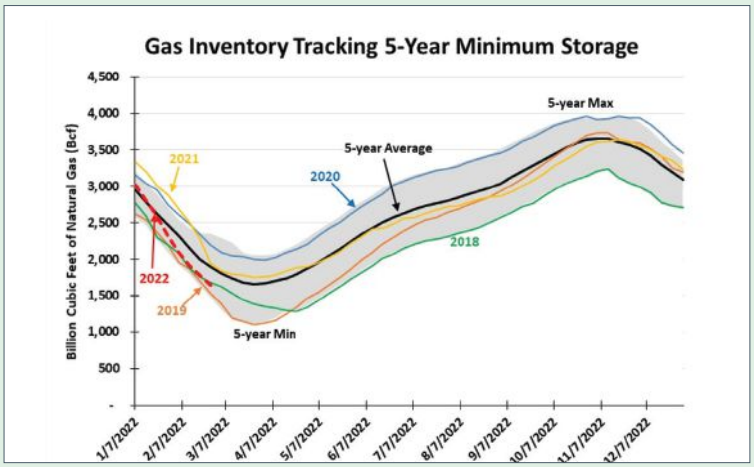
The additional LNG came from the two newest U.S. LNG terminal expansions this year, but there will be no further volumes available before 2024. A tight global gas market exists, as there are few new LNG export terminals being built anywhere. Therefore, for more gas to get to Europe requires redirecting it from other customers. A potential incremental supply source could be China, as it takes more gas from Russia and displaces LNG volumes it currently anticipates importing. Forget the political implications of such an arrangement.

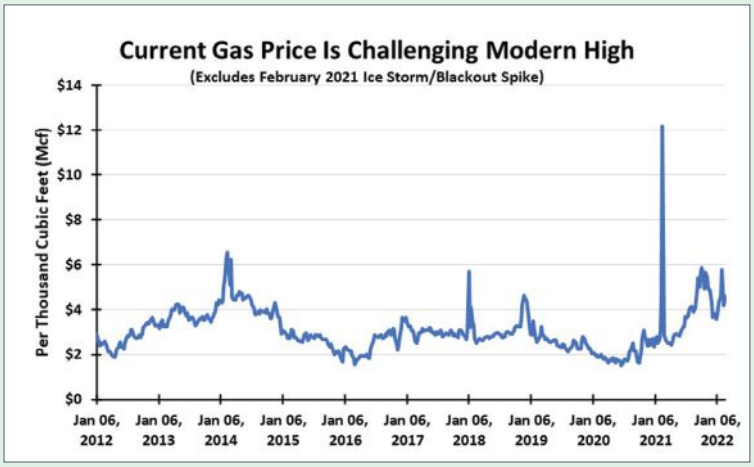
For U.S. gas consumers, the LNG market will operate at capacity keeping demand up and prices elevated. The world finds its gas storage volumes at historical lows, which will need to be rebuilt before next winter. This is also true in the U.S. As the world's largest exporter of gas, high domestic natural gas prices will be sustained. High prices signal the market wants more production if we do not want to enter next winter with low storage volumes, which could mean power supply challenges if weather is colder than normal.

It is still shocking how geopolitical events, the current U.S. administration's anti-fossil fuel governance agenda, and producers responding to the demand of their shareholders to exercise greater financial discipline and return more cash to investors have combined to transition the world's gas industry from chronic oversupply to sustained undersupply. Americans' electricity and gas bills are going up and will stay elevated into next year. Politicians who attack the gas industry and then beg for it to deliver more supply are finding that this hypocritical attitude is extending the industry's typical response time to commodity price signals. That delay is and will continue to create hardships for consumers. This situation could have been avoided if all parties had handled their roles differently.









verlume

» *Verlume's Intelligent Energy Management System (IEMS). (Image credit: Verlume)*

INTELLIGENT ENERGY MANAGEMENT: CRUCIAL TO FUTURE UNDERWATER DEVELOPMENTS

By Richard Knox,
Managing Director, Verlume

Offshore clean energy systems are an ideal solution for the growing need to reduce the emissions associated with hydrocarbon production, particularly as a means of powering longer offsets and reducing the costs of otherwise marginal fields.

A study conducted by Rystad Energy in January 2022 showed that, of around 80 oil and gas projects worth a total of $85 billion in the global pipeline for 2022, 45 of these will involve subsea tiebacks. These subsea tiebacks are a great opportunity for driving low-carbon production systems across worldwide energy projects. With such a significant number of subsea tiebacks due to come online and given that no two tiebacks are the same, there is a growing need for a diverse range of power generation systems as inputs.

INTEGRATING RENEWABLE ENERGY

Through industry projects, Verlume has engaged with a number of wave energy developers in order to integrate clean energy into oil and gas infrastructure and wider energy applications. These devices are scalable and adaptable for a variety of environments, where prevailing wavelengths and depths will differ. Other potential solutions include tidal energy and floating solar farms and of course, offshore wind.

Across these multiple types of energy inputs, an energy management system is the gateway between the clean energy input and secure energy delivery for subsea tieback projects. Effective energy management will allow the power to be used exactly when and where it is required, building resilience to overcome the challenges related to the intermittency of renewable energy production. Therefore, energy management will make it easier to implement alternatives to the traditional, fossil fueled methods of power delivery, allowing seamless integration of clean energy systems.

INTELLIGENT ENERGY MANAGEMENT

Verlume's Intelligent Energy Management System (IEMS) provides this gateway as an energy management system which is customizable and scalable for a range of different applications. The IEMS is power generation agnostic, meaning that we can adapt the technology to suit any renewable energy input, which autonomously manages delivery to multiple payloads, providing energy security and availability at all times.

Demand side management capabilities can add efficiency and reliability to the energy system. Verlume has a suite of tools for creating a detailed model of power input and demand versus time, to create a digital twin of the energy system for continued optimization.

Where possible, we have developed IEMS to be agnostic in terms of energy storage mediums for configuration as a standalone or integrated system. For example, the IEMS could be integrated with Verlume's Halo device, a scalable, modular battery energy storage system. Halo is currently part of a world-first autonomous offshore power sea trial at the US Navy Wave Energy Test Site, Hawaii which will demonstrate the integration of a selection of novel subsea technologies to deliver a reliable source of power as well as real-time over-the-horizon bi-directional data communications.

With over half of this year's new oil and gas developments across the world set to feature subsea tiebacks and with an increasing focus on the carbon intensity of offshore operations, the capability to be able to integrate any renewable energy technology and to intelligently manage this will be crucial to the underwater operations of the future.

For more information, visit: *www.verlume.world*.

CYNALYTICA DELIVERS FIRST DEPLOYMENT OF SERIALGUARD® CYBERSECURITY SOLUTION FOR GAS PIPELINE OPERATIONS

Cynalytica, Inc. Recently announced the delivery of the first SerialGuard® cybersecurity solution to a United States–based S&P 500 gas pipeline operator.

Designed for Industrial Control Systems (ICS), SerialGuard is a fully passive serial packet sniffer that enables secure visibility within vulnerable legacy networks. This fail-safe sensor monitors Level 0 and Level 1 serial communications between field devices and controllers. Combined with the Cynalytica AnalytICS Engine Platform, it can also reveal and help alert traffic anomalies that are indicative of a cyberattack, physical attack or system misconfiguration.

Legacy serial communications make up 30 to 60 percent of all U.S. critical infrastructure. These typically insecure and unmonitored assets have been historically overlooked, with most ICS security providers only monitoring TCP/IP and Ethernet communications, leaving gas pipeline and other utility operators with a large monitoring blindspot.

» *SerialGuard® a fully passive serial packet sniffer. (Photo credit: Cynalytica)*

"As geo-political cyberthreats to U.S. critical infrastructure escalate and we see the launch of the DHS/CISA Shields Up advisory, we're happy to see that many commercial infrastructure operators are becoming more aware of the need to protect their legacy infrastructure—something SerialGuard allows them to do safely and securely," said Richard Robinson, CEO of Cynalytica, Inc.

Cynalytica has been providing cybersecurity solutions to the U.S. Department of Homeland Security (DHS), U.S. Department of Defense (DoD) and U.S. Department of Energy (DOE) for many years. Its SerialGuard sensor enables pipeline operators to meet monitoring and baselining requirements under the DHS directive, "Security Directive Pipeline-2021-02: Pipeline Cybersecurity Mitigation Actions, Contingency Planning and Testing."

SerialGuard follows closely behind other cybersecurity regulations, including the Pipeline Owner Operator Security Directive, Federal Energy Regulatory Commission (FERC) and North American Electric Reliability Corporation (NERC), which is working to strengthen critical infrastructure protection reliability standards by requiring internal network security monitoring.

NEW MEASURES TO MAINTAIN HIGH GAS EXPORTS TO EUROPE

Equinor and its partners, together with Norwegian authorities, are taking new steps to meet the gas demand in Europe. Increased production permits allow the high gas production from the Troll, Oseberg and Heidrun fields to be maintained through the summer months.

"Our focus is to maintain safe and efficient operations on our facilities, remaining a reliable supplier of energy to the markets in Europe in a highly challenging situation. In close dialogue with the authorities and our partners we are now taking steps to maintain the high production level from the winter," said Kjetil Hove, executive vice president, Exploration & Production Norway.

The adjusted production permits from the Ministry of Petroleum and Energy allow the Oseberg field to increase its gas exports by around one billion cubic meters in the period up to 30 September. For the Heidrun field gas exports can increase by 0.4 billion cubic meters for the calendar year 2022.

1.4 billion cubic meters of gas meet the gas demand of around 1.4 million European homes during a year.

Increased Robustness

Equinor has also decided to postpone turnarounds on the Oseberg field from May to September this year in order to accelerate production. This is based on a thorough evaluation of the plants' technical integrity.

» *The Oseberg field center in the North Sea. (Photo credit: Ole Jørgen Bratland/Equinor ASA)*

Should needs for necessary maintenance still arise, this will be done during short turnarounds. Safety is the number one priority. The postponement results in a corresponding postponement of the Sture terminal turnaround.

In addition to increased exports, the adjustment of the permits also increases the robustness of the production on the fields exporting via the Kollsnes processing plant, as the Troll production can be increased by up to 1 billion cubic meters of gas in the event of loss of production on other fields in the area.

"In this highly challenging situation we do our utmost to deliver as much as possible to our customers, enabling them provide homes and companies with gas. We are pleased that we, together with the authorities, our partners and Gassco, now ensure that we can export more gas this summer, while increasing the robustness of gas exports," commented Irene Rummelhoff, executive vice president, Marketing, Midstream & Processing.

The Measures

- Planned turnarounds on four platforms on the Oseberg field in May will be postponed to September 2022. This will accelerate the production of slightly less than 500 million cubic meters from September to May.
- The Ministry of Petroleum and Energy has approved the application from Equinor for a more flexible production permit for the Oseberg field for the current gas year, enabling the field to maintain maximum production. Oseberg can thus increase gas exports up to 30 September 2022 by about 1 billion cubic meters. This is an about 15 – 20 percent increase for the current gas year, putting this year's production at about 7 billion cubic meters.
- The Ministry of Petroleum and Energy has approved the application from Equinor for an increase in the production permit to 38 billion cubic meters of gas for the Troll field for the current gas year. This increases production by 1 billion cubic meters, equivalent to an increase of slightly less than 3 percent for the Troll field in this gas year, in the event of loss of production from other fields.
- The Ministry of Petroleum and Energy has approved the application from Equinor to increase the gas production on the Heidrun field by 0.4 billion cubic meters in the current calendar year, i.e., an increase of up to approx. 30 percent.

Hammerfest LNG is also scheduled to come on stream from mid-May, providing more than 6 billion cubic meters of gas per year from the Barents Sea.

AKER CARBON CAPTURE AND SINTEF EXPAND CARBON CAPTURE UTILIZATION & STORAG TECHNOLOGY COLLABORATION

Aker Carbon Capture and SINTEF have entered a strategic collaboration to further developing carbon capture utilization and storage (CCUS) technology to reduce CO2 emissions from industry and energy solutions.

CCUS refers to a series of technologies for capturing CO2 and safely utilizing or storing it deep underground. Both the International Energy Agency (IEA) and United Nations (IPCC) consider CCUS to be crucial for reducing CO2 emissions and limiting global warming to under 1.5°C.

Through the collaboration, the parties will explore opportunities to develop new CO2 capture technologies, share knowledge, and collaborate more closely to generate new ideas.

"A partnership with SINTEF and access to their significant testing infrastructure and knowledge of CCUS and enabling technologies, will not only allow Aker Carbon Capture to continue to improve our existing technology portfolio, but also enable us to collaboratively identify the next generation CCUS technology and bring it to the market," said Aker Carbon Capture CTO Jim Stian Olsen.

BOEM ANNOUNCES WIND ENERGY LEASE SALE OFF-SHORE THE CAROLINAS

The Department of the Interior announced that the Bureau of Ocean Energy Management (BOEM) has completed its environmental review and will hold a wind energy auction for two lease areas offshore the Carolinas on May 11. The lease areas cover 110,091 acres in the Carolina Long Bay area that, if developed, could result in at least 1.3 gigawatts of offshore wind energy, enough to power nearly 500,000 homes. The announcement is part of President Biden's agenda to grow a clean energy economy that harnesses offshore wind projects to strengthen U.S. energy independence, create good-paying jobs, and lower energy bills for consumers.

"The Biden-Harris administration is committed to supporting a robust clean energy economy, and the upcoming Carolina Long Bay offshore wind energy auction provides yet another excellent opportunity to strengthen the clean energy industry while creating good-paying union jobs," said Secretary Deb Haaland. "This is an historic time for domestic offshore wind energy development. We will continue using every tool in our toolbox to tackle the climate crisis, reduce our emissions to reach the President's bold goals, and advance environmental justice."

President Biden catalyzed the offshore wind energy industry by announcing the first-ever national offshore wind energy goal, creating a clear vision for the future of this innovative industry. This goal is reinforced by President Biden's Bipartisan Infrastructure Law, which will make historic investments to build a better America with clean energy, resilient infrastructure, and strong domestic manufacturing and supply chains.

The Carolina Long Bay offshore wind energy auction will allow offshore wind developers to bid on one or both of the lease areas within the Wilmington East Wind Energy Area (WEA), as described in BOEM's Final Sale Notice (FSN), which is available today in the Federal Register Reading Room. The two lease areas include similar acreage, distance to shore, and wind resource potential.

The FSN includes several lease stipulations designed to promote the development of a robust domestic U.S. supply chain, advance flexibility in transmission planning, and encourage project labor agreements. Among the stipulations announced today, BOEM will offer a 20 percent credit to bidders if they commit to invest in programs that will advance U.S. offshore wind energy workforce training or supply chain development.

To advance BOEM's communication and environmental justice goals, the leases will also require lessees to identify Tribal Nations, underserved communities, agencies, ocean users and other interested stakeholders, and report on their communication and engagement activities with these parties. These stipulations are intended to promote offshore wind energy development in a way that coexists with other ocean uses and protects the ocean environment, while also facilitating our nation's energy future for generations to come. These innovative stipulations were embraced in the Department's recent lease sale for the New York Bight, which set a record as the nation's highest-grossing competitive offshore energy lease sale in history, including oil and gas lease sales.

WAVE ENERGY: TURNING THE TIDE TOWARDS COMMERCIALIZATION

By Dae Hyun Kim,
Business Development Director, INGINE

Seoul-headquartered wave energy developer INGINE is set to celebrate its landmark 10th anniversary this year as its technology edges ever closer to commercialization.

Having also completed five successful years of wave energy operation in Northeast Asia, via the Jeju Bukchon Wave Power Plant, the company is now preparing for major international expansion with international projects spanning across continents.

A key project includes a joint Vietnamese and Korean initiative in Quang Ngai province—with a five-party MoU also involving Quang Ngai People's Committee, SK Innovation, Doosan Vina and VinGroup. A separate Far East venture includes developing a 10 MW wave energy project for diesel replacement in Indonesia.

Further afield, INGINE will expand its global footprint in North America after inking a deal with the Mowachaht Muchalaht First Nation (MMFN). Initial work in 2022 will include detailed design for an onshore wave energy system in Yuquot, British Columbia (Canada). Other collaborative plans are underway in France, Morocco, Taiwan, and Japan.

Having acquired a wealth of knowledge over the last decade, INGINE's work is not going unnoticed, being recently ranked 2nd in Forbes Korea's marine energy innovation, ESG and carbon reduction listing. Now entering an exciting growth phase, its forthcoming cross-continental projects follow years of careful preparation, leveraging finance and establishing secure and stable international partnerships.

ENERGY INDEPENDENCE FOR ISLAND COMMUNITIES

INGINE's overarching mission is focused on replacing conventional, polluting sources of energy, starting with the use of diesel generators in remote islands and coastal areas. With around 730 million people currently living on islands, most communities remain dependent on mainland fossil fuel imports. To this day, immense technical and economic challenges stand in the way of their energy independence. However, *INGINE is one of a band of pioneering ocean energy tech developers looking to reverse the 'island isolation' deficit through effective harvesting of the waters which surround them. It believes the answer lies in the world's greatest untapped energy resources—the ocean.*

An estimated 3 TW of energy are stored in ever-unfurling ocean waves, promising efficient, reliable, dense and predictable power. However, the pursuit to commercialize wave energy technology has historically proved challenging, largely because offshore ocean energy systems have been too costly in the past. In order to be competitive with other renewables they require accumulative installed capacity of 1 GW. However, technology is advancing rapidly, and the

After five successful years of wave energy operation in Northeast Asia, INGINE is preparing for major international expansion. (Photo credit: INGINE)

climate emergency cannot wait, with island communities particularly vulnerable and all too often hamstrung by their own economic limitations.

NOVEL ON-SHORE ELECTRICITY GENERATION

This plight for island energy independence provided the initial spur for the development of INGINE's INWave™ WEC (Wave Energy Converter). It offers a unique take on the process with a novel 'on-shore' solution, meaning electricity is generated on land, away from extreme conditions and the high seas. Essentially, this eliminates the requirement for expensive, multi-million-dollar, subsea cables. Instead wave power is collected by floating devices located close to shore. This energy is then mechanically transmitted to land through ropes. Due to this innovative design INWave™ power plants can reduce capital and operations and maintenance expenditures, greatly facilitating market entry.

More specifically, the 'on-shore' approach uses multi-directional energy harvesting technology within the water, targeting close-to-shore waves. The shallow waters of coastal areas act as breakwaters, weakening the strong waves coming from the open sea. For example, in waters less than 10 meters deep large waves from the open sea are converted into small and medium-sized waves.

The technology offers a flexible, modular based system, with singular modules range from 25 kW to 500 kW to adapt to local demand and site conditions. Even at this small scale the plants are economically viable with the potential to multiple modules into multi-megawatt installations, making the solution viable for small islands and coastal cities alike. The technology is especially well suited for remote coastal communities which do not have access to the central power grid and depend on diesel generators for electricity supply.

SIGNIFICANT CLIMATE IMPACT

Aligning with the United Nation's Sustainable Development Goal (SDG) 7—Providing access to clean and affordable energy—INGINE'S INWave™ solution is expected to make a significant climate impact. In figures, a 1 MW plant could save up to 33,000 tonnes of CO2 in its 20-year lifetime. Through lessons learnt in its steady, long-term development, the technology is being positioned to contribute to the production of Environmental, Social, and Governance (ESG) best practice for wave energy projects in off-grid locations.

And with the economic value as a 'first mover' in the industry estimated at $6.4 billion, INGINE has assembled a global team of highly skilled engineering and business professionals to realize its full potential, with 58 patents registered and Technology Readiness Level 7 already achieved.

Multi-sector partnerships have now been finalized in more than 10 countries across five continents, and the firm's full business proposition includes the provision of WEC technology to independent power producers, alongside project development and feasibility study services, as well as O&M parts and services for installed facilities.

The fifth year of operation of the Jeju Bukchon Wave Power Plant also means the firm has now successfully completed full-scale prototype testing at sea, setting the stage for its first commercial scale wave power plant in Vietnam. Casting ahead, INGINE is preparing to create a firmer foothold in Europe investing in an R&D center, while creating further synergies across the blue economy integrating WECs with offshore platforms.

» *INWave™ WEC eliminates the need for expensive subsea cables as power is collected by floating devices located close to shore. (Image credit: INGINE)*

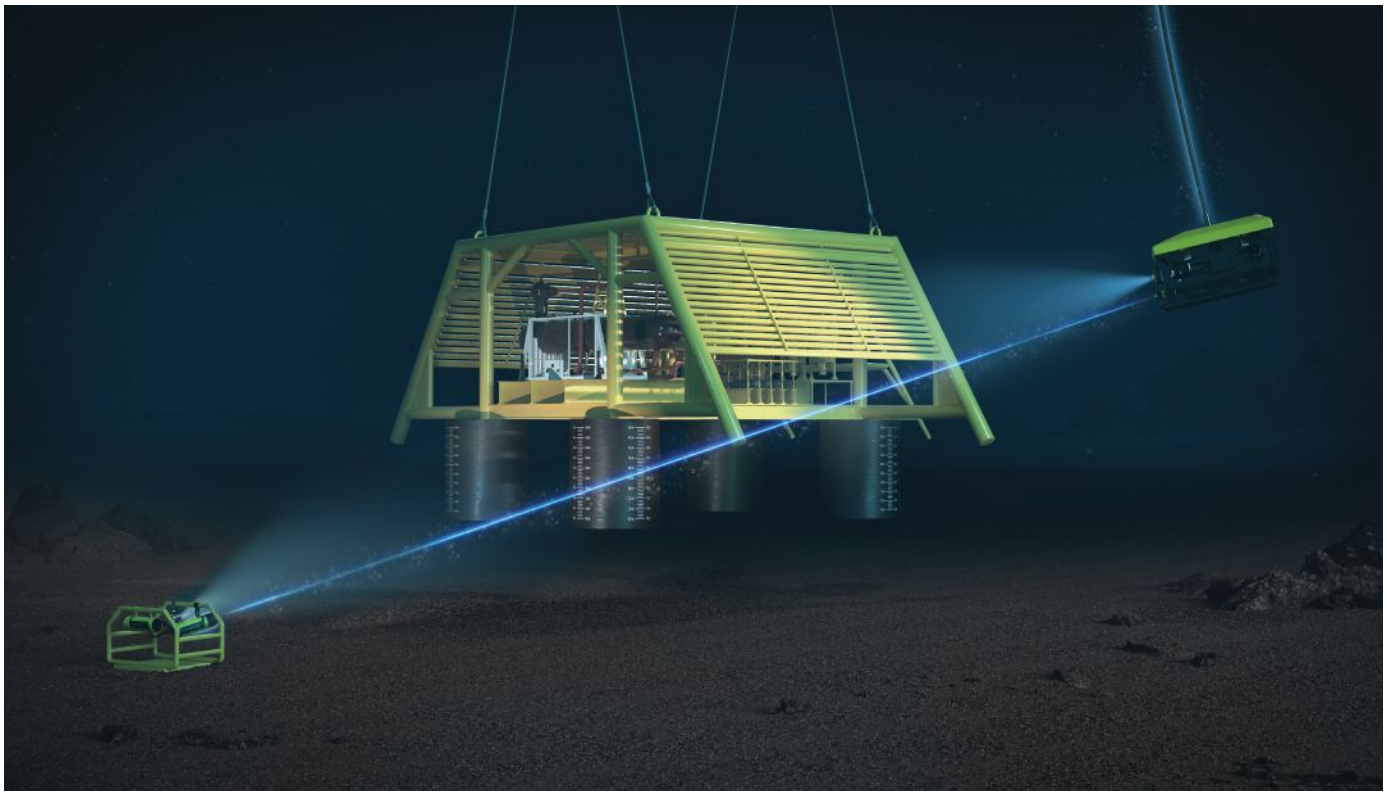
» *With full-scale prototype testing at sea completed, the next stage is to develop a commercial scale wave power plant in Vietnam. (Photo credit: INGINE)*

» *INGINE has assembled a global team of highly skilled engineers, with 58 patents registered and Technology Readiness Level 7 already achieved. (Photo credit: INGINE)*

ECONOMIC FEASIBILITY & SOCIAL VALUE

Recognized for its economic feasibility and social value, INGINE has received significant national and international finance support, including $2 million from SK Innovation in 2019. This was supported by a further $3 million from South Korea's state lender Korea Development Bank (KDB) in 2021, which enabled INGINE to successfully close its $6 million Series B round. In 2021, other forms of technical and financial assistance were granted to support INGINE's projects through the Korea Environmental & Industry Technology Institute (KEITI), the United States Agency for International Development (USAID) and the Clean Energy for European Union Islands Secretariat.

Early in 2022, additional private financing of $1.7 million was secured thanks to INGINE's R&D capabilities which have generated 58 patents globally. INGINE is planning to go public in 2023 and has selected Hana Financial Investment to be the lead manager for the Initial Public Offering (IPO). Before the IPO, INGINE will work on its Series C round throughout 2022, as a pre-IPO phase to promote R&D and commercial developments. *www.ingine.co.kr/en/*



» *Kongsberg's cNODE Mantis is able to act as a second set of eyes with live video stream-ing from the seabed. (Image credit: KM)*

KONGSBERG MARITIME INTRODUCES NEW WIRELESS VIDEO SOLUTION FOR SUBSEA OPERATIONS

Kongsberg Maritime (KM) has launched cNODE Mantis—a new addition to the cNODE product range of acoustic modems which introduces the new capability to stream a live video feed for a variety of subsea installation tasks.

Having established itself over the years as an acoustic positioning system of unmatched reliability and robustness, the cNODE has set the standard for subsurface operational technology. The same principles of technical innovation and tough build quality have been brought to bear in the expanded functionality of the cNODE Mantis: the addition of a live video solution significantly increases the number of applications and services for which cNODE systems could be used.

"In many cases, the cNODE Mantis could be a vital asset for increasing efficiency in challenging operations by supplementing high-quality video from an ROV with acoustic video streaming from a remote camera placed on the seabed, or on a structure which is being lowered," explained Jan Erik Faugstadmo, Product Line Manager, Kongsberg Maritime. "During subsea installation projects, being able to visually monitor placement of structures on the seabed is obviously of prime importance, so in some scenarios it will be advantageous to have a second view to assist the ROV, or indeed to provide a view from an angle where it is impractical or impossible for an ROV to be positioned."

The full potential of the cNODE Mantis as 'a second set of eyes' in this respect is easily realized. The live video it streams is transmitted to a receiver installed either on the ROV's TMS (Tether Management System) or on the vessel itself, at ranges of up to 500 m. As the wireless video transfer works on a high-speed acoustics link it will function in both murky and clear water conditions and is unaffected by background light. With a bit-rate of up to 70 kbit/s, it allows for the transfer of live video with a typical quality of 420 x 380p at four frames per second.

"With the cNODE Mantis solution, live images can be streamed from an AUV or drone to a surface vessel equipped with a HiPAP 502 system upgraded with a Mantis receiver, or towards a separate receiver installed on a surface vessel," added Spencer Collins, VP Sales, Kongsberg Maritime.

KONGSBERG

CYPRUS SUBSEA'S NEW SEAGLIDER FLEET READY FOR ACTION

Cyprus Subsea Consulting Services Limited has established a fleet of four Seaglider AUVs to unlock new long-duration subsea survey and monitoring capabilities for research and commercial organizations. Featuring four M1 Seagliders acquired in February 2022, the new privately-owned fleet is one of the largest of its kind in Europe and is ready for operation now.

With more than a decade of supporting clients on scientific, regulatory, and commercial Seaglider projects globally, Cyprus Subsea's 1000-meter rated M1 Seagliders are a major boost in its capacity to provide real-time environmental monitoring services in the open seas for diverse applications.

The fleet enables customers to leverage glider capabilities for one-off or short-term projects without the need for investing in glider infrastructure or specialized staff. Larger organizations may also benefit from leveraging the new fleet as a lower cost alternative to maintaining internal glider capabilities all year round.

"For gliders to fulfil their full potential as a cost-effective, low carbon marine monitoring and research tool, the barriers to their usage must be reduced or removed. The learning curve and initial investment are too high for most, and we believe we can help by providing our expertise and assets as a turnkey solution anywhere in the world," said Daniel Hayes, Managing Director, CSCS Ltd.

Equipped with a variety of sensors, Cyprus Subsea's state-of-the-art gliders acquire ocean profile data such as temperature, salinity, and dissolved oxygen, as well as biogeochemical, biological, and acoustic data. Pilots on shore manage the on-board autopilot system and sensor payload configuration via satellite.

An underwater glider is a highly efficient autonomous underwater vehicle (AUV) which utilizes slight changes in buoyancy, pitch and roll to achieve forward, profiling, motion over long distances. They are a reusable, cost-effective method for collecting repeat subsurface ocean observations. Mission endurance is measured in months, with the gliders surfacing to transmit data to shore.

Cyprus Subsea is taking a flexible approach to provision of its new Seagliders, with related services including mission planning, launch/recovery, piloting, maintenance, training, in addition to data management, analysis and reporting all available according to project requirements.

The company's DeepEcho Module for identifying and quantifying components of the marine ecosystem on a range of scales, the gListen Board and the UVP6-LP Underwater Vision Profiler will also be available as part of Seaglider rental packages.

» *Cyprus Subsea's 1000-meter rated M1 Seagliders. (Photo credit: Cyprus Subsea)*

» *Kirk Anderson (L), Managing Director, Load Monitoring Systems and Andy Smerdon, Managing Director, Aquatec Group*

COLLABORATION TO COMBINE SUBSEA COMMUNICATIONS AND LOAD MONITORING

Subsea communications experts Aquatec Group and load monitoring pioneers Load Monitoring Systems (LMS) have announced the launch of a collaboration between the two development environments in a move designed to reduce the cost of subsea installation, maintenance, and decommissioning in the Offshore Wind and Oil & Gas industries.

The specifics of the joint venture were discussed during Global Underwater Hub's renowned Subsea Expo exhibition in Aberdeen in February this year, where both companies exhibited and showcased their capabilities, and announced at Oceanology International 2022.

The collaboration will result in a soon-to-be presented streamlined modular design created to monitor subsea loads from 0-250Te as standard. The wireless subsea load sensing shackle will cater to different design applications, including visual monitoring of the loads on subsea moorings and winches using subsea displays or digital monitoring via signals transmitted wirelessly to the surface or ROV.

Kirk Anderson, LMS managing director, said: "We have been looking for a reliable and innovative subsea communications specialist with which to develop and enhance our subsea shackle technology, and it was vital to find the right partner. Therefore, we are delighted to be working with such an established, reputable organization as Aquatec Group. Our combined specialist knowledge will benefit not only our businesses but also the wider subsea industry."

Andy Smerdon, Managing Director of Aquatec Group, added: "As soon as we were introduced to LMS, we recognized the similarities between the businesses—both are quality-focused businesses delivering innovation to the offshore industry. We believe there is a significant role to play here, in providing real-time and logged data to improve the understanding and performance of subsea equipment—and therefore to reduce the cost of offshore energy."

IXBLUE RAMPS UP DRIX USV PRODUCTION

As the maritime industry makes its transition towards more efficient and environmental-friendly autonomous operations, iXblue, a key player in maritime autonomy, has been ramping up its production of DriX Uncrewed Surface Vehicles (USV) to meet the industry growing need for efficient and sea-proven autonomous platforms.

With over 20 DriX in operation worldwide, iXblue's USV has been met with strong interest from the industry. The USV has already been acquired, deployed or trialed by several leading operators and scientific institutes for seabed mapping missions and other subsea positioning operations, including the US National Oceanic and Atmospheric Administration (NOAA), the British Antarctic Survey (BAS), the Polish Navy, the French Hydrographic Institute (SHOM), or the French Research Institute for Ocean Science (Ifremer), as well as survey contractors and operators in the energy market such as TotalEnergies, Ocean Infinity, Sulmara and other rental companies such as Unique and WAMS.

"We would like to thank all our customers for choosing our DriX USV as they transition towards autonomous operations," stated Olivier Cervantes, VP Maritime & Autonomy at iXblue. "DriX's versatility, both in terms of mission types, and working environments, as well as its reliability and overall performance, has indeed translated into fast commercial success, this strong increase in order intake has led us to review our whole industrialization process for series production with the aim of strongly reducing our lead time, resulting in quicker deliveries and availability of our DriX USV for our customers."

Designed to support hydrographic and geophysical surveys, water column analysis and subsea positioning operations from shallow to medium water depths, iXblue DriX USV can conduct both remote-controlled and supervised autonomous operations (within visual range or from Onshore Remote Control Centers). DriX offers outstanding seakeeping and speed capabilities, drastically reducing costs and increasing operational efficiency. Able to host a wide range of payloads for multi-capabilities missions, DriX is a versatile autonomous platform able to operate in both shallow and deep waters (from 2 m to 2,500 m). Certified by leading class society (BV, Lloyd's), the USV is equipped with advanced perception means, including a radar, a LiDAR and cameras, as well as artificial intelligence, all of which enable it to adapt to its environment, avoid obstacles and carry out missions autonomously.

» *DriX can conduct successful missions in conditions up to sea state 5. (Photo credit: iXblue)*

ROVCO TO INVEST IN SMD'S NEW EV WORKCLASS ROV SYSTEM

World leading subsea equipment manufacturer Soil Machine Dynamics Ltd (SMD) and intelligent offshore services provider Rovco Ltd have signed a Letter of Intent (LOI) for next generation EV Work Class ROV (WROV) technology.

SMD will provide Rovco with a new Atom EV high performance electric WROV, this will be the first of a fleet of vehicles designed to interface with Rovco's latest computer vision and AI capabilities, offering a smarter way of working to drive efficiency and lower project costs. This solution enables Rovco to offer a step change in autonomous services to its client's, powered by its technology spin-off, Vaarst.

The Atom EV WROV operates with superior precision in 3 knot water currents, drastically increasing the ROV operating window and enabling Rovco to offer services that others with older technologies cannot. The new vehicle's cutting-edge DC power system offers high efficiency and a reduced CO2 footprint, together with adaptive onboard flight control which interfaces seamlessly with Vaarst technology and supports future advances in this pioneering solution. The Atom EV WROV will be paired with an all-electric launch and recovery system from MacArtney, pushing eco-credentials even further.

Mark Collins, Business Development Director at SMD said: "Rovco and Vaarst have big plans in subsea autonomy and artificial intelligence. This fits well with SMD's advanced underwater robotics program and having spent nearly 5 years developing this exciting new technology we are delighted Rovco has chosen us as their next generation subsea robotics partner."

Simon Miller, Managing Director at Rovco added: "We have been working closely with the team at SMD to tailor this solution, and Rovco is absolutely delighted to move the deal forward. This is a significant investment in ensuring Rovco remains at the leading edge of the survey and inspection projects we deliver to the Marine Energy Sector. One of our passions and key drivers is ensuring that the technology we deploy plays a pivotal role in the quality of the data we collect and deliver, and indeed the overall service we provide to our valued customers. Another is making sure that we continue to engineer new ways to reduce our own carbon footprint. The all-electric Atom WROV system fully enables both of these drivers to be achieved. With our SubSLAM and ML library integration, combined with over-the-horizon control, our move toward the realization of fully autonomous ML and AI led subsea inspections is further accelerated."

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

» *SMD's Atom EV high performance electric WROV. (Image credit: SMD/ Rovco)*

» *The Edge DVR Mobile Workstation features 17" screens that fold out from the main unit. (Photo credit: Digital Edge Subsea)*

DIGITAL EDGE SUBSEA

MOBILE EdgeDVR WORKSTATION: A PORTABLE OFFSHORE DVR AND INSPECTION SOLUTION

A world leader in offshore digital video recording and inspection systems, Digital Edge Subsea develops and manufactures products for use throughout the offshore oil and gas industry, working with clients of any size to provide the system that best suits their needs. The company, established more than 12 years ago, boasts a team of hand-picked specialists who are proud to nurture strong customer relationships

Digital Edge Subsea is now pleased to add another industry first to an expanding product range: the Mobile EdgeDVR Workstation. A great solution for those who have a need for portability or for projects short on space, this portable workstation has 17" integrated triple monitor display units in a small form factor for field deployment. The three screens fold out from the main unit to create a compact system capable of displaying sonar, ROV topside and DVR displays.

It has a total storage capacity of 30 TB, has the same capabilities as the rack mounted system and 4 channel HD recording capability.

The system has 3 removable hard drives which store the survey video and photos. The Windows 10 Pro operating system is stored on a solid state hard drive for increased speed and reliability, with a second solid state hard drive for redundancy. The system is supplied in a custom Pelican case.

RELIABLE SOFTWARE OPTIONS

Digital Edge offer 3 versions of software (Lite, Edge and Pro) and the Mobile EdgeDVR is available in all 3. In addition, you can create a command and control field deployable computing solution by adding a further mobile display unit of another three 17" screens.

You can be assured of a reliable system, whichever unit you choose. Digital Edge also supply excellent technical support where all systems can be remotely accessed. All units have been designed to be simple to use by personnel of all levels of ability and training is also covered for increased peace of mind.

The 3 levels of software available:

1. EdgeLite: an entry level unit, suitable for surveys and inspections, where there is no requirement for eventing.

2. EdgeDVR will is able to record 4 channels of HD simultaneously. It continues to offer the creation of Workpacks and offline editing.

3. EdgePro has an extended database that allows tasks to be assigned to components under inspection. This allows customers to either create their own Workpacks, or they can be created in-house at Digital Edge. It also provides an automatically generated report to capture inspection results.

DEPENDABLE DATA STORAGE

All units come with EdgeArchive, a data storage and back-up solution that uses an integral app within Edge architecture, to avoid needing a 3rd party app.

Edge Archive 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 are not impacted by a 3rd party program trying to access the same file that the DVR app is currently using.

For more information, a quote, or a demonstration of the system, contact info@digitaledgesubsea.com.

www.digitaledgesubsea.com

KONGSBERG LAUNCH
HUGIN EDGE AUV

The latest addition to Kongsberg Maritime's HUGIN family builds on the proven capabilities of the advanced HUGIN architecture, adding cutting edge autonomy to deliver the most advanced low drag Autonomous Underwater Vehicle (AUV).

HUGIN Edge's design combines elements of HUGIN's carbon monocoque approach used with success for the last 20 years coupled to extensive hydrodynamic modelling to refine the hull's low-drag shape.

HUGIN Edge includes an innovative forward looking sonar design providing 3D sensing capabilities for improved trajectory planning and directional collision avoidance coupled to traditional forward scanning methodology.

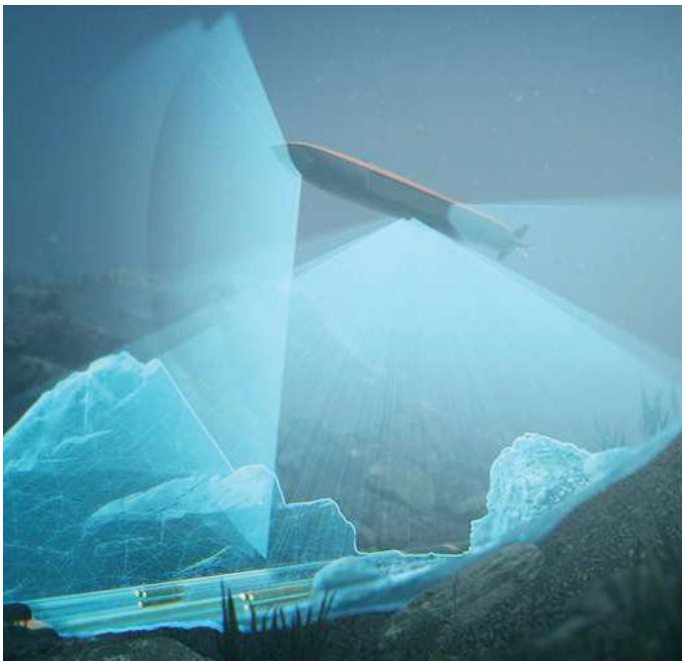
To enable greater interoperability, the vehicle is equipped with the latest open interfaces for integration to third party planning and mission management tools. There are also new tools specifically designed to optimize results for every deployment. Central to these are goal-based mission planning tools and mission execution.

The mission planning capabilities provides a higher-level mission planning interface, requiring less specialist knowledge and input by the operator, while in-mission edge-processing capabilities drive step-changes in both performance and efficiency for all operations.

Measuring less than 4 metres long, HUGIN Edge weighs approximately 300 kg. It is packaged with the latest battery technology to provide more than 24 hours operation at depths of up to 1,000 meters. The general arrangement includes the next generation of KONGSBERG synthetic aperture sonar, a high frequency multibeam echosounder and a swappable camera or sub-bottom profiler.

From inception HUGIN Edge is designed to operate from Uncrewed Surface Vehicles (USVs), small surface vessels and from shore. The design has been developed around Kongsberg's automated Launch and Recovery (LAR) with battery charging through inductive power providing true over the horizon operations.

Richard Mills, Vice President of Marine Robotics Sales at KM said: "Since the first dive of HUGIN on 7th March 1993 it has evolved into the most successful commercial off-the-shelf autonomous underwater vehicle ever made. In that time, the shape has changed, from a smooth low-drag design to a more traditional cylindrical hull form focused on modularity and providing a flexible configuration. Over the last few years, we have released the high performance HUGIN Superior, the pinnacle of survey capabilities within autonomous vehicles and HUGIN Endurance which stretches the operational range to 2200-line kilometers in a single dive. HUGIN Edge returns to our original design philosophy of a smaller low drag body using the common architecture and user interface enabling interoperability of all HUGIN systems. Hydrodynamic efficiency is combined with optimized sensor integration to provide the best of both worlds: efficiency and productivity."



» *HUGIN Edge can operate for 24 hours at depths to 1,000 meters. (Image credit: Kongsberg)*

BRISTOL HARBOR GROUP INC.

ALTERNATIVE FUELS IN THE OFFSHORE ENERGY TRANSITION

By Ian Lawson,
Naval Architect, Bristol Harbor Group, Inc.

Alternative fuels dominate much of the discussion around reducing greenhouse gas emissions and promoting sustainability in the ocean industry. Liquefied natural gas (LNG) is currently the most widely adopted and fastest growing alternative to oil for marine vessels. LNG offers a moderate reduction in CO2 emissions and a large reduction in the emissions of harmful regulated pollutants. Further, increased market supply, decades of technological development, and expansion of distribution infrastructure have made the adoption cost—engine conversion—an increasingly attractive investment for vessel operators.

The trends that have spurred adoption of LNG are ongoing, and demand for LNG as a marine fuel is predicted to continue growing through the next few decades. However, if the trajectory of marine regulations continues to trend toward zero net greenhouse gas emissions, the future of low-carbon shipping will likely rely on a new generation of alternative fuels.

THE PROMISE OF HYDROGEN

Hydrogen fuel has fast become a focal point of energetic discussion, speculation, and technological development in the space of alternative fuels. Hydrogen is the simplest molecule that can readily react to release energy. As a result, its emissions can be minimal under the right conditions, leaving behind only water vapor and no residuals like carbon dioxide or harmful pollutants.

Hydrogen itself, when leaked, has a global warming potential less than that of natural gas, though leaks must still be minimized. Hydrogen can be produced with zero fossil fuel input by applying renewable electricity to water through electrolysis, resulting in "green" hydrogen, a term distinguishing this production process from others which do rely on fossil fuels. Hydrogen can be incorporated into or carried by other molecules to create "e-fuels"—a wide range of more complex synthetic fuels including hydrocarbons which can be produced via "green" pathways rather than consuming fossil resources.

THE COST OF CLEAN ENERGY

Green hydrogen and other synthetic fuels are promising, but they all start at a cost disadvantage with fossil fuels for one fundamental reason: we have to collect all the energy they contain, then collect and use significantly more energy to store it in chemical form. For example, green hydrogen production consumes about 5 times the energy content of the hydrogen produced. The energy density, stability, and transportability that chemical fuels provide is undeniably crucial, but the cost and effort of creating them is high.

Fossil fuels only seem cheap because the work of producing them from solar energy and geological forces was done for us by nature over millions of years. Our rapid consumption of this energy gift from the past has allowed human civilization to become what it is today, but we must now deal with the side effects of that disproportionate consumption and prepare for a sustainable future once that cheap energy is no longer available. One reality of that future is the real cost of chemical fuels which we will eventually need to pay to continue benefiting from their crucial energy density and transportability.

OVERCOMING BARRIERS

The other barriers facing hydrogen are similar in nature to those that LNG is currently overcoming. Distribution infrastructure is not yet built; handling it safely is difficult and requires advanced technology and training; ships need new equipment to harness it for power; and the supply of green hydrogen specifically is orders of magnitude lower than the likely future demand.

Overcoming these challenges, along with the intrinsic cost, will require time for technology to mature. Along the way, other hydrogen-carrying alternative fuels may become front-runners, and partially green production methods may be useful for early adoption. In any case, this growth will require coordinated regional and global policy to incentivize early investors and give vessel owners and operators an economic justification for adoption. With ventures starting around the globe, we are already seeing the beginnings of this process, and though barriers remain, the path towards lowering them has been laid out before us.

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NIWA-NIPPON FOUNDATION TONGA ERUPTION SEABED MAPPING PROJECT

NIWA and The Nippon Foundation are undertaking a mission to discover the undersea impacts of the recent Tongan volcanic eruption.

NIWA scientists will survey the ocean seafloor around the Hunga-Tonga Hunga-Ha'apai (HT–HH) volcano and surrounding regions and collect video images of the eruption's impact from NIWA's research vessel, RV *Tangaroa*, and using SEA-KIT International's Uncrewed Surface Vessel (USV) *Maxlimer*.

The NIWA-Nippon Foundation Tonga Eruption Seabed Mapping Project (TESMaP) is being funded by The Nippon Foundation—the largest non-profit organisation based in Japan which, amongst other philanthropic activities, has been facilitating projects in the ocean field since 1962. The research is also supported by The Nippon Foundation-GEBCO Seabed 2030 Project which aims to map the world's ocean floor by 2030.

The survey team predicts that there will be extensive changes to the underwater landscape around Tonga.

"Submarine cable breakages show impacts up to 50 kilometres from the volcano caldera, implying changes to the seabed over an area of at least 8,000 square kilometres," Project leader and NIWA Chief Scientist Oceans Mike Williams. "This survey will investigate the impacts of the eruption in the water column and on the seabed around HT–HH."

The Nippon Foundation Chairman Dr Yohei Sasakawa hopes that this research is vital to help protect people from similar natural disasters in the future: "We hope that this work will help researchers and governments understand and mitigate the risk of future eruptions, which will be of particular benefit to countries that lie within proximity of these threatening natural wonders, like Japan and New Zealand."

Scientists will gather acoustic data using echosounders to determine the shape and structure of the underwater landscape, including the thickness of ash deposits and the formation of any new bedforms. This data will then be compared with previous maps to identify areas for sampling, so that further changes to the area, such as impacts to marine life and the seafloor's chemical composition, can be assessed.

Ben Simpson, CEO, SEA-KIT International, said it is an exciting opportunity to demonstrate data collection using less than 2% of the fuel of a typical survey vessel: "USV *Maxlimer* will be controlled from the other side of the world, at our base in the UK, as she safely gathers a range of data types from inside the caldera for a full month to develop and support understanding of the eruption's undersea impact."

» *SEA-KIT International's USV Maxlimer will conduct a month of mapping and environmental data collection in Tongan waters. (Photo credit: SEA-KIT)*

NEXANS TO CONNECT THE DIEPPE-LE TRÉPORT OFFSHORE WIND FARM

Nexans has been awarded a contract by RTE to supply and install 47 km of offshore and 18 km of onshore power export cable for the wind farm located in the English Channel, more than 15.5 km from Le Tréport and 17 km from Dieppe.

With a capacity of 496 MW, the wind farm is expected to produce an average of 2,000 GWh per year, which represents the annual electricity consumption of approximately 850,000 people, or about two-thirds of the population of Seine-Maritime or more than the entire population of the Somme.

Developed by the consortium "Éoliennes en Mer Dieppe Le Tréport," this is one of the largest commercial offshore wind projects in France. Its success is of major importance as it will contribute to the country's response to climate change. The project is fully in line with France's objectives regarding the energy transition, energy mix, including offshore renewable energy, and energy independence of the country. RTE has been appointed by the State to connect this wind farm from the offshore substation to the onshore power grid through the installation of two 225,000 volt subsea and onshore links.

For the subsea section, Nexans will supply two 23.5 km lengths of 225 kV three-core cable. Featuring innovative new technology, the cable has hybrid armoring and incorporates a fiber optic element to remotely monitor the health of the link and transmit information between the offshore wind farm and the onshore base. The cables will be laid by the CS *Skagerrak*, one of the Group's two cable laying vessels along with the newly constructed *Aurora*.

Nexans' Halden plant in Norway will manufacture the subsea cables, while the land cables will come from the Nexans plant in Charleroi, Belgium. The fiber optic elements will be supplied from the Norwegian site in Rognan. The installation of the subsea cables should start in the second half of 2024.

» *Nexans' cable ship Skagerrak. (Photo credit: Nexans)*

CONSTRUCTION OF THE FIRST CABLE SYSTEM USING ALUMINUM CONDUCTORS COMPLETED

Aqua Comms, Bulk Fiber Networks, and Meta have completed the construction of the Havhingsten cable system. A fully funded project, the parties have contracted with Alcatel Submarine Networks (ASN) to build the subsea cable, which will bring greater connectivity in Europe and the Nordics.

The Havhingsten cable system showcased several key innovations and technological milestones throughout its design and construction.

Firstly, Havhingsten is the world's first aluminum conductor powered subsea cable system. As a material, aluminum allows for a much lower cable conductor voltage drop, which ultimately allows for a higher number of fiber pairs per cable. To achieve such innovative solutions requires investment in technology and close collaboration with partners and vendors. The removal of traditional copper raw material and replacement with aluminum from the manufacturing process benefits the overall system in efficiency and cost reduction, as copper is associated with variable availability and higher price. Additional benefits include, lighter aluminum allows more cable to be loaded onto an installation vessel and improved resistance to hydrogen penetration, an element which is unfavorable to the operation of optical fiber in ocean waters.

Secondly, the end-to-end system combines data transmission seamlessly across both an unrepeatered subsea segment in the Irish Sea, a terrestrial segment in the UK and a repeatered segment in the North Sea. Typical systems have one or two of these elements, but not all three.

Lastly, the system utilized a new enhanced, jet-assisted burial plough in both the North and Irish Sea segments, allowing the installers of the system to bury the cable to our specific demanding level of protection in very challenging seabed conditions along the route.

WIND, WTS TO ESTABLISH US CABLE STORAGE YARD

WIND, the Dutch subsea cable specialist, has signed a long-term cooperation agreement with Waterson Terminals, a large terminal operator located in the state of Rhode Island with operations at ProvPort (RI), the Port of Davisville (RI) and Port of New Bedford (MA).

Having completed several US cable projects successfully, WIND now plans to establish a new cable storage yard on the east coast region of the US, similar to what the team has already achieved in Velsen/Eemshaven in the Netherlands and effectively replicated in Taiwan and Korea.

The cable storage yard will be located at ProvPort in Providence, Rhode Island, and is expected to be fully operational by the beginning of Q3 2022.

The US yard will be run with the same flexible service that WIND customers have come to rely on, and US customers can now count on the quality of expertise WIND is known for in Europe, Asia and the rest of the world.

The main cable storage yard will be set up in Providence, with the potential to expand into other WTS facilities as the business grows and more space is required. From Providence, WIND will provide all cable and accessories storage and handling, while the project management will be carried out from WIND's headquarters in Alkmaar, the Netherlands.

WIND CEO, Tom Nooij, said: "We want to bring the experience that we have gained in the European energy market over the last 10+ years to the US, and extend our contribution to the global energy transition, in our own small way. I thank Waterson Terminals and International Longshoreman's Association (ILA) for their passion, efficiency, and professionalism in getting us to this point and look forward to a lengthy collaboration together."

For the first US projects this year, WIND's European cable team will be on site working with an experienced, local labor force from WTS and the ILA. Over time, local labor will be trained in specialty equipment and handling techniques to increase local job creation.

Waterson Terminal Services General Manager, Chris Waterson, added: "Waterson Terminal Services is thrilled to partner with WIND as we work to provide a high level of port logistics and stevedoring service to the US offshore wind supply chain. WIND has gained valuable experience supporting cable logistics projects in Europe and Asia and combining that expertise with our existing management team and skilled, local ILA workforce will further strengthen our service offering."

» *ProvPort at night*

PCCW GLOBAL DOUBLES CAPACITY ON PEACE WITH INFINERA

Infinera and PCCW Global have announced the completion of a significant deployment on the PEACE cable system between Marseille, Cyprus and Abu Talat.

Utilizing Infinera's ICE technology, PCCW Global now offers network operators the ability to significantly increase capacity per fiber pair on these critical Middle East and Mediterranean fiber routes.

Network operators are continually expanding cloud-based services to create more connected communities, driving the need for subsea network upgrades globally. PCCW Global's capacity upgrade on the PEACE cable system is one of a series of upgrades planned for this year. As the first and only open cable system in the Mediterranean Sea, the PEACE cable system can support numerous service providers in the region.

By leveraging Infinera's ICE technology on the GX Series Compact Modular Platform, PCCW Global is able to reach individual wavelength speeds of 650Gbs resulting in more capacity, with less hardware, and providing up to 25 terabits per fiber pair. The combination will enable network operators to efficiently provide high-capacity services between the Middle East and the Mediterranean region.

Mr. Haitham Zahran, Vice President of EMEA Subsea Cable Systems, PCCW Global, said: "The PEACE cable system is the highest-performing open cable system connecting Asia, Europe and Africa. By collaborating with Infinera to upgrade our network segment to increase fiber capacity, we are able to offer customers industry-leading innovation that provides the most reliability and highest capacity fiber pair available."

Mr. Nick Walden, Senior Vice President of Worldwide Sales, Infinera, added: "Infinera's subsea solutions have historically provided network operators the greatest amount of value from their fiber assets using innovative, industry-leading technology. Infinera's ICE solution enables PCCW Global to offer network operators open, scalable and flexible services to meet the region's growing bandwidth demands."

CHECK THE TECH SPECIAL

Oi oceanology international 2022
15-17 MARCH 2022
LONDON, EXCEL

For ocean technology enthusiasts, there was only one place to be last month—ExCeL London for Oceanology International (Oi) 2022, from 15 – 17 March. Oi 2020 was one of the first major ocean tech conferences to fall foul to COVID-19, so this year's return to in-person proceedings was eagerly anticipated, to say the least.

The collective urge to "get back to business" was palpable and affirmed by a bustling turnout; organizers reported a total attendance of more than 10,000 and 447 exhibitors from 70 countries.

These pages cannot do full justice to the impressive array of exciting technologies on show in London but here are a few of ON&T's top picks.

LEADING-EDGE AUV

Kongsberg's booth proved a big draw for visitors for the unveiling of HUGIN Edge, the latest addition to the HUGIN AUV family. At only 4 m in length, it is the smallest and lightest member of the HUGINs and notable for its unique low drag profile designed to give this mid-size AUV the "edge" over other vehicles in its class.

» *Kongsberg's HUGIN Edge*

HUGIN Edge has been engineered with full autonomy and remote operations in mind and can be delivered with a USV or uncrewed launch and recovery system. The AUV's wet flooded carbon monocoque body and flexible payload bay hosts a side-scan sonar or (upgradeable) synthetic aperture sonar for ultra-high-resolution imagery and is depth-rated to 1,000 m with an endurance of 24 hours @ 4 knots (top speed 5 knots).

In-mission adaptive autonomy allows HUGIN Edge to make real-time decisions and continuously adjust mission execution as more information about the surrounding environment is gathered by the sensors, ultimately allowing the AUV to self-optimize its performance and efficiency.

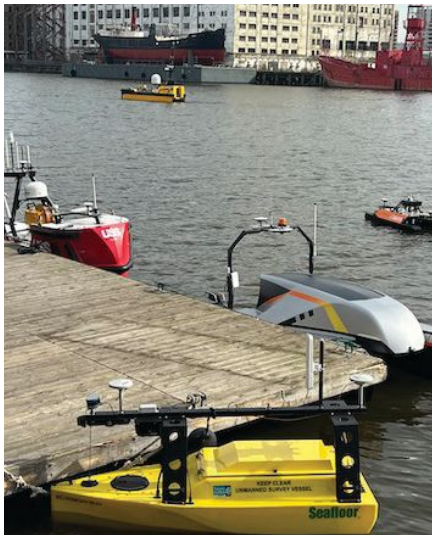
NEXT-GEN SMALL-CLASS UUV

Huntington Ingalls Industries' (HII) president of the Unmanned Systems, Duane Fotheringham was in town to field questions about the recently launched REMUS 300, an open architecture small-class UUV capable of diving to depths of 305 m. The team at HII gathered first-hand feedback from hundreds of REMUS 100 operators to help inform some of the critical design parameters of REMUS 300. The result is increased UUV payload flexibility and in-field utility.

Modular energy sections allow for field replacement of 1.5, 3.0 or 4.5 kW-hour lithium-ion batteries, potentially extending mission endurance to up to 30 hours—impressive given its dimensions: 230 cm (L) x 19 cm (W) and weighing in at only 56 kg. Common applications for this highly portable UUV include mine countermeasures, hydrographic survey, rapid environmental assessment, search and recovery, and marine research. REMUS 300's compact and efficient core electronics, advanced autonomy, and common operating system allow for interoperability with the entire REMUS family of systems and the growing HII ecosystem of unmanned craft—above and below the waterline.

SMART HULL CLEANING

The Greensea Systems team used Oi's return to introduce delegates to **Armach Robotics**, a spin-off company looking to reshape the future of ship husbandry. By fusing autonomy software and intelligent marine robotics, Armach seeks to curb the onset of naval biofouling and provide shipowners with greater awareness of optimal hull conditions through reliable,



» *USV dockside demonstrations*

cost-effective and scalable technology.

The business aims to leverage Greensea's formidable expertise in advanced navigation, vehicle control, supervised autonomy, and human machine interfacing to offer a subscription-based robotic hull cleaning service. Central to this end-to-end grooming process is Armach's man-portable crawler, which, as a hull agnostic solution, uses nonmagnetic adhesion and coating-friendly tracks to navigate its path.

While there are several hull cleaning

» *Fugro's Blue Essence USV Orca*

platforms already operational in the market, Armach's solution is powered by Greensea's open architecture software platform, OPENSEA, which directly informs the crawler's most efficient and effective route to 100% coverage. Armach's system features an intelligent brush system that adjusts the force needed to groom certain areas and surfaces, while the robot's cameras and sensors monitor progress and record specific hull features to help optimize the efficiency of future cleaning cycles.

As always, there was plenty to sample waterside at ExCeL London. USVs, unsurprisingly, featured heavily. Visitors were keen to get a first-hand look at **Fugro**'s 12-m Blue Essence USV Orca, designed and built by UK-based unmanned systems specialist SEA-KIT International to serve a broad range of missions, including offshore inspection and hydrographic survey.

DOCKSIDE DEMOS

Among the other uncrewed craft demoed—which included L3Harris' C-Worker 7, Maritime Robotics' Otter Pro, and OceanAlpha's SL40, among others—there was a second Orca that demanded attention, a multipurpose USV designed by the Portugal-based **CEIIA (Centre of Engineering and Product Development)** to offer an adaptable, complete and cost-effective solution for inland, coast and offshore data acquisition. Capable of supporting payloads to 100 kg, this fully integrated 3.4-m USV boasts a top speed of 5 knots and is capable of 24-hour-long deployments. It is equipped with a 30-m winch and is governed by a proprietary mission control software that allows for fully autonomous operations, making this customizable unit a turnkey solution for bathymetry studies, surveillance and inspection missions, and water sampling campaigns.

MINI BUT MIGHTY

As modernity dictates, the trend for shrinking technologies was also a feature at Oi 2022. **Seafloor Systems** launched their 1.3-m, 31.8-kg Trident USV, a trimaran platform purpose-built for multibeam hydrographic surveys. With battery endurance of up to 4 hours at 2 knots and propelled by 2 brushless thrusters with weed guard, this highly portable USV squarely targets operators that prioritize rapid ease of deployment. As does **GPASEABOTS**' SB100PRO, which was also available for in-booth inspection. Also weighing in at 31 kg, the 103-cm USV—available with side-scan sonar, thermal camera, and LiDAR—is another sound option for hydrographers on the move.

For investigation below the waterline, the team from **Advanced Navigation** put their new micro-AUV through its moves in an on-stand tank. Hydrus is a single-person-deployable, plug-and-play image-based survey solution supported by an in-built, cinema grade underwater camera. Still image resolution is 12 MP, with simultaneous 4k 60 fps video capture. Hydrus uses 3D coordinate mission plans to determine travel path, way points, and depth, and the INS is tightly coupled to the DVL for following mission trajectory,

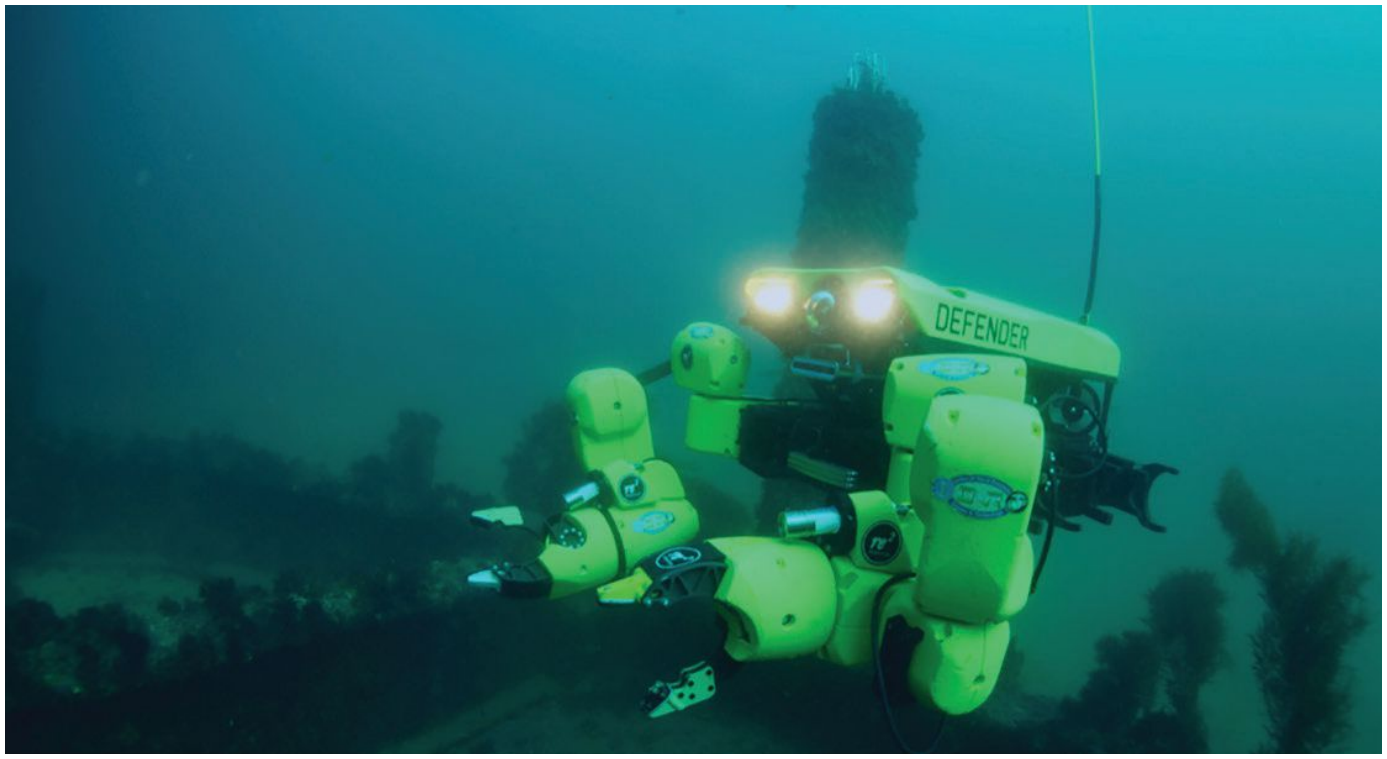
» *CEIIA's Orca USV*

» *GPASEABOT's SB100PRO*

regulating vehicle speed and maintaining distance from seabed and other objects. The unit is depth rated to 3,000 m.

Rounding up this snapshot of this year's Oceanology International, attendees got their first look at **Valeport**'s new Bathy2, due for commercial release later in 2022. Designed for surveyors that need bathymetric data for ROVs, underwear vehicles or drop structures, Bathy2 is a fully integrated sensor suite for deployment to 6,000 meters and uses state-of-the art sensors to generate sound velocity and density profiles for precision depth and height data. The Bathy2 also has an external pressure sensor input option for Digiquartz referencing and offers other useful parameters such as altitude, interfacing with Valeport's VA500 altimeter or other popular third-party options.

If you have a new product, service, or technology that you would like to see profiled in ON&T's monthly Check the Tech feature, get in touch at *editor@oceannews.com*.



» *VideoRay's inspection-class Defender ROV equipped with RE2 Sapien™ Sea Class underwater robotic arms. (Photo credit: RE2 Robotics)*

RE2 ROBOTICS AND VIDEORAY ACHIEVE NEW DEPTH MILESTONE WITH UNDERWATER AUTONOMOUS ROBOTIC SYSTEM

RE2 Robotics, a leading developer of intelligent mobile manipulation systems, announced that its Maritime Mine Neutralization System (M2NS) reached an unprecedented depth milestone of more than 1 kilometer during a recent open-water demonstration for the U.S. Navy's Office of Naval Research (ONR), the project's sponsor.

M2NS is an underwater autonomous mine neutralization system composed of RE2 Sapien™ Sea Class underwater robotic arms mounted onto VideoRay's inspection-class Defender remotely operated vehicle (ROV). M2NS also uses RE2's advanced computer vision and autonomy software, RE2 Detect™ and RE2 Intellect™, to enable the precise, autonomous, and clandestine neutralization of a target.

During the test event, which took place in the Pacific Ocean with support from the Naval Information Warfare Center Pacific in Point Loma, Calif., four successful dives exceeding 1,000 meters of depth were completed. The dives were conducted using supervised autonomy, which allows human operators to monitor the robotic system's autonomous movements and make corrections if necessary.

"These tests allowed us to demonstrate the continuing success of the M2NS project for the U.S. Navy," said Jack Reinhart, vice president of project management, RE2 Robotics. "The progress we made during these deep dives shows that we could successfully complete an underwater supervised autonomous mission at depths of more than 1,000 meters without any damage to the system. The M2NS system succeeded where no other system of this class has before."

All onboard electronics remained operational during the deep dives, including the ROV's camera feed and data to the support vessel, proving the survivability of the complete system to a depth of more than 1,000 meters.

"We have proven the ability to deploy the Defender with a large payload to depths of 3,500 feet (1,000+ meters) from a small deck footprint," said Marcus Kolb, chief technology officer, VideoRay. "We performed complex, autonomous manipulation tasks with the RE2 system while station-keeping a few feet off the bottom. We are excited about the direction of this program and how it will help accelerate commercial solutions."

Following the success of these dives, RE2 Robotics and VideoRay are planning future demonstrations for ONR to test the system's autonomy capabilities using a tetherless ROV at extended depths. OceanComm, Inc., a provider of high-speed wireless underwater communication technology, will provide wireless acoustic modems for future dives.

MSUBS AND SONARDYNE TO COLLABORATE ON ADVANCING AUTONOMOUS NAVAL PLATFORM CAPABILITIES

Submersible manufacturer MSubs and marine robotics technology company Sonardyne have signed a strategic partnership to advance the capabilities of long endurance, autonomous underwater platforms for the UK defence sector.

The Memorandum of Understanding (MOU) will see the two companies working to integrate and evaluate Sonardyne's commercial-off-the-shelf navigation, communications and imaging payloads into MSubs 9 m-long extra-large uncrewed underwater vehicle (XLUUV) to provide naval forces with enhanced situational awareness across the underwater battlespace.

From Plymouth, south-west England, where both companies have research, trials and manufacturing facilities, Sonardyne will supply and support a suite of its technologies to MSubs. These will include SPRINT-Nav X, a hybrid inertial-Doppler navigation sensor that's suitable for GNSS-denied environments; AvTrak 6, a long-range tracking, command and control instrument; and Vigilant, a forward-looking obstacle avoidance sonar (FLS) jointly developed by Sonardyne and sister company Wavefront Systems.

MSubs' XLUUV has been selected by the UK's Royal Navy to help it understand the future roles for XLUUVs for surveillance, reconnaissance and anti-submarine warfare (ASW) missions, and deliver new capabilities to the organization years earlier than otherwise be possible.

In 2021, MSubs and Sonardyne took part in the first phase of the UK's Defense and Security Accelerator (DASA) Uncrewed Underwater Vehicle Testbed—Opportunity to Integrate competition, run jointly with the Royal Navy and the Defense Science and Technology Laboratory (Dstl). As part of the demonstration, MSubs' XLUUV used bathymetric data gathered by its Vigilant FLS to navigate in open waters off Plymouth.

The announcement builds on this success, with the two companies targeting further emerging opportunities from the UK's Ministry of Defense, such as Project CETUS. This will see the design and build of an extra-large autonomous underwater vehicle (AUV), which may one day work alongside the Astute-class attack submarines.

Brett Phaneuf, Managing Director of MSubs said: "The integration of Sonardyne equipment on our extra-large AUV is a key factor for our continued success, helping us to move the state of the art forward swiftly. The operator-centric approach to engineering from Sonardyne and MSubs makes it easy to enhance our vehicle performance and reliability through applied research, bringing much needed capability to the underwater domain and greatly reduced timelines and budgets."

Ioseba Tena, Head of Defence at Sonardyne, added: "Our two companies are at the forefront of the development of unmanned platforms and payloads that are reshaping the underwater battlespace playbook; delivering tactical edge to navies and governments facing new and increasingly capable underwater adversaries. We're excited to be opening a new chapter of collaboration with the MSubs team, and where better for that collaboration to be centred than Plymouth, the UK's marine autonomy city."

» *The MOU will see MSubs and Sonardyne working closely to enhance the operational capability of XLUUVs for the UK's underwater defence sector. (Photo credit: MSubs/Sonardyne)*

PHOENIX AND SUPSALV PERFORM SALVAGE OF F-35C AIRCRAFT IN SOUTH CHINA SEA

Phoenix International Holdings, Inc., under the direction of the U.S. Navy's Supervisor of Salvage and Diving (SUPSALV), has located and recovered a downed U.S. Navy F-35C Lightning II aircraft in the South China Sea from a depth of 12,400 feet. Working aboard the offshore construction vessel Picasso, Phoenix and SUPSALV deployed the U.S. Navy's AUV *Trondheim* to locate the aircraft. The Phoenix and SUPSALV team then used the U.S. Navy's ROV CURV 21 to attach specialized rigging and lift lines to the aircraft. The aircraft was lifted to the surface and hoisted aboard *Picasso*.

"Phoenix is honored to have played a role in this successful salvage operation for the U.S. Navy" said Pat Keenan, President of Phoenix International Holdings, Inc.

Phoenix is an employee-owned, ISO certified marine services contractor providing manned and unmanned underwater solutions, engineering, and project management services to a diverse set of clients worldwide. Expertise is available from seven regional offices in the areas of wet and dry hyperbaric welding, Nondestructive Testing, (NDT), subsea engineering, conventional and atmospheric diving, Autonomous Underwater Vehicle (AUV) and ROV operations. Company capabilities are directed to underwater inspection, maintenance, and repair; deep ocean survey, search and recovery operations; submarine rescue; construction; subsea tieback; plug and abandonment; subsea mining; archaeological; and documentary projects.

BOLLINGER SHIPYARDS SUBMITS FINAL PROPOSAL TO BUILD U.S. COAST GUARD HERITAGE-CLASS OFFSHORE PATROL CUTTER

Bollinger Shipyards, a privately-held and leading designer and builder of steel military and commercial vessels, has submitted its final proposal to the United States Coast Guard to build Stage 2 of the Heritage-class Offshore Patrol Cutter ("OPC") program. If chosen, Bollinger would construct and deliver a total of 11 vessels to the U.S. Coast Guard over the next decade, helping to sustain the Bollinger workforce through 2031.

The proposal submitted by Bollinger states that the construction will occur at its facilities in Houma, Louisiana. That shipyard is strategically placed within a 100-year hurricane risk reduction system with direct access to the Gulf of Mexico without any hindrances such as drafts or time-zone differences.

In a new study conducted by the Economics & Policy Research Group at Louisiana State University (LSU) on the economic impact should Bollinger be chosen to build up to 11 ships for the OPC Program, LSU found that the project would create more than 2,700 direct and indirect jobs and generate $7.3 billion in economic output for Louisiana.

"The numbers tell a compelling story—the Offshore Patrol Cutter program would be a major game changer for the State of Louisiana and Bollinger is the right shipyard at the right time to build this platform for the U.S. Coast Guard," said Ben Bordelon, Bollinger President and CEO. "For over 75 years, Bollinger has been proud to be a major job creator and economic contributor in south Louisiana. To be awarded the contract for OPC would allow us to continue that legacy. It is my hope that we're able to continue our long partnership supporting the brave men and women of the U.S. Coast Guard."

LSU received information from Bollinger on the estimated employment, wages and timing of the construction activities required if chosen for the Offshore Patrol Cutter Program. This data was then used to conduct an economic impact analysis to quantify the full impact of the OPC program on Louisiana's economy. Key findings of the report include:

- The project will create 2,776 direct and indirect jobs in the State of Louisiana with total new earnings over $2.3 billion and output of $7.3 billion.
- Over 1,800 workers will be employed on the various aspects of the project by 2026.
- Terrebonne Parish will receive major economic benefits from the project with an average of 1,836 direct and indirect jobs created with earnings totaling over $1.6 billion and new output totaling over $5.2 billion.
- The region consisting of Terrebonne, St. Mary, Lafourche, St. Charles, St. Tammany, Orleans, and Jefferson Parishes should expect significant economic growth with 2,597 total direct and indirect jobs created, total new earnings of $2.2 billion and output of $6.9 billion.
- Terrebonne parish can expect over $16.1 million in sales tax revenue while the region will earn over $38.8 million during the ten-year time horizon.
- The project is estimated to generate over $113 million in Louisiana state tax revenues by 2031.

"If Bollinger wins the Offshore Patrol Cutter Program, it will serve as a major economic stimulus to the State, Region and Terrebonne Parish," said Dr. Dek Terrell, Executive Director at LSU's Economics & Policy Research Group. "The project will create over $2.3 billion in new Louisiana earnings and $7.3 billion of Louisiana output."

Bollinger has been actively involved in every step of the U.S. Coast Guard's OPC acquisition process, including execution of the Stage 1 Preliminary and Contract Design, where the Company was included in the final three shipyards, as well as execution of the OPC Stage 2 Industry Study. In June of 2021 Bollinger submitted its initial proposal to build Stage 2 of OPC program. This unique experience ensures Bollinger's understanding of every detail and aspect of the program.

Notably, in its current program for the U.S. Coast Guard, Bollinger has delivered Sentinel Class Fast Response Cutter hulls 1139 through 1148 a total of 180 days ahead of the contract schedule, despite the incredible challenges of the COVID-19 global pandemic and sustaining significant damage from a direct hit by Hurricane Ida, a powerful Category 4 storm.

Bollinger has a long history building for the U.S. Coast Guard, delivering 174 vessels in the last three decades alone. This includes the Island Class (49 delivered), the Marine Protector Class (77 delivered), and now the Sentinel Class (48 of 64 delivered to-date).

» *The USCGC John Scheuerman, a 154-ft FRC. (Photo credit: Bollinger Shipyards)*

HII DELIVERS VIRGINIA-CLASS SUBMARINE MONTANA (SSN 794) TO U.S. NAVY

» *Virginia-class attack submarine Montana (SSN 794) successfully completed initial sea trials in February 2022. (Photo credit: HII/U.S.Navy)*

HII, America's largest shipbuilder and leading provider of mission-driven defense technologies, recently delivered the newest Virginia-class fast-attack submarine to the U.S. Navy.

Montana (SSN 794), which successfully completed sea trials in February, is the 10th Virginia-class submarine to be delivered by HII's Newport News Shipbuilding division and the 21st built as part of the teaming agreement with General Dynamics' Electric Boat.

"We continue to be proud of our partnership with the U.S. Navy in delivering the most advanced ships in the world to our warfighters," said Jason Ward, Newport News Shipbuilding vice president of Virginia-class submarine construction. "The results of the Navy's board of inspection and survey during sea trials are a testament to our priorities of safety and quality. We are proud of our team of shipbuilders for delivering these critical capabilities to the Navy and the nation."

More than 10,000 shipbuilders from Newport News Shipbuilding and Electric Boat have participated in Montana's construction since the work began in May 2015. The submarine was christened by the ship's sponsor, former U.S. Secretary of the Interior Sally Jewell, during a ceremony in September 2020.

Montana is the third of the 10-ship group of Virginia-class submarines known as Block IV. Block IV submarines incorporate design changes focused on reduced total ownership cost. By making smaller-scale design changes, the Navy will increase the length of time between maintenance stops and increase the number of deployments.

AMERICAS

Offshore Technology Conference (OTC)
Houston, TX » May 2-5
https://2022.otcnet.org/

Canadian Hydrographic Conference
Ottawa, Canada » June 6-9
https://www.chc2022.org/en

H2O Conference
Halifax, Nova Scotia » June 14-16
https://www.h2oconference.ca/

US Offshore Wind
Boston, MA » July 18-19
https://reutersevents.com/events/offshore-wind/content-boston.php

Dredging Summit & Expo
Houston, TX » July 20-28
https://dredging-expo.com/

Underwater Minerals Conference
St. Petersburg, FL » October 2-7
https://www.underwaterminerals.org/

OCEANS
Hampton Roads, VA » October 17-21
https://hamptonroads22.oceansconference.org/

ACP Offshore WINDPOWER
Providence, RI » October 18-19
https://cleanpower.org/events/offshore-windpower-2022/

EUROPE

Submarine Networks EMEA
London, UK » May 17-18
https://www.terrapinn.com/conference/submarine-networks-world-europe/index.stm

EEEGR Southern North Sea
Norwich, UK » May 25-26
www.eeegr.com/events/sns2022/

Int'l Conference on Ocean, Offshore, & Arctic Engineering (OMAE)
Hamburg, Germany » June 5-10
https://event.asme.org/OMAE

Undersea Defence Technology (UDT)
Rotterdam, The Netherlands » June 7-8
www.udt-global.com

Underwater Technology Conference
Bergen, Norway » June 14-16
https://www.utc.no/

Seanergy
Normandy, France » June 15-17
https://www.seanergy-forum.com/en/seanergyforum

Seawork
Southampton, UK » June 21-23
https://seawork.com/

Offshore Northern Seas (ONS)
Stavanger, Norway » August 29- September 23
https://www.ons.no/

OTHER REGIONS

Telecoms World Middle East
Dubai » May 24-25
https://www.terrapinn.com/conference/telecoms-world-middle-east/index.stm

Submarine Networks World
Singapore » September 7-8
https://www.terrapinn.com/conference/submarine-networks-world/index.stm

Mediterranean Offshore Conference
Alexandria, Egypt » October 18-19
www.moc-egypt.com

Telecoms World Asia
Bangkok » November 2-3
https://www.terrapinn.com/conference/telecoms-world-asia/index.stm

ADIPEC
Abu Dhabi » November 7-10
https://www.adipec.com/

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	CONTENT FOCUS & PRODUCT/SERVICE
JANUARY **Editorial:** Dec. 17 **Ad:** Jan. 13	» **Uncrewed Surface Vehicles** Floating Wind Solutions / March 1-3 Oceanology International / March 15-17	**Content Focus:** Remote Marine Operations, Force Multiplication, Ocean Research, Search & Rescue, Tooling **Product/Service:** A/USV manufacturers, multibeam echosounders, side scan sonars, control systems, thrusters, positioning systems, thermal cameras, communication systems
FEBRUARY **Editorial:** Jan. 24 **Ad:** Feb. 10	» **Naval Defense & Security** UDT / June 7-9	**Content Focus:** Intelligence, Surveillance & Reconnaissance (ISR), Mine Countermeasures (MCM), Harbor Security, Anti-Submarine Warfare (ASW) **Product/Service:** AUVs, USVs, marine robotics, search and rescue technologies, underwater tracking & communications
MARCH **Editorial:** Feb. 21 **Ad:** Mar. 10	» **21st Century Marine Survey** AUVSI XPONENTIAL / April 25-28 IPF / April 26-28 OMAE / June 5-10 💻 H2O Conference / June 14-16	**Content Focus:** Hydrographic Survey, Sensor Innovation, Research Vessels **Product/Service:** Sensor manufacturers, UAVs, multibeam echosounders, sonars, software & analytics, deck handling equipment, survey companies, research vessels
APRIL **Editorial:** Mar. 21 **Ad:** Apr. 07	» **Green Energy** US Offshore Wind / July 18-19 OTC / May 2-5	**Content Focus:** Renewable Offshore Energy (Wind, Solar, Tidal & Wave), Green Hydrogen, Power Storage Supply Chain **Product/Service:** Offshore wind supply chain, alternative offshore energy technologies, subsea batteries, hydrogen powered vessels
MAY **Editorial:** Apr. 18 **Ad:** May 05	» **Subsea IMR Technology** Canadian Hydrographic Conference June 6-9	**Content Focus:** Shore-based Command Systems, Subsea Residency, Digital Twins **Product/Service:** AUVs, ROVs, robotic tooling, buoyancy materials, cameras & lighting, pressure sensors, propellers, tethers, simulation software
JUNE **Editorial:** June 06 **Ad:** June 23	» **Oceanography** Dredging Summit & Expo / July 25-28	**Content Focus:** Data Collection, Transmission & Communication, Data Analytics & Software Platforms **Product/Service:** Buoys, drifters, acoustic modems, releases & transponders, magnetometers, subsea cables, connectors, weather stations
JULY **Spotlights:** June 14 **Ad:** July 11	» **Uncrewed Vehicles Buyers' Guide** 💻	**Content Focus:** Special Edition
AUGUST **Editorial:** July 25 **Ad:** Aug. 11	» **Submersibles & The Deep Sea** OCEANS / October 17-21	**Content Focus:** Deep-sea Exploration, Seafloor Archaeology, Deep-sea Science, Ocean Mining **Product/Service:** Crewed submersibles, support vessels, mining machines, geotechnical technologies
SEPTEMBER **Editorial:** Aug. 22 **Ad:** Sep. 08	» **Artificial Intelligence & Remote Marine Operations** Offshore Energy / November 29-30 ACP WINDPOWER / October 18-19	**Content Focus:** Swarm Technology, Control Systems, Automation, Ocean Health, Maritime Efficiency **Product/Service:** Uncrewed vehicles, simulation & modelling platforms, cloud-based data analytics
OCTOBER **Editorial:** Sep. 19 **Ad:** Oct. 06	» **Offshore Energy**	**Content Focus:** Sector Diversification, Seabed IMR, Sensor Innovation, HSSE, Decommissioning, Oil Spill Response, Renewables **Product/Service:** Marine survey, oil spill response, renewable energy technologies, geotechnical services
NOVEMBER **Editorial:** Oct. 17 **Ad:** Nov. 03	» **Underwater Imaging**	**Content Focus:** Bathymetric Mapping, IMR, Habitat Characterization, Acoustic Sensing **Product/Service:** Observation ROVs, AUVs, cameras, lights, diving innovation, tracking & positioning systems, optical and acoustic sensors
DECEMBER **Editorial:** Nov. 14 **Ad:** Nov. 18	» **The Future of Ocean Technology**	**Content Focus:** Special Edition

💻 Digital Issue

» *Peter Sparkes, Chief Executive at UKHO (L) and Jamie McMichael-Phillips, Seabed 2030 Project Director*

THE NIPPON FOUNDATION-GEBCO SEABED 2030 PROJECT SIGNS COLLABORATION AGREEMENT WITH THE UK HYDROGRAPHIC OFFICE

The Nippon Foundation-GEBCO Seabed 2030 Project has signed a memorandum of understanding (MOU) with the UK Hydrographic Office (UKHO), which will see the parties work together to advance the industry's understanding of ocean bathymetry, and in support of the Decade of Ocean Science for Sustainable Development.

Seabed 2030—a flagship program of the Ocean Decade—is a collaborative project between The Nippon Foundation and the General Bathymetric Chart of the Oceans (GEBCO) with the goal of the complete mapping of the world's oceans by 2030, as well as compiling all bathymetric data into the freely available GEBCO Ocean Map. GEBCO is a joint program of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC), and is the only organization with a mandate to map the entire ocean floor.

As part of its official partnership with Seabed 2030, the UKHO will provide bathymetric gridded map products to be used by the project within the GEBCO gridded bathymetric data set. UKHO will also share and promote methods and best practices in technological innovation, infrastructure, and solutions for ocean mapping and bathymetric data management.

The MOU signed today follows the technical cooperation agreement that the UKHO, Seabed 2030 and Teledyne CARIS entered into in June 2021 to advance efforts in producing the definitive map of the seafloor by the year 2030.

Commenting on the announcement, Peter Sparkes, Chief Executive at the UK Hydrographic Office, said: "Today marks an important date in our partnership with Seabed 2030 as we initiate the release of identified data contributions to the project. As a world-leading center for hydrography, we share the Seabed 2030 vision and believe that the full mapping of the world's oceans is a key milestone in supporting safe, secure and thriving oceans.

"Knowing the depth of the seabed is of vital importance for navigation and coastal management. It is a fundamental parameter for understanding ocean circulation, tides, wave action, sediment transport, environmental change, underwater geo-hazards, cable and pipeline routing, and much more. High quality marine geospatial data will play an instrumental role in Seabed 2030, and we are delighted to actively support and contribute to the project's mission.

"By working alongside international governments. commercial partners, institutions and initiatives such as Seabed 2030, we will continue to engage with the wider geospatial and technology community to meet the changing needs of all those who depend on the marine environment and ensure the best use of our oceans in safer, more secure and more sustainable ways."

Seabed 2030 Project Director Jamie McMichael-Phillips added: "We are delighted to further develop our partnership with the UKHO in support of producing the complete map of the ocean floor.

"With eight years left until the end of the decade and 80 percent of the sea floor still to be mapped, UKHO's data contribution and expertise on ocean mapping solutions will no doubt play a significant role in supporting Seabed 2030 realize its essential goal, for the benefit of humanity."

DOI APPOINTS NEW BSEE DIRECTOR

The Department of the Interior has announced that Kevin M. Sligh Sr. will join the Department as the new Director of the Bureau of Safety and Environmental Enforcement (BSEE). Kevin will oversee BSEE's efforts to promote safety, protect the environment, and conserve offshore resources through vigorous regulatory oversight and enforcement.

"The Bureau of Safety and Environmental Enforcement is playing a critical role as the Interior Department moves quickly to tackle the climate crisis, lead the nation into a clean energy economy with good-paying union jobs, and conserve and protect America's lands, waters and wildlife," said Secretary Deb Haaland. "Kevin's exemplary public service career, with years of service at the Federal Emergency Management Agency (FEMA) and as an active-duty and reserve serviceman in the U.S. Navy and Coast Guard working on emergency response and operational readiness, will be invaluable assets for the Department and our mission."

» *Kevin M. Sligh Sr. (Photo credit: FEMA)*

"I am deeply honored to join the Interior Department and continue my public service career on behalf of the American people. I've dedicated my life to keeping the public safe, and I look forward to continuing that service alongside the Bureau of Safety and Environmental Enforcement's incredible career employees," said Director Sligh.

Kevin joins the Department after serving in a variety of roles with FEMA, including as Individual Assistance Division Director, Senior Advisor on Equity and Deputy Regional Administrator. Before joining FEMA, Kevin served as Deputy Director for the U.S. Coast Guard's Office of Marine Environmental Response Policy, Chief of the Incident Management & Crisis Response Division, and Area Contingency Plan program manager.

Kevin has more than 24 years of both active duty and reserve career experience from his service in the U.S. Navy and Coast Guard. He attended college part-time throughout his enlisted and commissioned military career, earning a bachelor's degree from Excelsior College and a Master of Business Administration degree from Northcentral University.

BSEE is the lead federal agency charged with improving safety and ensuring environmental protection related to the offshore energy industry on the Outer Continental Shelf.

BSEE
Bureau of Safety and Environmental Enforcement

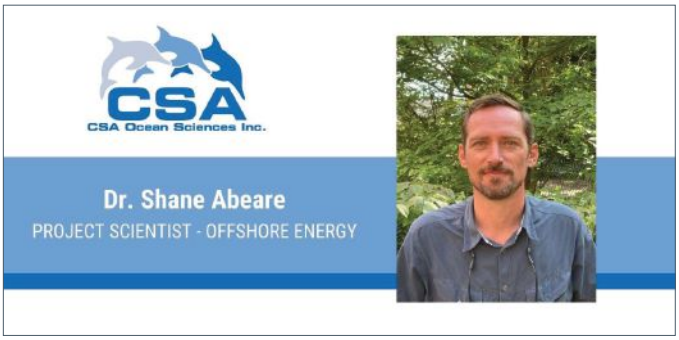
OCEAN SCIENCES APPOINTS NEW OFFSHORE ENERGY PROJECT SCIENTIST

CSA Ocean Sciences Inc. (CSA) has expanded its Offshore Energy team with the appointment of Dr. Shane Abeare to the position of Project Scientist—Offshore Energy, based out of CSA's U.S. headquarters in Stuart, Florida. Abeare will support CSA's scientific and operational activities on a range of multidisciplinary marine projects in the U.S. and internationally, particularly those serving offshore oil, gas, and wind clients.

Abeare has substantial international experience, having worked more than 10 years in various countries across the African continent, Madagascar, and the Pacific Islands. During this period, his work primarily focused on coastal resource management, and the creation and management of marine protected areas and national parks. He also brings diverse experience acquired from serving as a Fish Biologist for the U.S. Fish and Wildlife Service in California and as a postdoctoral researcher at the Center for Biodiversity and Conservation Research at the University of Mississippi.

"We welcome Shane to CSA at an exciting time in our company's history," said CSA's General Manager/Vice President, Gordon Stevens. "His substantial experience developing and managing natural resource projects complements our Offshore Energy team as we seek to further strengthen our service offering to the rapidly diversifying international offshore energy sector—including the burgeoning renewables market. To meet the growing demands of the energy industry, CSA continues to invest in marine technologies and market-leading subject matter experts needed to deliver unrivalled marine survey services and scientifically robust environmental analysis."

Speaking of the announcement, Abeare said: "I am thrilled to join CSA at such an important chapter in the company's growth. I look forward to engaging in the development and execution of offshore energy projects to help provide customized, competitive, and high-quality services to industry and government stakeholders."



AKER SOLUTIONS APPOINTS NEW SENIOR VP FOR SUSTAINABILITY

Aker Solutions has appointed Trine Svalestad to the new position of senior vice president for sustainability. The company sees significant increase in demand for its solutions powering the ongoing energy transition.

Aker Solutions is a leading supplier to international oil and gas projects with multiple solutions to reduce carbon emissions. The company is also rapidly increasing its deliveries to renewable energy production.

Svalestad has experience from a range of management positions in Equinor, including leading compliance and governance processes, and heading the digitalization of the large Johan Sverdrup offshore field development. She is a Norwegian national with a Master of Law from the University of Bergen, Norway.

"Aker Solutions has not just set high targets for how it will reduce its own environmental footprint. The company has also established specific annual plans for how it will implement improvements for its own operations and enable customers to meet their global climate objectives. I am very keen to take a key role in this transition. I am looking forward to collaborating with all parts of the organization in delivering results, and in developing new business opportunities," said Svalestad.

Svalestad will start in her new position on May 1, reporting to Marianne Hagen, executive vice president and head of sustainability, HSSE and communications.

"The urgency for climate action has never been higher and we are committed to being a driving force for the energy transition. By 2030,

» *Trine Svalestad, New SVP for Sustainability at Aker Solutions. (Photo credit: Ole Jorgen Bratland/Equinor)*

low-carbon solutions and renewables will make up two-thirds of our revenue, becoming the largest part of our business. I am welcoming Trine to our team to work on reducing both our own, and our customers' emissions, and at the same time contributing to develop our renewables offering. Trine will take on the responsibility for the full scope of the sustainability agenda," said Hagen.

The international energy markets are brimming with plans for development of new energy facilities. For the coming years, Aker Solutions forecasts significant increase in its activities as a key supplier, and this includes a 20 percent growth already in 2022.

"Throughout 2022, we plan to recruit more than 2,000 new experts on our team. Even before this campaign has really begun, we have been approached by many of the industry's best talents within a wide range of disciplines. We see that our central role in the acceleration of the global energy shift is highly motivating for skilled people across all countries, cultures and age groups," said Hagen.

FUGRO USV PROJECT TEAM WINS ENERGY INDUSTRY GAME CHANGER AWARD

Fugro's Blue Essence uncrewed surface vessel (USV) has been awarded the Energy Industry Game Changer Award at the 2021 Energy Club WA Award, an initiative of the Australian Institute of Energy (AIE). The award is presented to an individual or team who have made an outstanding contribution to the energy industry resulting in significant advancement of the industry's knowledge and capability.

The Fugro and Woodside teams were presented with the award following the successful completion of the first entirely remote inspection project on 125 km of Woodside's gas trunklines, utilising the new Blue Essence 12 m USV, Fugro Maali in 2021.

Fugro's USV offers a unique solution for subsea inspection that requires no offshore crew and demonstrates the many benefits of remote operations such as a reduction in CO2 emissions by up to 97% when compared to a traditional vessel solution, and the ability to remove personnel from high-risk environments.

The USV and e-ROV conducted successful over-the-horizon operations during the project, further demonstrating the capabilities of this technology.

Paul Mullins, Director of Remote Operations for APAC said: "Fugro's USVs and remote operations are changing the way the industry carries out subsea inspection operations and over the coming year the team will be pushing the boundaries on additional USV capabilities."

» *2021 Energy Club WA Award winners. (Photo credit: Energy Club WA)*

CGG APPOINTS DAVID VINER
AS HEAD OF ENVIRONMENTAL SCIENCE

CGG has appointed Professor David Viner, an internationally recognized climate change, ESG and transition strategist, as Head of Environmental Science. David will lead, develop and grow CGG's environmental science business and also advise the company in defining the best strategies to deliver on its ESG commitments.

David has over 30 years' experience working internationally across global climate change and sustainability arenas in the academic, public and private sectors.

In 2012 David joined Mott MacDonald, where he provided the evidence base for the establishment of the Climate Resilience Initiative which helped to transform and position the group as a world leader in developing climate resilience solutions. His most recent position was as an Associate Director at the Green Investment Group at Macquarie, where he led the team responsible for ensuring that all its investments were aligned to the global green transition.

Most notably, David has been involved with the UN's Intergovernmental Panel on Climate Change (IPCC) since 1992 and was a Co-ordinating Lead Author for its Working Group 2 Sixth Assessment Report published on 28 February. He is also a member of the UK Natural Environmental Research Council's Scientific Committee, a Fellow of the Institute of Environmental Science and an Honorary Lifetime Member of Friends of the Countryside for work on climate change and land management. He has published more than 100 peer-reviewed papers and reports to date.

Peter Whiting, EVP Geoscience, CGG, said: "We are delighted to welcome David to CGG. His appointment underscores the strength of our commitment to growing our portfolio of new technologies, data and solutions which address environmental and energy transition challenges. His outstanding expertise in delivering transformational change will help us to accelerate our efforts and become a leader in environmental science. We are looking forward to his active involvement in our ESG strategy, providing CGG with the best possible insight for fulfilling our own ESG and net-zero commitments.

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Birns Aquamate design and manufacture underwater electrical connectors, cable assemblies, and cable terminations. The company produces a wide range of standard industry products such as the **5500 Series, SC, MC, LP, FAWL/FAWM, NANO, TC, Rubber Molded**, etc. Birns Aquamate is the only manufacturer to guarantee compatibility with other uw connectors. Birns Aquamate also specializes in fast turn-around for custom design of special connector solutions. All connectors are manufactured under DNV ISO 9001:2000 certification. Dealers in Canada, Brazil, UK, Belgium, Holland, Norway, Germany, South Africa, Holland, Italy, and China.

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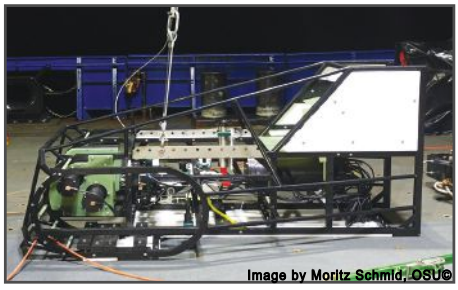

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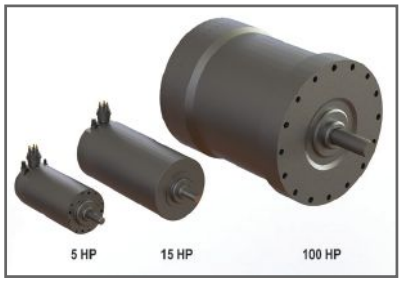

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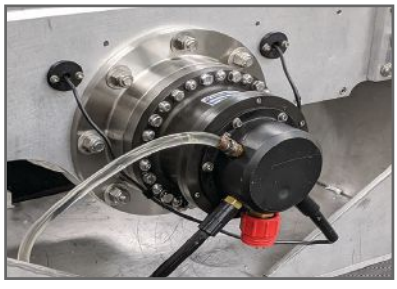

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