

June 2022

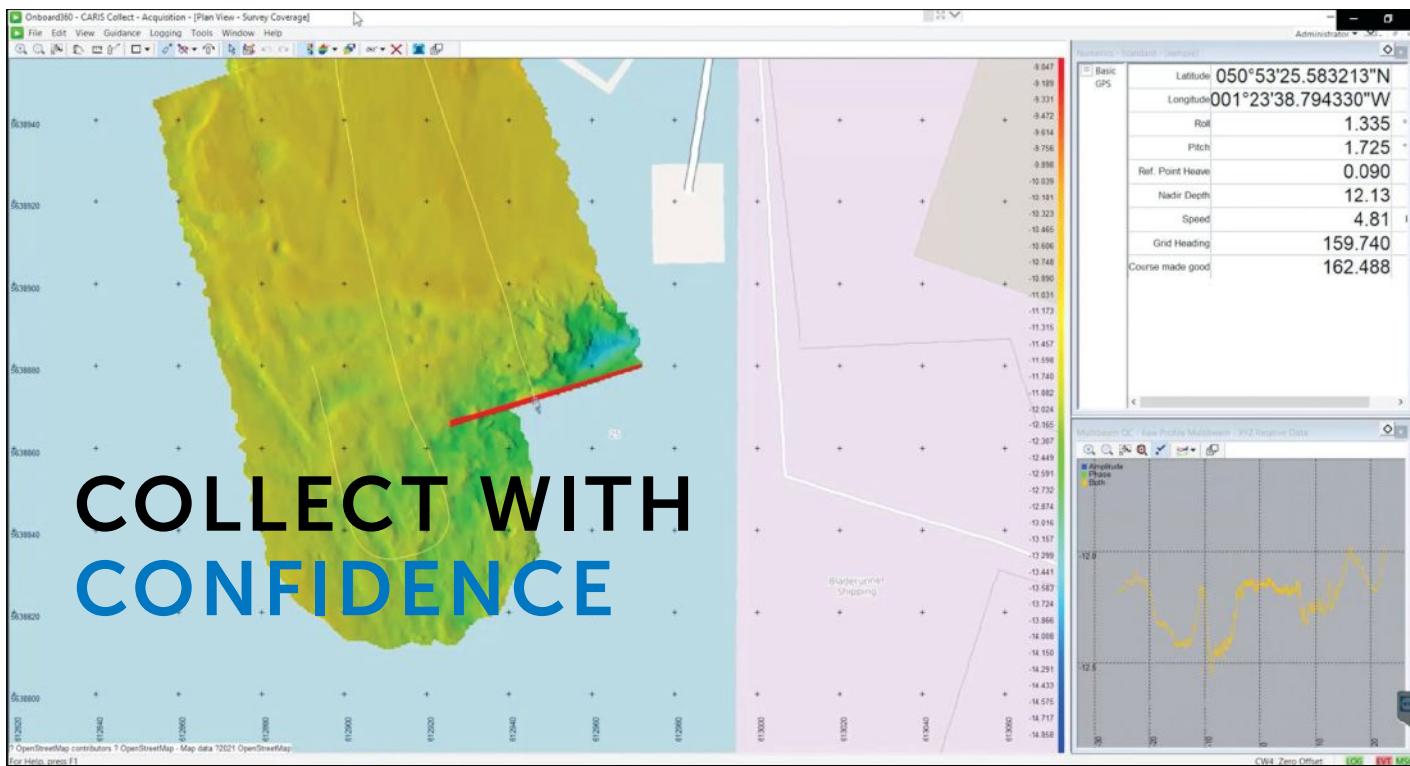
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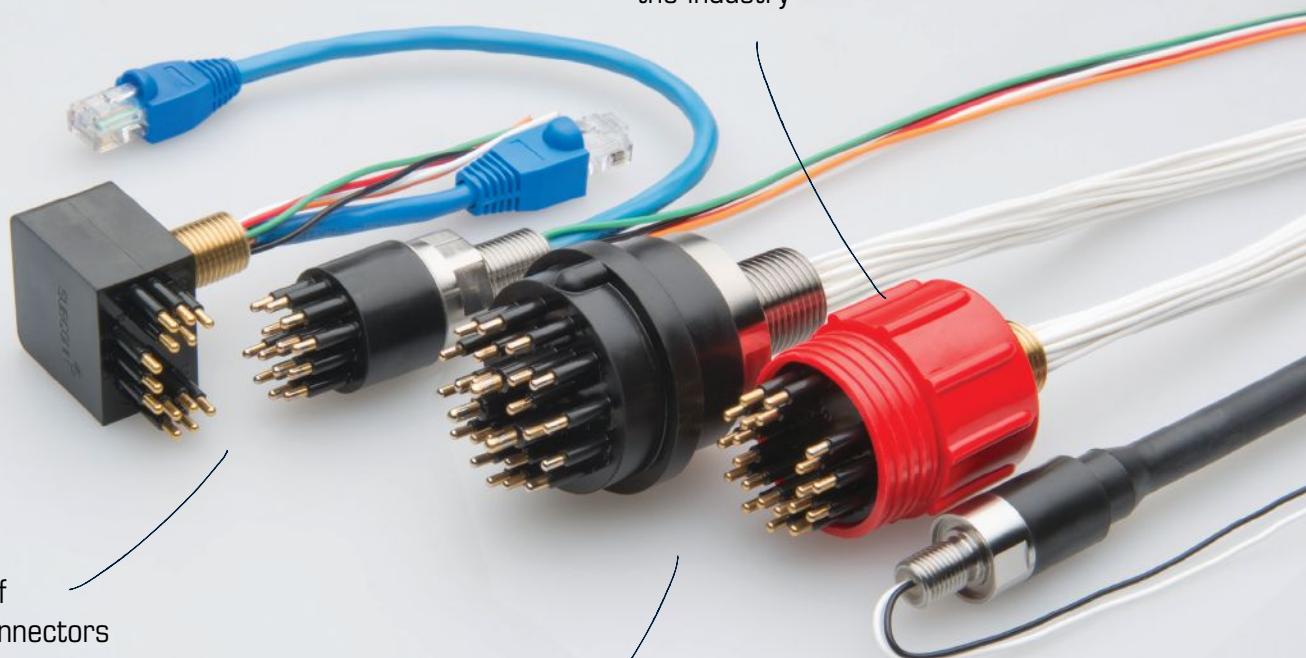
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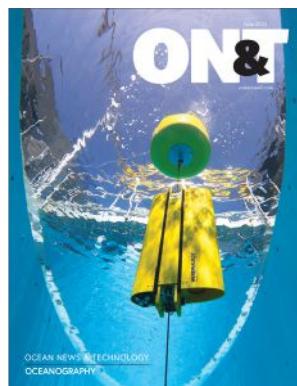


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ON THE COVER:

Del Mar Oceanographic's Wirewalker is a mobile vertical profiling system powered by surface waves; with no need for electronic propulsion, all on-board power can be used to extend the duration of the integrated sensing payload. (Photo credit: Chris Kontoes/ DMO)

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[WITH THANKS - Ed.]

Oceanography is a multidisciplinary pursuit to further our collective understanding of the past, present and future of the planet's oceans through robust data and scientific analysis.

Today, thanks to cross-sector cooperation and continued investment in emerging technologies and marine survey instrumentation, the capacity to explore new frontiers safely and efficiently—and ultimately harvest, process, analyze, and manage huge swathes of data—presents a new chapter in the study of our oceans.

In June's ON&T, we profile some of the people and organizations working to define this new era of data-led enterprise and climate conscious collaboration—some of the leading proponents of 21st century oceanography. This month, our thanks go to Del Mar Oceanographic, Saildrone, Canada's Ocean Supercluster, Bedrock Ocean, Birns, Tadiran Batteries, Forcys, and Jaia Robotics.

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PROPELLING THE BLUE ECONOMY WITH GREATER ACCESS TO OCEAN DATA AND TECHNOLOGY



By Matt Womble,
Director of Ocean Data Programs,
Saildrone



The ocean impacts every aspect of human life, and yet we know more about the topography of Mars than we do about our own ocean here on earth. Everyone who operates in a maritime environment knows firsthand the many challenges it can present. Over the last 100 years, instruments used to observe our ocean have improved dramatically, but the fundamental method has not: Large, crewed ships at sea for weeks or months deploy owned instruments to collect data for highly specific purposes. This is expensive, can be dangerous, creating hardship for personnel, and adversely impact the environment.

Autonomous vehicles designed for surface and underwater use are quickly being adopted across maritime industries, ranging from offshore energy and wind to commercial shipping, telecommunications, environmental research, and defense. Parallel to the technological advances, industry is also creating more innovative and cost-effective business models to help more people get data when and where they need it.

ACTIONABLE OCEAN INTEL

Saildrone is on the leading edge of a paradigm shift in how critical ocean data is provided to the global community. We provide comprehensive turnkey data services so that our customers can focus on what's most important to them: actionable ocean intelligence. Saildrone removes the need for capital expenditure for building, operating, and maintaining a fleet of vehicles, as well as the resources required for training fleet operators.

Just as the remote sensing industry has shifted away from selling individual satellites to selling the data customers want, the same proven data-as-a-service model can accelerate

scientific research by making ocean data collection easier and more cost-effective.

Saildrone uncrewed surface vehicles (USVs) have already sailed 800,000 nautical miles and spent 18,000 days at sea—and counting—collecting data to serve a wide range of research objectives, from seafloor mapping and maritime security to climate science and sustainable fisheries management. Our solutions for ocean data, mapping, and maritime security are cost-effective, environmentally friendly, and don't risk human lives at sea.

A COLLABORATIVE APPROACH

Ocean resources must be sustainably managed to ensure future generations thrive on a healthy planet. We're already two years into the United Nations' Ocean Decade of Science, gathering stakeholders worldwide to accelerate efforts to reverse the cycle of decline in ocean health.

The key to achieving this goal is to fundamentally transform how we work together, making ocean data and ocean exploration more accessible to all, so that industry, government, and the community can collaborate to protect and preserve our world for future generations.

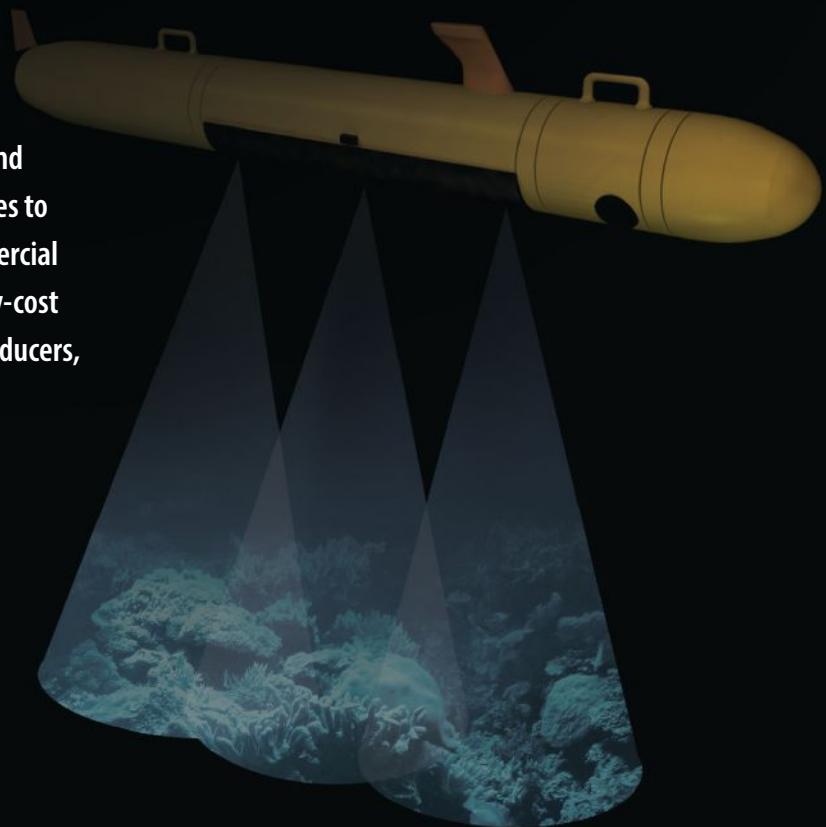
Saildrone is a US-based company that provides real-time access to critical data from any ocean on earth, 24/7/365, and uses proprietary software applications to transform that data into actionable insights and intelligence. Saildrone's fleet of uncrewed surface vehicles (USVs), powered by renewable wind and solar power, have a minimal carbon footprint and operate 24/7/365, without the need for a crewed support vehicle.

For more information, visit: www.saildrone.com.

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OCEAN WAVE-POWERED PROFILING CONTRIBUTES TO NASA SATELLITE MISSION



By Alison Cobb, Research Data Scientist



Del Mar Oceanographic (DMO) has secured funding from NASA's Jet Propulsion Laboratory (JPL) to use the ocean wave-powered Wirewalker profiler in a project led by JPL. Wirewalkers will be installed on four deep-ocean moorings off the coast of California for the calibration and validation (Cal/Val) of the new Surface Water and Ocean Topography (SWOT) satellite. Onboard the satellite, a next-generation altimeter using a wide-swath Ka-band interferometer (KaRIn) will collect detailed global measurements of Earth's surface water and sea surface height, with launch planned for November 2022.

SWOT VALIDATION

Calibration and validation are important for any satellite mission. For the SWOT mission, a portion of the Cal/Val activities include the assessment of the measurement performance relative to direct ocean measurements of sea surface height (SSH). In the open ocean, SSH is connected to the distribution of temperature, salinity, and density. These properties must be measured with high vertical and temporal resolution to provide a ground truth for the satellite. With a planned launch in late 2022, a key portion of the NASA SWOT mission oceanography Cal/Val plan will use an array of eleven moorings,

four of which will be Wirewalker profilers, situated directly under the satellite flight path to gather snapshots of steric height to compare to the measurements gathered from space. These moorings are designed to withstand all weather and provide high data density in the upper part of the ocean, where the density field changes rapidly.

The Wirewalker provides a cost-effective way to gather high resolution data in the top 500 m, with a single instrument driven up and down a wire using wave energy.

During the SWOT pre-launch field campaign, a deep-ocean taut mooring was combined with a 500 m profiling Wirewalker system to assess performance and robustness of the hybrid mooring and seafloor to surface telemetry. (Photo credit: Tyler Huguen)



The Wirewalker has already proven effective across these depths, and the key innovation for this project is upscaling to full open ocean depth modality. The design combines a conventional taut mooring from the sea floor to 600 m depth with the Wirewalker operational in the top 500 m, producing vertical profiles of density every hour. Using inductive technology, all of the data from the seafloor through the entire water column are transmitted in real-time. While the Wirewalker can carry a wide range of instruments, for this project they will be equipped with CTDs.

A pre-launch field campaign was conducted during winter 2019-2020 to assess the ground truth instrumentation prior to launch of the satellite. This site was 300 km west of Monterey, California, in the heart of the North Pacific storm track, and at a depth of approximately 5 km. The moorings performed well in these fully exposed conditions, giving confidence in their future deployment for SWOT satellite validation that will be in the rough seas off Point Conception in the depth of winter. During this pre-launch field campaign phase, the Wirewalker yielded about 3,500 roundtrip profiles to 500 m (~3,500 km traveled), during its 86 days of deployment. The mooring allowed a full-ocean depth estimate of SSH with an uncertainty of less than 1 cm, according to results published this year in the Journal of Atmospheric and Oceanic Research by a team of institutions led by JPL (<https://doi.org/10.1175/JTECH-D-21-0039.1>). Additionally, a similar mooring was recently recovered after 223 days near Cortes Bank off San Diego, California; yielding about 7,400 roundtrip profiles to 500 m (~7,400 km traveled), with an average repeat rate of one cycle every 43.4 minutes.

Oceanographer and co-author of the study Rob Pinkel noted, "the Wirewalker sampled the top 500 m roughly every 40 minutes, providing an unparalleled look at the density field in the sea." This campaign proved that DMO's full ocean depth mooring that combines a traditional mooring plus the Wirewalker profiling system is capable of providing enough resolution and accuracy to validate the NASA satellite.

OCEAN WAVE-POWERED PROFILING

The Wirewalker is a mobile vertical profiling system powered solely by surface waves. A length of wire is suspended from a small surface float and at the deep end of the wire a weight encourages the entire length of wire to move vertically, following the oscillatory motion of the surface float. The Wirewalker



» The Wirewalker profiling system consists of a surface float, profiler, profiling wire, and downweight. (Photo credit: Tyler Hughen)



» The standard Wirewalker system is small boat friendly, deployable by hand. (Photo credit: Tyler Hughen)



» A free-drifting Wirewalker in the final moments of recovery aboard the R/V Sikuliaq. (Photo credit: San Nguyen)

profiler rides along the wire, with an internal cam grabbing the wire when it descends and releasing when the wire ascends. At the bottom of the desired profiling range, the profiler collides with a mechanical turnaround bumper which releases the cam, enabling the Wirewalker to free-ascend to the top of the wire under its own buoyancy, at a target ascent rate of about 0.5 m/s. The fast, continuous, profiling enables rapidly evolving small-scale phenomena to be monitored on climatological time scales.

The Wirewalker is a robust mechanical system, requiring no electronics or battery power for propulsion. Any on-board power is exclusively used to extend the duration of the integrated sensing payload. The Wirewalker differs from most buoyancy or motor-driven profilers in that it can either be moored to the sea floor or allowed to drift free with the currents. There is also no requirement for precision ballasting on the Wirewalker, making it much more versatile than buoyancy-driven profilers.

WIREWALKER APPLICATIONS

The Wirewalker has already been successfully deployed for a multitude of projects, including within academic, monitoring, and commercial sectors. The Wirewalker can be tailored to a wide variety of applications through its modular design and ability to accept large custom payloads. Most commercially available sensors can be integrated into the Wirewalker, with optical, acoustic, and chemical sensors commonly used. For example, the City of Los Angeles and Orange County sanitation districts use the Wirewalker to monitor coastal ocean characteristics in the vicinity of their wastewater outfalls. Similar deployments have been useful to scientists and industry leaders since DMO's founding in 2015. Original development of the Wirewalker was performed by the Ocean Physics Group, Scripps Institution of Oceanography, University of California San Diego. The Wirewalker is now produced commercially by Del Mar Oceanographic (DMO) under exclusive license from the University of California. A beneficiary of the Technology Transfer Programs of NSF, ONR and UCSD.

View JPL's YouTube Channel for more info about the SWOT mission: see video titled "SWOT: NASA-CNES Satellite to Survey the World's Water (Mission Overview)"

Find out more about DMO's Wirewalker at www.delmarocean.com.

MACARTNEY SUPPLIES SPECIALIST WINCH FOR UNIQUE ANTARCTIC CLIMATE STUDIES

MacArtney, a leading supplier of underwater technology, has supplied the British Antarctic Survey (BAS) with a Cormac Q5 winch, specially upgraded to cope with extreme temperatures down to -30°C in the summer and customized to carry a 3,500 m cable.

The winch has been specially adapted to conduct electromechanical ice drilling and subglacial lake sampling in partnership with British Antarctic Survey. The winch will be used in West Antarctica, where an 18 km² subglacial lake has been identified by the Chilean research centre, Centro de Estudios Científicos (CECs). The lake, named Lake CECs, is situated below the ice sheet, which has a thickness of 2,600 m at that location.

Sampling historical climatic data

Lakes deep beneath the Antarctic Ice Sheet do not freeze due to geothermal heating and the high pressure created by the weight of the ice sheet above them. Potentially their undisturbed beds could provide a unique insight into climatic conditions hundreds of thousands of years ago.

The winch will send down various probes to take samples of the bottom sediment, collect lake water and measure water properties. These samples will be analyzed to identify any microbial life within the lake and uncover the past environment at the lake site.

Long-term relations

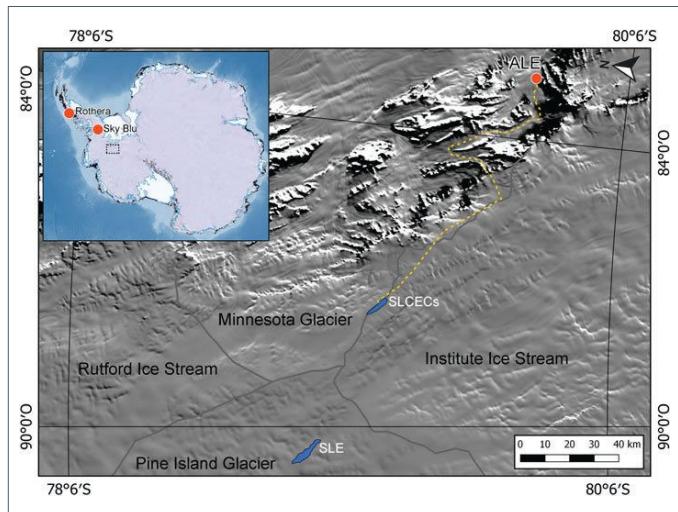
MacArtney's Hans-Jørgen Hansen, Sales Director - Ocean Science, is thrilled to work with the British Antarctic Survey once again: "We have a long-term relationship with the BAS, supplying them with winches and other gear going back to the early 1990s. The BAS is one of the world leaders in ice drilling, an expertise much in demand by other countries. We were invited to tender for the supply of this customized winch and won the contract due to the reliability and proven performance of previously delivered MacArtney winches for Arctic and Antarctic operations."

Customized winch solution

The winch is fitted with a power & data cable with conductors for ice drilling but can also be spooled with 3,500 m of coated zylon tether for an ultraclean sampling of the lake. A percussion corer probe designed to recover up to 3 m of lake bed sediment will be attached to the tether to collect core samples. The sediment under the Antarctic ice sheet is likely to date back hundreds of thousands of years to a time when humans first started to evolve. Samples collected from it will give a unique insight into climatic conditions and microbial life at that time.

MacArtney delivered the winch solution to the British Antarctic Survey in the UK.

"Once again, MacArtney has delivered an excellent solution for BAS. Taking an off-the-shelf winch and upgrading the capabilities for our requirements for subglacial lake sampling in Antarctica. During the factory acceptance test, the winch was clearly able to overdeliver on the specifications," said Julius Rix, Ice Core Drilling Engineer at BAS.



» Satellite image showing the region around Subglacial Lake CECs. (Image credit: British Antarctic Survey)



» MacArtney CORMAC Q stainless steel winch. (Image credit: MacArtney)

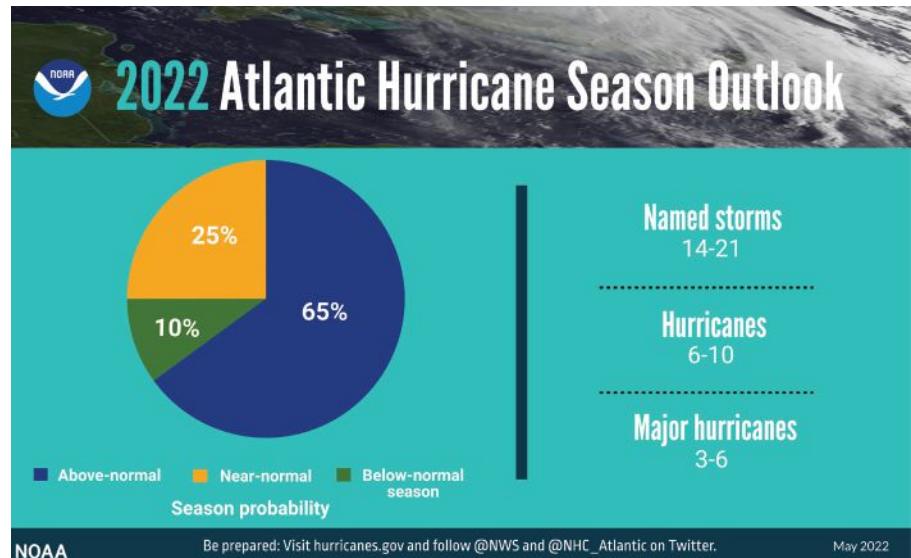
ABOVE-NORMAL 2022 ATLANTIC HURRICANE SEA- SON PREDICTED

Forecasters at NOAA's Climate Prediction Center, a division of the National Weather Service, are predicting above-average hurricane activity this year—which would make it the seventh consecutive above-average hurricane season. NOAA's outlook for the 2022 Atlantic hurricane season, which extends from June 1 to November 30, predicts a 65% chance of an above-normal season, a 25% chance of a near-normal season and a 10% chance of a below-normal season.

For the 2022 hurricane season, NOAA is forecasting a likely range of 14 to 21 named storms (winds of 39 mph or higher), of which 6 to 10 could become hurricanes (winds of 74 mph or higher), including 3 to 6 major hurricanes (category 3, 4 or 5; with winds of 111 mph or higher). NOAA provides these ranges with a 70% confidence.

"Early preparation and understanding your risk is key to being hurricane resilient and climate-ready," said Secretary of Commerce Gina M. Raimondo. "Throughout the hurricane season, NOAA experts will work around-the-clock to provide early and accurate forecasts and warnings that communities in the path of storms can depend on to stay informed."

The increased activity anticipated this hurricane season is attributed to several climate factors, including the ongoing La Niña that is likely to persist throughout the hurricane season, warmer-than-average sea surface temperatures in the Atlantic Ocean and Caribbean Sea, weaker tropical Atlantic trade winds and an enhanced west African monsoon. An enhanced west African monsoon supports stronger African Easterly Waves, which seed many of the strongest and longest lived hurricanes during most seasons. The way in which climate change impacts the strength and frequency of tropical cyclones is a continuous area of study for NOAA scientists.



» NOAA's 2022 Atlantic Hurricane Season Outlook. (Image credit: NOAA)

"As we reflect on another potentially busy hurricane season, past storms—such as Superstorm Sandy, which devastated the New York metro area ten years ago—remind us that the impact of one storm can be felt for years," said NOAA Administrator Rick Spinrad, Ph.D. "Since Sandy, NOAA's forecasting accuracy has continued to improve, allowing us to better predict the impacts of major hurricanes to lives and livelihoods."

Additionally, NOAA has enhanced the following products and services this hurricane season:

- To improve the understanding and prediction of how hurricanes intensify, NOAA's Atlantic Oceanographic and Meteorological Lab and Pacific Marine Environmental Lab will operate five Saildrone uncrewed surface vehicles during the peak of the 2022 hurricane season and coordinate for the first time with uncrewed ocean gliders, small aircraft drone systems, and NOAA Hurricane Hunter aircraft to measure the ocean, atmosphere and areas where they meet.
- The Hurricane Weather Research and Forecast Modeling System and Hurricanes in a Multi-scale Ocean-coupled Non-hydrostatic model, which have shown significant skill improvements in terms of storm track and intensity forecasts, have been successfully transitioned to the newest version of the Weather and Climate Operational Supercomputing System, allowing for uninterrupted operational forecasts.
- The Excessive Rainfall Outlook (ERO) has been experimentally extended from three to five days of lead time, giving more notice of rainfall-related flash flooding risks from tropical storms and hurricanes. The ERO forecasts and maps the probability of intense rainfall that could lead to flash flooding within 25 miles of a given point.
- In June, NOAA will enhance an experimental graphic that depicts the Peak Storm Surge Forecast when storm surge watches or warnings are in effect. Upgrades include an updated disclaimer and color coding that illustrates the peak storm surge inundation forecast at the coast. This tool is currently only available in the Atlantic basin.

JAPANESE RESEARCHERS HELP SUBMERSIBLES NAVIGATE SAFELY IN SHALLOW WATERS

From large-scale submarines to solo divers, safe passage through shallow waters represents a common navigational challenge. But recently, researchers from Japan have achieved centimeter-scale accuracy in the acoustic positioning of a submerged object. By digitally removing reflected wave signals, the effects of multipath interference can be reduced. This work may help accelerate commerce by allowing underwater navigation in ports and other shallow areas.

Acoustic positioning is similar to sonar, but instead of the same object sending and receiving sound pulses, as in echolocation, here the moving object, which could be a submersible vehicle or diver, sends only the sound waves. The waves are received by hydrophones in the water with known locations, so the exact position of the moving object can be calculated based on the

arrival times of the pulses. However, this method can be unreliable in harbors or other areas with shallow water because the sound waves can be reflected along multiple paths before reaching the hydrophones. A new approach that is not thrown off by multipath interference is needed.

Now, a team of researchers from the University of Tsukuba and Aomi Construction in Tokyo, Japan, has proposed a new approach that allows for accurate positioning of underwater objects even in shallow water. However, their approach does not rely on simply taking the loudest signal. "The amplitude of a reflected wave may, in fact, be larger than that of the direct wave due to interference effects, which is why our method is needed," explained Professor Tadashi Ebihara.

Instead, a database of signals is pre-collected by calculating the sound arrival times received when the source is at one of the points of a 2D "mesh" underwater. This provides rough positioning by matching a new signal to the closest pattern in the database. Then, a more precise location can be found by using this information to selectively remove the reflected wave, leaving only the direct wave. This method can work as long as the depth of the transmitter is also known. In experiments using a test tank, the locations of objects could be determined to an accuracy of a few centimeters.

"Our process can be easily implemented using existing hydrophone installations," Ebihara added. The team hopes that this work can be extended to other applications, such as sending research subs into narrow underwater channels.



» Improved underwater acoustic positioning based on direct wave arrival time may help submersibles navigate more safely in shallow water.

FUGRO AIDS SAFE DELIVERY OF DEVELOPMENT ASSETS FOR JUMBO IN GULF OF MEXICO

Jumbo Maritime has awarded Fugro a positioning and metocean services contract to help guide the safe transport and installation of a new floating production system (FPS) for Vito, a deepwater development in the US Gulf of Mexico. Fugro services will support both inshore and offshore towing of the 24,000-ton structure as it leaves the coast of Texas and travels 800 km to the Vito field for final positioning and hook-up. The project is expected to be executed in summer 2022.

Asset positioning will be accomplished using a remotely enabled Fugro Starfix® solution. The approach will provide real-time knowledge of all vessel locations, both in relation to each other and the FPS, while

limiting the number of surveyors required in the field. Given the number of assets required for the project—eight inshore and offshore towing vessels, two anchor handling vessels and the FPS—the remote technology will significantly reduce health and safety exposure, as well as carbon emissions. During installation, positioning data will be complemented by real-time current monitoring information to support situational awareness and safe working conditions.

Dan Matthews, Fugro's Commercial Director for Asset Integrity in the Americas stated: "As a long-time global contractor to Jumbo, Fugro is pleased to support the tow-out and hook-up of the new Vito FPS. Working

in partnership with Jumbo, we've designed a highly technical solution that will help to ensure a safe project outcome and support efficient operations in the field."



» Fugro's remote rig positioning services provides live monitoring of assets.
(Photo credit: Fugro)

EDGETECH ADDS NEW FEATURE TO THE 2050-DSS

EdgeTech, a leader in high resolution sonar imaging systems and underwater technology, has recently added a new feature to the popular 2050-DSS combined sub-bottom profiling and side scan sonar system. The new Pipeline Survey Mode provides the ability to select a smaller hydrophone sub-array enabling a larger fore-aft beamwidth and faster transmission rate and hence increasing pipeline detection when running crosslines.

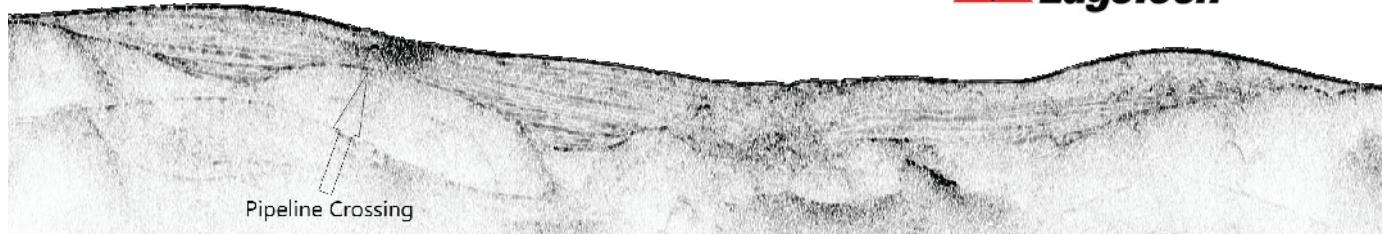
The 2050-DSS systems use a flat multi-channel Polyvinylidene Fluoride (PVDF)

hydrophone array to generate high resolution images of the sub-bottom stratigraphy in oceans, lakes, and rivers and provides excellent penetration in various bottom types. The sub-bottom receiver array is segmented for standard sub-bottom profiling surveys or pipeline survey mode for optimal location of pipelines or cables and measurement of depth burial.

The 2050-DSS also boasts a tri-frequency side scan sonar, where any two frequencies can be operated simultaneously. The towfish can be fitted with either a 120,

410 & 850 kHz or a 230, 540 & 850 kHz arrays along with a 2-16 kHz sub-bottom projector.

The 2050-DSS comes complete with a combined side scan and sub-bottom towfish with built in depth, heading and altitude sensors, digital telemetry over a single coax cable, ROV interface, a 19-inch rackmount topside, EdgeTech's DISCOVER acquisition software and optional magnetometer interface.



» The 2050-DSS generates high resolution images of the sub-bottom stratigraphy in oceans, lakes, and rivers. (Image credit: EdgeTech)



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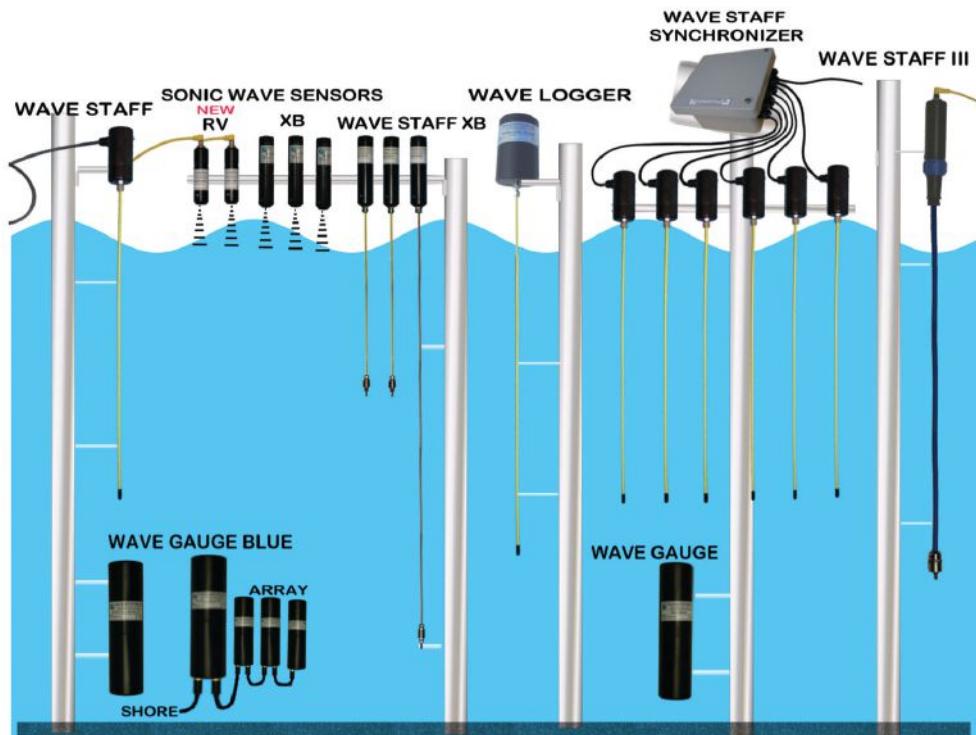
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CHECK THE TECH

» Weighing just 2.3 kg, the 84-cm JaiaBot is highly portable and can be easily deployed by one person. (Photo credit: Jaia Robotics)

MICRO HYBRID AUTONOMOUS SURFACE AND UNDERWATER VEHICLE

As advances in marine robotics continue to push operators towards the exciting paradigm shift of autonomous operations, the commercial market for multipurpose survey grade uncrewed vehicles and systems, such as USVs and AUVs, continues to expand.

But many of these smart platforms, despite their impressive capacity-to-size ratio and operational endurance, still rely on complex and often expensive launch and recovery systems. This lack of true person-portability, alongside the logistical complexity of actual deployment, poses a series of challenges for USV/AUV manufacturers looking to stimulate trial and adoption among the commercial survey community. Another hurdle, unsurprisingly, is the significant capital outlay associated with the acquisition—and subsequent integration—of the latest USV/AUV technology.

PLUG-AND-PLAY ROBOTICS

Enter Jaia Robotics, a Rhode Island-based start-up looking to disrupt the conventional approach to USV/AUV manufacturing. Jaia Robotics was born out of a passion for protecting marine ecosystems and finding ways to field affordable multi-sensor packages to collect the precise aquatic data needed to better understand and safeguard their future. The company's solution, a micro-sized hybrid autonomous system, is a refreshing new take on plug-and-play robotics for survey to depths of 100 m.

Measuring just 84 cm in length and weighing a mere 2.3 kg, the JaiaBot is a highly intuitive handheld platform optimized for rapid and reliable data capture at a fraction of the price of conventional autonomous systems. Affordability, both in terms of system acquisition and ease of deployment, were core product considerations for the firm's founders.

"As marine survey operators continue to integrate the broadening capabilities of AI-led robotics, the range of unmanned systems accepted for commercial use is set to diversify at an unprecedented rate," said Jaia Robotics CEO and Co-Founder Ian Estaphan Owen, speaking exclusively to ON&T.

"Today, there is very little that is beyond the scope in terms of automating how we explore marine environments—it is more a question of scalable application. We recognized a clear opportunity for a low-cost system that can be easily user-configured for a wide set of different mission types in coastal, estuarine, and inland waterways by a single operator and which renders real-time data."

FORCE MULTIPLIER

Such a utilitarian proposition hinges on an intuitive and open-source user interface, one that only requires minimal training time to become fully proficient. The JaiaBot was also conceived with rapid force multiplication in mind; that is, multiple units—up to 20 at one time—can be

deployed in minutes by a single operator, as opposed to the hours and personnel needed to operate any one of the USV/AUVs on the market.

Given the rugged design—ideal for surf zone ops and 5 m drop launchable—applications for the JaiaBot(s) include but are not limited to environmental characterization; mobile CTD sound velocity profiles; bathymetry and bottom type assessment; hazard and channel marking; port security and diver intervention; hydrologic assessments; boundary condition and plume tracking; and rapid environmental assessment. JaiaBot's propulsion, a system that was developed in collaboration with HydroComp, delivers speeds of 10 kt (5 m/s).

JAIABOTS AS A SERVICE

Recognizing that some customers may not be ready to invest in owning their own micro JaiaBot, the company also offers data collection services: JaiaBots as a Service (JaaS). The field team partners with customers to identify their needs, configure the system sensors to collect the required data, plan the missions and operate the vehicles. Data is then delivered in a variety of formats including HDF5, CSV and XML for ingestion into post processing tools.

For more information, visit:
www.jaia.tech/jaiabot.



NORWEGIAN PETROLEUM DIRECTORATE RELEASES FIRST DATA ON SEABED MINERALS

The first data on seabed minerals on the Norwegian Continental Shelf was released to the public in June at a seminar at the Norwegian Petroleum Directorate (NPD).

NPD has decided to share seabed data in the same fashion that they publish petroleum data, with the objective to provide stakeholders and interested parties with, according to the NPD website, "equal access to good data, so they can compete to determine who can make best use of the data in connection with licensing rounds on the Norwegian shelf."

The seminar was well attended and gave the 90 delegates an opportunity to learn more about NPD's 2018 and 2020 expeditions in the Norwegian Sea, as well as other survey campaigns conducted by the University of Bergen and the University of Tromsø.

"This is only the start, and more data will be

released later," said NPD's Jan Stenløkk. "The Norwegian Petroleum Directorate has been given responsibility for collecting data on seabed minerals on the Norwegian shelf, and for distributing this data."

The first released data sets—now available at npd.no—reveal the depths of surveyed areas, as well as some additional geophysical information.

Stenløkk stated that the data is of significant interest to both industry and academic circles.

Norwegian authorities have initiated an impact assessment as the next step towards discussing commercial operations. Norway, through the Seabed Minerals Act, is the only country in the world to have implemented this legislation, and, as far as Stenløkk is aware, is the first country to have released seabed mineral data like this to the public.



» Tour of the NPD's Geobank: Jan Stenløkk (second from left) displayed concrete evidence from expeditions to the guests. (Photo credit: Arne Bjørøen)

NINE FLAG STATES AND MASSPEOPLE TO COLLABORATE ON REMOTE OPERATOR TRAINING

MASSPeople was launched in early 2021 with the task of bringing focus to the people behind the technology revolution currently gripping the maritime industry. The working group founded and chaired by Fugro with support from SeaBot Maritime has brought together multiple national maritime authorities around the world to share in the challenge of developing world-class training and competency standards for the workforce of tomorrow. The involvement at the Flag State level is key for driving the conversation to the

highest regulatory tables with the aim of aligning international standards and enabling MASS operators. MASSPeople will work to develop new job profiles for the people involved in ensuring the safe operation of MASS. These profiles will inform recommendations on new competency standards for discussion at the International Maritime Organization (IMO), where currently, a roadmap containing scope, steps and timelines is being prepared by the Maritime Safety Committee (MSC).



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COLLABORATIVE, TECH-ENABLED PROBLEM SOLVING IN THE NEW BLUE ECONOMY

By **Kendra MacDonald**
CEO, Canada's Ocean Supercluster

In Canada and in coastal countries around the world, the ocean has helped shape communities and provided a way of life for generations. While it is a mighty and resilient resource, human activity has taken its toll on our ocean. As a result, it is warmer than it once was, more polluted, and showing signs of increased acidification. These are far-reaching impacts and the pace at which we must address them is accelerating. Today, the shift toward a new global blue economy is underway and it is driven by necessity for the well-being of our planet and its people.

ADDRESSING CHALLENGES, IDENTIFYING OPPORTUNITIES

The success of this new blue economy will be defined by our collective ability to tackle these shared, global ocean challenges and realize sustainable growth opportunities in doing so. It's arguably one of the most important opportunities of our time, and those wishing to lead will need to adopt nothing less than an all-hands on deck, collaborative approach. This is the foundation on which Canada's Ocean Supercluster (OSC) was built.

Established in 2018, the OSC has brought together and mobilized a pan-Canadian network as well as numerous international partners to change the way ocean business is done. This includes a wide range of programming and projects that commercialize solutions including those that focus on decarbonizing marine shipping, increasing food security, tracking marine species health and movement, worker safety and environmental monitoring, going further and deeper in the ocean than we ever have before, while also building the capabilities and diverse workforce to support the growth being generated.

UNITING THE OCEAN TECH COMMUNITY

While wide-ranging, these challenges require accelerated solutions that are being realized through a common thread—ocean technology. *Catalyzing new partnerships that are cross-sectoral in nature, Canada's Ocean Supercluster has brought the country's ocean community together to get more of our research developed and to market quickly.* This has meant expanding partnerships and building many new ones across the research community, companies of all sizes, regional innovation hubs, Indigenous communities, investors, and government to create a sense of cohesiveness and shared focus that didn't exist before.

The OSC's activity to date is an indication of the incredible growth still to come. Based on projects in flight today, we will see Canadian innovators deliver more than 120 ocean products, processes, and services to the world, with the promise of much more as the cluster continues to build its momentum and reach. These solutions include those that are focused in the areas of uncrewed vessels, real-time monitoring, renewable and transitional fuels, digital twins, virtual reality, artificial intelligence, and other innovative technologies, as well as sustainable fish feed and tools for smarter fishing, and are designed specifically to support a more sustainable and prosperous ocean future. What this means for both traditional and emerging ocean industries alike is access to the viable solutions they need to be both successful in the new blue economy and good stewards of our ocean.

For more information, visit: www.oceansupercluster.ca.

SOUTH DEVON COLLEGE PIONEERS MARITIME AUTONOMY TRAINING WITH ACQUISITION OF TWO HYDROSURV USVs

South Devon College has acquired two Uncrewed Surface Vessels (USVs) that will give marine autonomy students at its new Marine Academy hands-on experience of remote vessel operation. The USVs were unveiled at the Academy's opening ceremony in Dartmouth in April, a milestone moment in the history of South Devon College, which is celebrating its 90th birthday this year.

The REAV-16 and REAV-10 USVs, named USV Dart and USV Exe, were built by Exeter-based HydroSurv for research collaborations and demonstrations that catalysed the company's international growth. HydroSurv has since refitted and upgraded the fully electric, zero emission vessels for use by future students at the Academy, which aims to support industry by delivering a skills pipeline to meet the demands of a rapidly changing maritime sector.

Familiarization with current and future unmanned vessel innovations will be a key element of the college's planned marine autonomy training, due to be rolled out across multiple learning levels from September 2022.



» HydroSurv's USV Dart carrying a LiDAR, HD camera & MBES payload on a previous inspection project. (Photo credit: HydroSurv)

Paul Singer, Business and Qualification Development Coordinator at South Devon College said: "The use of USVs in industry is increasing every day and South Devon Marine Academy will be taking a leading role in the development of USV related training, from maintenance and servicing through to in-service operations. Our new workshops and classrooms are just meters from the River Dart, making them the ideal location from which to deliver this training."

The use of USVs for commercial operation is creating career options for maritime students that did not previously exist. Marine engineers, for example, need to understand their operation, maintenance and propulsion systems. From a programming, cyber security and civil engineering perspective, digital media professionals will also benefit from an awareness of the technology as it becomes widely adopted for a range of data-collection applications.

David Hull, Founder and CEO of HydroSurv said: "Both USVs were originally developed, tested and demonstrated within industrial research

projects. These projects focused on platform design, core technology development and industrial showcasing through a series of real-world demonstrations to end-users, equipment manufacturers and academia.

"Following refit and upgrade, the second life use of these USVs has come full circle to support the seeding of new skills that are in strong demand across the ocean technology space. We're delighted to be partnering with South Devon College, who are putting future specialist skills into the hands of tomorrow's workforce, enabling them to take on

important, productive jobs in the sector."

South Devon College and HydroSurv enjoy a long-standing relationship. As part of a growing Southwest clean maritime cluster, the collaboration is a strong example of how partnerships between academia and the business community are actively addressing the skills gap and opening additional research and development opportunities. HydroSurv currently hosts an apprentice from the college, with another intake planned this year.

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NEW STUDY HIGHLIGHTS MAJOR STEP FORWARD IN MONITORING OCEAN HEALTH

In a major step forward for monitoring the biodiversity of marine systems, a new study published in *Environmental DNA* details how MBARI researchers are using autonomous underwater robots to sample environmental DNA (eDNA). eDNA allows scientists to detect the presence of aquatic species from the tiny bits of genetic material they leave behind. This DNA soup offers clues about biodiversity changes in sensitive areas, the presence of rare or endangered species, and the spread of invasive species—all critical to understanding, promoting, and maintaining a healthy ocean.

For the study, researchers combined two novel autonomous platforms developed by MBARI: the long-range autonomous underwater vehicle (LRAUV) and the Environmental Sample Processor (ESP). The LRAUV is a nimble robot that can travel to remote areas of the ocean for extended periods of time. The ESP is a robotic "laboratory-in-a-can" that filters seawater and preserves eDNA for future study. By equipping an LRAUV with ESP technology, researchers can expand the scale of ocean monitoring over time and space. By comparison, traditional sampling of eDNA in the ocean requires weeks on an expensive research vessel limited to a localized area. Technology innovations like this are revolutionizing ocean conservation efforts.

"We know that eDNA is an incredibly powerful tool for studying ocean communities, but we've been limited by what we can accomplish using crewed research vessels. Now, autonomous technology is helping us make better use of our time and resources to study new parts of the ocean," said Kobun Truelove, a biological oceanographer at MBARI and the lead author on the paper.

Marine biodiversity is a measure of the abundance of individuals and species in the ocean. This interconnected mosaic of organisms—from the smallest plankton to the largest whales—supports food webs, produces the air we breathe, and regulates our climate. Autonomous tools like the LRAUV and ESP enable MBARI researchers to maintain a persistent presence in the ocean and monitor changes in sensitive ecosystems in ways that were not possible previously.

"Organisms move as conditions change in our oceans and Great Lakes, affecting the people and economies that rely on those species. We need cheaper and more nimble approaches to monitor biodiversity on a large scale. This study provides the synergistic development of eDNA and uncrewed technologies we need, in direct response to priorities laid out in the NOAA 'Omics Strategic Plan," said Kelly Goodwin, a



» MBARI researchers launch a long-range autonomous underwater vehicle (LRAUV) from the R/V Paragon in Monterey Bay. (Photo credit: Kim Fulton-Bennett/MBARI)

co-author on the study and collaborator at the National Oceanic and Atmospheric Administration (NOAA).

For this research, MBARI collaborated with researchers at the NOAA Atlantic Oceanographic and Meteorological Laboratory and the University of Washington to complete three expeditions in the Monterey Bay National Marine Sanctuary. The team coordinated sample collection between MBARI's three research vessels, the NOAA Fisheries ship Reuben Lasker, and a fleet of MBARI's LRAUVs.

A ship-based team lowered bottles to a specific depth to collect and preserve water samples. Meanwhile, an LRAUV equipped with an ESP autonomously sampled and preserved eDNA at similar locations and depths. The eDNA samples were returned to the lab for in-depth sequencing.

Related organisms share common sections of DNA, known as gene markers. For this study, researchers analyzed eDNA samples with a technique known as metabarcoding. This method looks for short DNA excerpts and provides a breakdown of the groups present in the sample. This technique is especially helpful for translating eDNA data into a measure of biodiversity. The researchers analyzed four different types of gene markers, each representing a slightly different level of the food web. Together, the results yielded a more holistic picture of community composition. The samples collected from research ships and autonomous vehicles revealed similar patterns of biodiversity.

Truelove noted that the findings from the study mark an exciting step forward for monitoring marine ecosystems. "This work is all about increasing the scale of eDNA research. Instead of looking at an individual species, we can start to more broadly characterize biological community structure in the ocean," he said.

"Good data are the bedrock of sustainable ocean management," said Francisco Chavez, MBARI Senior Scientist and a co-author of the study. "Regular environmental DNA monitoring tells us who is there and what is changing over time. When it comes to understanding the impacts of climate change—one of the biggest threats to ocean health—this information is essential."

LRAUVs are able to travel for weeks at a time and for hundreds of kilometers. They can enable more frequent sampling in areas of interest than traditional research vessels, which typically only visit remote sites infrequently. Autonomous robots will allow researchers to study previously unsurveyed regions of the ocean. Filling in these data gaps is critical to strengthening global ocean health. Ship-based research will continue to play an important role in oceanographic studies, but adding new autonomous technology to the toolkit will expand capacity for research, monitoring, and resource management. Ultimately, MBARI researchers envision deploying a fleet of LRAUVs equipped with ESP technology.





EVOLOGICS US ROADSHOW 2022



» The highly portable Sonobot 5 USV (left and center) now comes with real-time object recognition, while EvoLogics' "drop and play" USBL buoy (right) is designed for rapid and hassle-free operation. (Photo credits: EvoLogics)

In June 2022, EvoLogics from Berlin, Germany, embarked on its first ever "roadshow" initiative, taking the company's underwater communication, positioning, and robotic solutions on a demonstration tour across eight locations in the United States.

The team's tour of both the East and West coasts was to present—with live demonstrations—the capabilities of EvoLogics' underwater acoustic modems, USBL and LBL positioning systems, as well as the company's surface and underwater vehicles to industry partners.

The lineup for the roadshow included the company's Sonobot 5, a highly portable and easy to maneuver uncrewed surface vehicle (USV) for marine survey and search and rescue operations; a USBL buoy, an "unfold and deploy" all-in-one unit for USBL positioning; and Quadroin, the penguin-shape-inspired autonomous underwater vehicle (AUV).

SONOBOT 5 USV

Sonobot 5 is EvoLogics latest USV model. The compact unit fits into a car trunk and can be deployed by a single operator—as EvoLogics demonstrated during the tour.

The vehicle can be outfitted with a range of sensors (single- or multibeam echosounder, side-scan sonar, front-facing camera etc.), WLAN and cellular communications, and a selection of GNSS options.

EvoLogics recently added an exciting new feature for the Sonobot platform—real-time object recognition. The AI-based system runs

directly onboard the vehicle and analyzes raw side-scan sonar output to detect and visually highlight various objects in the operator's control software.

A cloud-based ecosystem around the new feature provides users with regular updates and new detectable object classes. Sonobot-enabled object recognition is already in active use by Dutch Water Police in NL, with more customers in onboarding to make use of this feature.

USBL BUOY

The USBL buoy is a fully integrated device, first introduced by EvoLogics in late 2020. The buoy is an all-in-one solution for ultra-short baseline (USBL) positioning of underwater targets where position fixes are obtained from ranges and angles estimated by the USBL antenna.

The device is a mono-unit with a USBL transceiver, integrated PC, dual-antenna GNSS receiver and WiFi access point, built for applications that require a non-permanent installation of the USBL antenna with the quickest possible setup and recovery. Its design concept is focused on "drop and play" deployment and hassle-free operation. Unpacking and assembly take minutes, and before launching the buoy, one just needs to turn it on and unfold the GNSS antennas.

QUADROIN AUV

The Quadroin is EvoLogics' next-generation bionic AUV for environmental monitoring. In 2020, Prof. Burkard Baschek and the team at the Helmholtz-Zentrum Hereon joined forces

with EvoLogics to develop these underwater robots for the Helmholtz Association's MOSES initiative. One of this observation system's modules will be a mobile swarm of several Quadroin AUVs geared to collect data in ocean eddies.

The Quadroin is based on EvoLogics' low-drag bionic AUV design, with its outstanding hydrodynamic properties stemming from years of observational research into penguin locomotion. The Quadroin carries a payload of sensors to measure temperature, pressure, oxygen, conductivity, and fluorescence, and achieves speeds of up to 5 meters per second. In 2022, the latest Baltic Sea trials focused on executing coordinated formation maneuvers of three Quadroin AUVs, with EvoLogics USBL buoys acting as communication, positioning and surface relay nodes.



» Quadroin's low-drag design is capable of underwater speeds of 5 meters per second. (Photo credit: EvoLogics)

As part of the US tour, the team demoed two networked Quadroins and two USBL buoys present various real-time scenarios in the field and bring customers first-hand experience of this exciting new ecosystem of next-generation ocean technology.

For more information, visit: www.evologics.de.

HYDROGEN AT RISK OF BEING THE GREAT MISSED OPPORTUNITY OF THE ENERGY TRANSITION

Hydrogen has a crucial role in decarbonizing the world's energy system, but uptake will be too slow. Governments need to make urgent, significant policy interventions, according to a new report by DNV.

In *Hydrogen Forecast to 2050*, DNV predicts the amount of hydrogen in the energy mix will be only 0.5% in 2030 and 5% in 2050. However, to meet the targets of the Paris Agreement, hydrogen uptake would need to triple to meet 15% of energy demand by mid-century.

"Hydrogen is essential to decarbonize sectors that cannot be electrified, like aviation, maritime, and high-heat manufacturing and should therefore be prioritized for these sectors," said Remi Eriksen, Group President and CEO of DNV. "Policies do not match hydrogen's importance. They will also need to support the scaling of renewable energy generation and carbon capture and storage as crucial elements in producing low-carbon hydrogen."

According to *Hydrogen Forecast to 2050*, electricity-based green hydrogen—produced by splitting hydrogen from water using electrolyzers—will be the dominant form of production by the middle of the century, accounting for 72% of output. This will require a surplus of renewable energy, to power an electrolyser capacity of 3,100 gigawatts. This is more than twice the total installed generation capacity of solar and wind today.

Blue hydrogen—produced from natural gas with emissions captured—has a greater role to play in the shorter term (around 30% of total production in 2030), but its competitiveness will reduce as renewable energy capacity increases and prices drop.

Global spend on producing hydrogen for energy purposes from now until 2050 will be \$6.8 trillion, with an additional \$180 billion spent on hydrogen pipelines and \$530 billion on building and operating ammonia terminals, according to DNV's forecasts.

Cost considerations will lead to more than 50% of hydrogen pipelines globally being repurposed from natural gas pipelines, as the cost to repurpose pipelines is expected to be just 10-35% of new construction costs. Hydrogen will be transported by pipelines up to medium distances within and between countries, but not between continents. Global hydrogen trade will also be limited by the high cost of liquefying hydrogen for ship transport and the low energy density of hydrogen. The hydrogen derivative ammonia, which is more stable and can be more readily transported by ship, will be traded globally.

Early uptake of hydrogen will be led by hard-to-abate, high-heat manufacturing processes such as iron and steel production which currently use coal and natural gas. Hydrogen derivatives, such as ammonia and methanol, are key to decarbonizing heavy transport like shipping and aviation, but these fuels won't scale until the 2030s according to DNV's forecasts.

Hydrogen will not see uptake in passenger vehicles, and only limited uptake in power generation. Hydrogen for heating of buildings will not scale globally but will see early uptake in some regions that already have extensive gas infrastructure.

"Scaling hydrogen value chains will require managing safety risk and public acceptance, as well as employing policies to make hydrogen

projects competitive and bankable. We need to plan at the level of energy systems, enabling societies to embrace the urgent decarbonization opportunities presented by hydrogen," added Eriksen.

The uptake of hydrogen will differ significantly by region, heavily influenced by policy. Europe is the forerunner with hydrogen set to take 11% of the energy mix by 2050, as enabling policies both kickstart the scaling of hydrogen production and stimulate end-use. OECD Pacific (hydrogen 8% of energy mix in 2050) and North America (7%) regions also have strategies, targets, and funding pushing the supply-side, but have lower carbon-prices and less concrete targets and policies. Greater China (6%) follows on, recently providing more clarity on funding and hydrogen prospects towards 2035, coupled with an expanding national emissions trading scheme. These four regions will together consume two-thirds of global hydrogen demand for energy purposes by 2050.

FIGURE 1
Global annual average expenditure for production of hydrogen and its derivatives for energy purposes

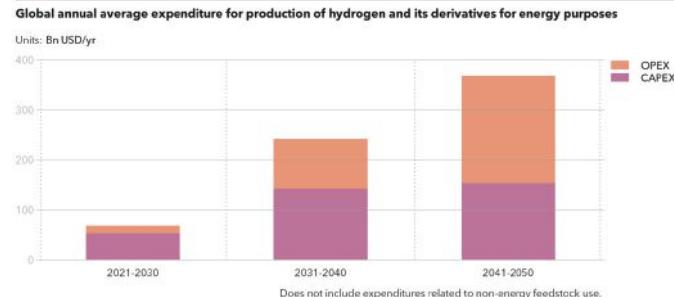


FIGURE 2
Global production of hydrogen and its derivatives for energy purposes by production route

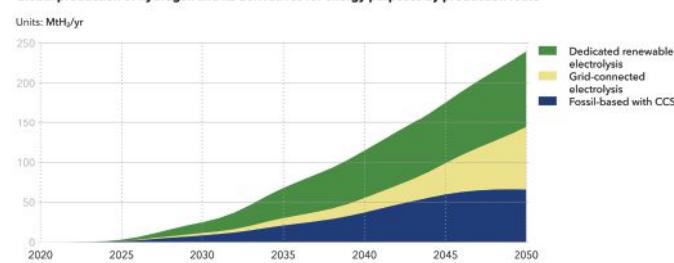
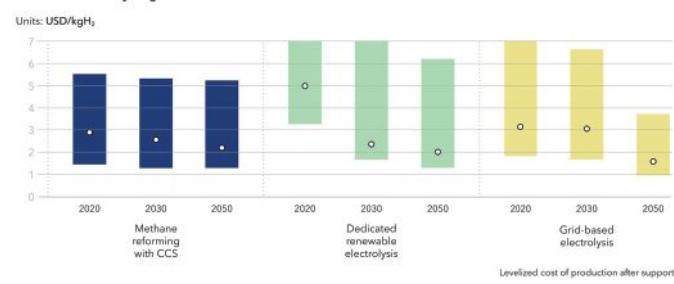


FIGURE 3
Levelized cost of hydrogen





» The Kingsnorth Fisher (left) and Aberthaw Fisher. (Image credit: James Fisher)

JAMES FISHER AND GRAIG LAUNCH THE INNOVATIVE ULSTEIN TWIN X-STERN™ SOV CONCEPT

James Fisher, a global provider of specialist products and services to the energy, marine and defense industries, and Graig Shipping, long established UK shipowner, have unveiled a pioneering service operation vessel (SOV) design concept. The ULSTEIN TWIN X-STERN named ULSTEIN SX221 Diamond SOV will support the UK's ambitious target of 50 GW of offshore wind energy generation by 2030, as part of its Net Zero Strategy.

The innovative concept is the result of extensive collaboration by the Diamond Consortium, a collaboration between James Fisher and Graig with support from DNV and design partner, Ulstein Design Solutions. The result will provide a future-proof design to address the increased demand for SOVs and will reduce the leveled cost of energy while delivering high levels of operability, personnel comfort and sustainability.

Placing sustainability at the fore, the Diamond SOV concept will address the supply chain chasm threatening to stymie offshore wind progress with a scalable, modular solution that can be achieved through high volume series construction to meet developer time and budgetary constraints. With a significantly reduced energy consumption and increased maneuverability, the vessel will also help developers lower scope 3 emissions in the construction of offshore wind farms.

As a top performing ship operator in Europe with strong safety and

environmental standards, James Fisher has been facilitating the UK's energy system transition through innovation in vessel design, technology, and propulsion systems throughout its 175-year history. It is ideally placed to support the UK's offshore wind journey and help address the challenges and operational requirements of developers.

Commenting on the launch of the ULSTEIN SX221 Diamond SOV, Jim Hey, group business development director at James Fisher said: "Building SOVs in series volumes achieves significant economies of scale and delivers a design that can be built in multiple yards simultaneously. Considering the anticipated market demand for SOVs in the UK and beyond by the end of the decade, this exciting new concept places the UK at the center of enabling global offshore wind ambitions."

Bringing over 100 years' experience in allowing clients and partners to enter the international shipping market, Graig Shipping PLC's expertise means that it is well-placed to deliver solutions to support the rapid growth of the UK's offshore wind industry, ensuring that ambitious goals for the energy transition can be met.

The Diamond Consortium is currently in discussion with major shipyard groups to reach specifications in conjunction with valued customers, with the first vessel capable of being completed by the end of 2024.

SHELL TO DEVELOP CRUX NATURAL GAS FIELD OFF-SHORE WESTERN AUSTRALIA

Shell Australia and its joint venture partner, SGH Energy, have taken a final investment decision to approve the development of the Crux natural gas field, off the coast of Western Australia. Crux will provide further supplies of natural gas to the existing Prelude floating liquefied natural gas (FLNG) facility.

"This project forms an important part of Shell's integrated gas portfolio," said Wael Sawan, Integrated Gas, Renewables and Energy Solutions Director at Shell. "Natural gas from Crux will play a key role in helping Asian customers move from coal to gas as a cleaner-burning fuel. The project will help us to meet the increasing demand for LNG as the energy market transitions to a lower carbon future. The project will also boost our customers' security of supply, which is becoming an ever more significant consideration for global consumers."

"Developing the Crux project reinforces our commitment to Australia, including boosting the regional economy, creating jobs and providing training opportunities," added Shell Australia Chair Tony Nunan. "The use of Prelude's existing infrastructure enables significantly reduced development costs, making Crux competitive and commercially attractive."

The Crux field is in Commonwealth marine waters in the northern Browse Basin, 620 kilometers north-east of Broome. The development will consist of a platform operated remotely from Prelude. Five wells will be drilled initially, and an export pipeline will connect the platform to Prelude, which is around 160 kilometers to the south-west of Crux.

Construction will start in 2022 and first gas is expected in 2027.



COMMODITY MARKETS CONFOUNDED BY GEOPOLITICS AND INCIDENTS



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

CRUDE OIL:

Crude oil price volatility has increased in recent weeks as economic and geopolitical events unsettle commodity markets. A prime example is uncertainty over the United States being in or about to enter a recession due to the Federal Reserve's interest rate hike designed to reduce inflation. The May Consumer Price Index showed an 8.6 percent annual increase, up from the 8.3 percent increase reported for April, both 40-year highs! Other economic measures—Producer Prices, Retail Sales, Home Builder and Consumer Sentiment indices, and Mortgage Applications—also reflect high inflation's impact on a weakening economy. If the country is in or headed for a recession, how severe will it be? For oil, the worse the contraction, the more pessimistic the outlook.

While uncertainty over the economy dominates the news, oil prices are also buffeted by the latest COVID-shutdown in China, potential recession throughout Europe, and the global ban of Russian oil

use due to its invasion of Ukraine. Each event impacts oil's use, but importantly each disrupts longstanding global crude oil trading patterns, often creating logistical issues for countries, causing oil prices to rise more.

As our accompanying chart shows, oil prices jumped nearly \$35 a barrel in late February when Russia invaded Ukraine. Within days, much of that rise evaporated when it became evident Russia was not going to cut off its fossil fuel flows to Europe. Later the West launched a boycott of Russian oil, but its scope was limited by the challenges European countries face in finding alternative oil supplies. Faced with oil sale bans, Russia discounted the price and sold more output to China and India who were willing to buy cheap "black market" oil in defiance of the anti-Russia sentiment.

With geopolitical events shaping commodity traders' oil price outlooks, the global economic recovery continues pushing demand higher while OPEC and U.S. producers struggle to find more supply. Energy company

shareholders are demanding producers reinvest less in their businesses and return more cash to investors, slowing oil supply growth. Furthermore, global refining capacity has shrunk due to historically poor financial returns and the massive investments needed for upgrades. Therefore, both crude oil and refined product markets remain tight at the same time, an unusual situation.

Limited gasoline and diesel fuel supplies are problems for politicians and consumers. For consumers it means sky-high pump prices. For politicians, escalating pump prices promotes a voter backlash with elections on the horizon. Politicians are pressured to do something—anything. Demonizing and taxing oil companies is their default response. It will not work. The public understands better than politicians that there are no short-term fixes for these markets. Demand destruction is the only sure fix, which will come from higher oil prices and a recession. No one wants to pay that price, but it may be our future.

NATURAL GAS:

For months we have been telling readers that gas prices depend on developments in the global liquefied natural gas market, especially for the U.S. industry. The Russia-Ukraine war forced European countries to re-examine their dependence on Russian fossil fuels, especially natural gas. Across Europe, the magnitude of Russian gas dependency, over one-third of gas use, shocked leaders. Dependency differed by country and their long-term commercial relationships with Russia. Neighbor countries were 100 percent dependent on Russian gas. Large economies such as Germany, Italy, and Poland got 40-50 percent of their supply from





Russia. Even France, with its large nuclear power industry, received 25 percent of its gas supply from Russia. Only a few countries received no gas from Russia.

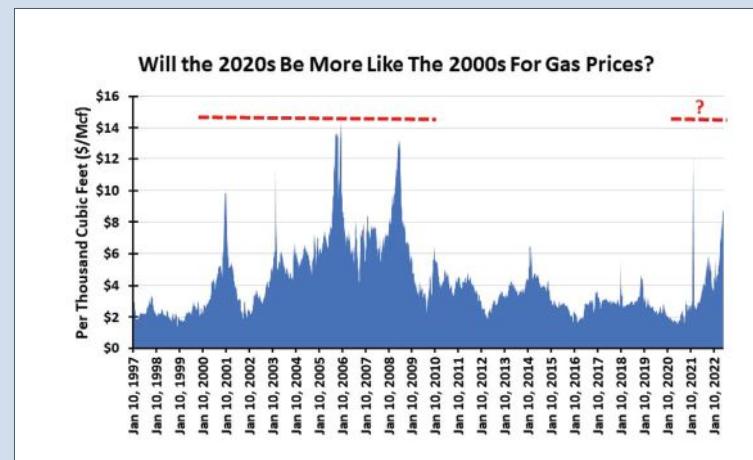
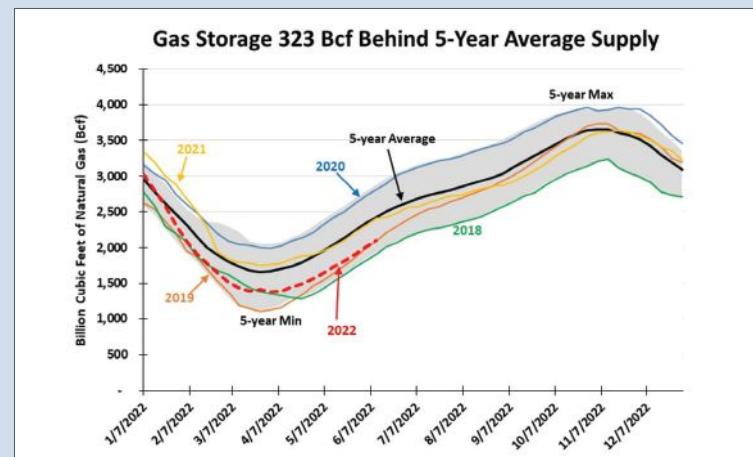
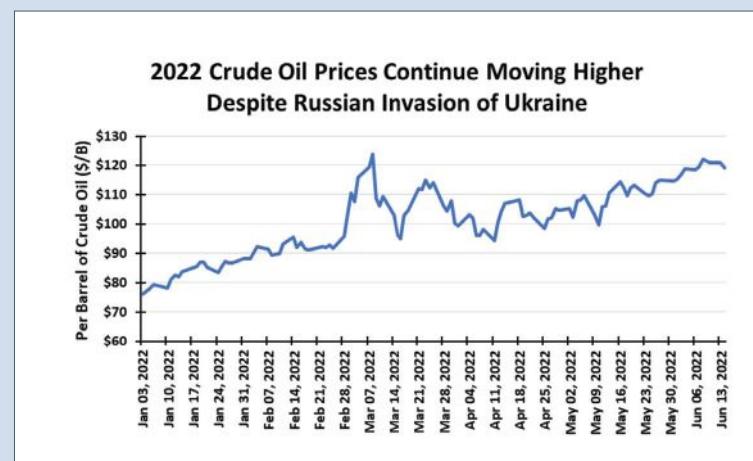
European Union members sanctioned Russia and tried to undercut its economy by banning fossil fuel purchases. That meant finding alternative supplies in a tight global gas market. Europeans turned to the United States for LNG and were willing to pay \$30 per million Btus, or nearly six times US prices. A warmer winter and continued Russian gas flows eased Europe's challenge.

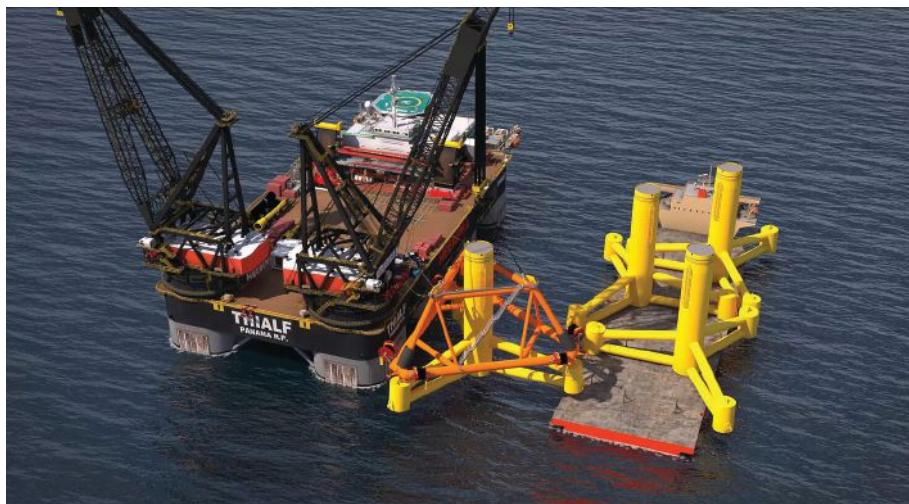
The US is the world's largest LNG exporter, accounting for 20 percent of the market. Europe's gas desperation had it boosting US imports for the first five months of 2022 to 15 billion cubic feet per day, a 29 percent increase over the prior year's volume. This was achieved because Asia cut back US LNG purchases since they would not match Europe's high prices. Furthermore, Asian countries had the option to ramp up coal use in generating electricity at cheaper prices, ignoring carbon emissions increases.

A June 8th fire at the Freeport LNG terminal in Corpus Christi, Texas upended the global gas market. The fire closed the terminal, responsible for 20 percent of US LNG exports. The immediate impact was European gas prices rose nine percent, while U.S. gas futures fell six percent. Shutting the terminal for three weeks (initial estimate) meant less gas going to Europe and more production staying at home. The incident signaled a tighter winter gas supply situation for Europe, but more supply for the US.

A week after the fire, Freeport LNG announced the terminal would be closed for three months, not three weeks, and its full operational capacity would not be restored until the end of 2022. With three-quarters of US LNG shipments going to Europe, the continent is scrambling for new alternative supplies. At 2 Bcf/d of production, 90 days of output adds an additional 180 Bcf of U.S. supply, shrinking the current 300 Bcf winter storage shortfall and lowering the odds of winter supply problems from 40 to 25 percent.

The US gas market remains captive to global LNG demand, which continues growing. Increases in US gas production, this summer's heat, the potential for Gulf of Mexico hurricane disruptions, and the amount of electricity generated from coal-fired plants will determine natural gas prices this summer. Barring future incidents like the LNG terminal fire, we expect gas prices to continue trading in the \$7-9 per thousand cubic foot range. Don't expect current high gas prices to drop appreciably anytime soon.





» Heerema's installation method seeks to negate some of the bottlenecks for scaling up floating offshore wind. (Image credit: Heerema)

FLOATING TO FLOATING OFFSHORE WIND INSTALLATION METHOD

Offshore floating wind will be essential for the world's energy transition, but methods under development can be costly, time-consuming, and ultimately prevent the commercial upscaling of this new frontier in offshore wind.

Heerema is committed to supporting clients in the offshore wind market and ensuring floating offshore wind can provide the energy the world needs to transition.

Appreciating the logistical challenges for deployment at scale, Heerema Marine Contractors has developed a new method for offshore floating wind installations. The company has significant experience in the complexities of installing floating structures offshore using its fleet of floating crane vessels. Heerema approached the development of the new Floating to Floating installation method with the following goals in mind:

- How can the Levelized Cost of Energy in offshore floating wind be reduced?
- What can be done to improve schedule robustness and duration?
- How can Heerema remove bottlenecks in the supply chain?

Floating to Floating installation method

Heerema's Floating to Floating installation method was developed to deliver solutions to industry challenges, such as efficient use of resources like steel and port infrastructure, offshore logistics and maintenance, and reaching the required scale and rate of installation.

Currently, there are various proposed methods that involve assembling floating foundations (floaters) in port before wet-towing to the field. This presents logistical challenges, as well as there being pressure on the number of suitable harbors.

Therefore, Heerema has developed an alternative method that does not require a wet-tow and removes the need for marshalling yards. Using the Floating to Floating installation method, floaters can be constructed on land before being dry-towed on a transport vessel to the location. After arrival, they will be installed using Heerema's floating installation frame to lift the floaters from the vessel. After that, they will be installed on location. Heerema's floating installation frame will submerge the floaters down by weight, removing the need for high-tech ballasting or tensioning systems and reducing installation duration. The bottom foundation work can be

executed in parallel by optimizing the capabilities of Heerema's semi-submersible crane vessels.

Lower EPC cost

The floaters' volume and weight are reduced by removing the need for wet-towing. Also, the floater is lifted directly from the transportation asset in the field, which means both the floater and wind turbine generator can be optimized for in-place conditions only.

A low-tech floater design is possible by integrating installation requirements such as ballasting provisions into reusable installation tooling, removing the requirement to build these functionalities into each floater.

Reducing transport costs

By efficiently using space onboard transport vessels to deliver multiple floaters directly from the fabrication yard to the offshore wind site transport and marshalling costs are significantly reduced.

By removing the need for in-port assembly of the floater and WTG there is less space and draught required in the port and reduced quayside capacity, which helps avoid one-off mega-investments in port areas.

Ensuring efficiency

By removing time-consuming and highly weather-sensitive wet tows and mooring connections, higher throughput can be achieved on floating wind projects. The Floating to Floating installation method means floater and WTG campaigns can be decoupled, reducing supply-chain pressure, and resulting in a more efficient process.

The crane-supported floating to floating installation method is built on proven technologies from the oil and gas floating platform industry. It allows the saving of tons of steel per floater and will reduce overall project CAPEX.



EAST OF ENGLAND ENERGY GROUP APPLAUDS UK'S FIRST-EVER CARBON STORAGE LICENSING ROUND

As the North Sea Transition Authority (NSTA) launches the UK's first-ever carbon storage licensing round, with 13 areas of exciting potential available, the East of England Energy Group (EEGGR) welcome the news with open arms.

The new carbon storage areas have the potential to make a significant contribution towards aims of storing between 20-30 million tonnes of carbon dioxide by 2030. Following the Intergovernmental Panel on Climate Change report published in April 2022, the news is welcomed across the country not least by companies in the east eager to enter the market, led in the Southern North Sea by the Bacton Energy Hub (BEH) study.

With 13 areas offered for license of the coast with a mixture of saline aquifers and depleted oil and gas field storage opportunities, EEGGR's Executive Director of Policy and External Affairs, Simon Gray, shared the industry's delight at the prospects on the horizon for the region:

"EEGGR is delighted to see that the North Sea Transition Authority have launched their first-ever carbon storage licensing round with 13 areas of exciting potential available. Of course, of particular interest to our region are the opportunities in the Southern North

Sea which could be of huge benefit to the Bacton Energy Hub (BEH) study, considering the possibilities for hydrogen coupled with Carbon Capture and Underground Storage (CCUS)."

"This announcement states that the 'capture of CO₂ emissions from industrial processes will play a crucial role in decarbonizing the UK's major industries [...] This CO₂ is then transported from where it was produced, via ship or in a pipeline, and stored offshore, deep underground in geological formations.' This is precisely what the BEH study is considering, with the production of 'blue' hydrogen from natural gas reserves, removing the carbon, and then injecting this carbon back into disused gas wells prior to the sealing of these wells, trapping the carbon permanently," he concluded.

It is understood that the application window will be open for just 90 days, closing on September 13, and will be evaluated by the NSTA on technical and financial criteria.

» Simon Gray



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BLUE-CENTRIC ECONOMY MEETS DATA EFFICIENCY



By Anthony DiMare,
CEO & Co-Founder, Bedrock Ocean

Our ocean holds the key to producing clean, renewable energy. It can provide us with the abundant natural resources needed to vastly accelerate global decarbonization efforts. But we currently lack the critical seafloor data needed to unlock this potential within the time frames needed.

Notably, our ability to map the seafloor quickly is a single inhibiting factor to meeting our emission reduction goals. For one, we simply don't have the capacity to conduct surveys fast enough to get offshore wind farms built at the same time.

Today, it takes four to eight years to build an offshore wind farm from lease signing, in part due to the snail's pace at which surveying can be done. Pre-construction alone requires between four to seven surveys and every survey campaign can take 12-18 months to complete and get usable data into the hands of engineers. To hit our renewable energy goals, we must now accelerate the rate at which we can complete critical geophysical surveys of

the seafloor—and we must do this without leaving a trail of destruction in our wake.

Current seafloor exploration requires expensive, manned, and clunky ships, cumbersome hard drives, and incompatible mapping desktop software, and often doesn't consider the detrimental effects to our environment and to marine life. The success of surveying also depends on weather, crews, ship infrastructure and availability, which can impose operational, economic, and scalability hurdles.

Post-acquisition, the data collected lives on physical hard drives and flows through desktop computers running on-premises software, not connected to the internet or the cloud. The result is a data lifecycle from raw collection to actionable insight that can take months to move from ship to processor, to geophysicist, to ultimately an engineer and management team who require access to the final geospatial products of a survey. This doesn't even take into consideration the permitting needed to do traditional geophysical surveying.

It doesn't need to be this way.

The future must be built from a tech-driven blue-centric economy, where much of the critical infrastructure needed to support life will include the ocean in some capacity, coupled with new sophisticated AI-powered technology.



» Bedrock Ocean's team is united in the mission to create public access to reliable and validated data into one a publicly accessible resource. (Photo credit: Bedrock Ocean)



» Bedrock Ocean's proprietary AUV design is instrumental to the company's vertically integrated data solution. (Image credit: Bedrock Ocean)

NO-HARM TECHNOLOGY

Unmanned autonomous vessels are key to collecting the much-needed seafloor data. Using fleets of 100% electric powered AUVs immediately mitigates risk to animals or environmental damage in Marine Protected Areas. In addition, this tech can be mobilized more frequently, cost-effectively, and faster than traditional survey vessels. AUVs should be lightweight and portable, mobilizable in days not months. By virtue of this, AUVs can also shave months off permitting time and the associated expenses that traditional topside support cannot escape.

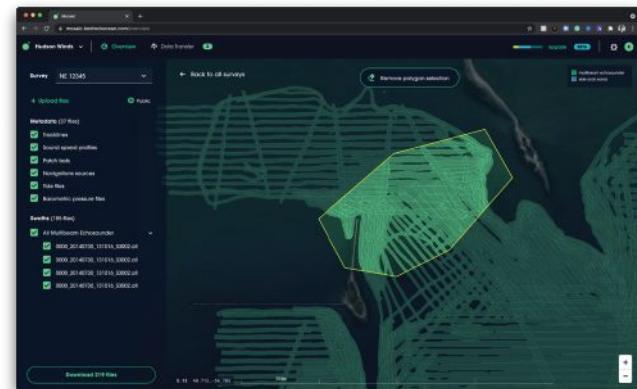
ACCESSIBLE OCEAN DATA

But safe data collection alone isn't enough. There must be a place where this information can be viewed, analyzed, and shared amongst peers—a single source of truth (SSOT) where data is available and accessible to those that need it.

It's imperative that we prioritize public access to seafloor data and improve the processing tools we use to interpret that data. Without the necessary data—on our climate, on vulnerable marine ecosystems, and on the geographic potential for renewable energy infrastructure—we cannot harness the full power of our seas to build the sustainable future we need. A free-access, downloadable database of publicly ocean mapping data must be our focus.

NEXT GENERATION NAUTICAL CHARTS

Feeding data into a single point is critical, but visualization is also an integral component to exploration. After all, most of us are visual learners. It's how we interpret vast quantities of data already. This is where nautical maps come into play. These maps allow us to dive underwater without getting wet, giving us seafloor information through visual representation. It's these maps that depict coastal topography, bathymetry, landmarks, geographic place names and marine boundaries. Until recently, there were only two types of nautical charts: Raster Nautical Charts (RNC) and Electronic Nautical Charts (ENC). At Bedrock, we believe it is time to take the next step and develop a third type: Web Nautical Charts (WNC).



» Intuitive interfacing and the clear visualization of complex data sets is integral to the Bedrock Ocean offering. (Image credit: Bedrock Ocean)

Initially, the marine industry relied on RNCs, which only showed printed images, but did not allow for data queries. This problem was partially solved with the creation of electronic-based ENCs, which provided electronically rendered vector data that can be shown on registered electronic screens but failed to provide a deeper level of interaction with the underlying data on many different devices.

It's now time to move onto a whole new category of high-quality maritime web applications and system developments. Ocean data platforms should include WNCs that are interactable on any web browser, on any app, on any machine. This technology should be a fully cloud-native implementation, truly scalable far beyond the current systems. WNCs will be the first ever fully vector-based, API-built charts, engineered for viewing and interacting with all, truly global, ENC data in a developer-friendly way in any platform.

THE ULTIMATE SOLUTION: VERTICALLY INTEGRATED TECH

Eco-consciously built AUVs (even USVs), widely available ocean data, and next generation nautical tools are all necessary for ocean expeditioning, but these tools are only currently distributed amongst different companies and often require a number of complicated, non-compatible software to access and utilize. Piecemealed technology systems requiring complex operational processes pose serious integrational challenges. The solution, and Bedrock's core mission, is to establish a vertically integrated technology across the marine industry, where the focus is on data. And most importantly, making that data available easily, and with correct context as to how it can be responsibly used.

New, vertically integrated full-service seafloor data platforms are designed to solve many of the time-consuming, big data problems associated with seafloor surveys, mapping, and ocean exploration in general. Everything—from the way we operationally acquire raw marine survey data to the way it's stored, distributed, and worked with—needs a new and faster technology solution.

The bottom line is this: without tech that is integrated across the marine industry, we risk never fully understanding how our ocean works. This will be catastrophic, for all that call Earth home. We risk never reaching critical renewable energy and net-zero goals. Ultimately, we risk not mitigating a sustainable future for humanity.

For more information, visit: www.bedrockocean.com.

bedrock

VERLUME AND OASIS MARINE POWER SIGN MOU TO EXPLORE NEW ELECTRIC WIND FARM VESSEL CHARGING CONCEPT

Verlume, an intelligent energy management and storage technologies specialist, has signed a memorandum of understanding (MoU) with electric vessel recharging pioneer Oasis Marine Power. The MoU will explore the creation of new intelligent in-field energy storage and charging infrastructure for crew transfer vessels, further enabling electrification of offshore wind farm operations.

The non-exclusive MoU will evaluate the viability of using an intelligent power conditioning and management system with a powered mooring station to create a microgrid interface within the wind farm. This innovative configuration will allow for the in-field charging of hybrid and electric wind farm vessels, contributing to significant reductions in greenhouse gas emissions over the life of the wind farm.

The proposed intelligent infield charging system will utilize energy available at the optimum time whilst providing a safe mooring point and maximizing value to both the vessel and offshore wind farm operator.

Oasis Marine Power, a specialist in renewable energy solutions for the marine environment, will supply its Oasis Power Buoy infrastructure to enable the transfer of power to vessels. The Oasis Power Buoy is an offshore mooring and charging station that

optimizes carbon dioxide reductions with a zero-emission power source fed from wind turbines. The concept commenced testing in the Port of Cromarty Firth, Scotland during January 2022, and will continue in various locations throughout the year.

Verlume's Halo subsea battery energy storage system will provide energy storage services to optimize the charging profile. Integrated as part of the Halo device will be an intelligent power conditioning and management system which will provide intelligent management of the available energy, allowing charging at times of low energy demand from the wind farm, and therefore maximizing revenue from power generation.



» Verlume's Paul Slorach (left) with George Smith of Oasis Marine Power.

FUGRO INVESTIGATION RECOMMENDS COMBINING CSS WITH OFFSHORE WIND FARM DEVELOPMENTS

The Netherlands' Ministry of Economic Affairs and Climate Policy commissioned Fugro to assess whether areas of the North Sea could simultaneously be used for offshore wind farm (OWF) developments as well as carbon capture and storage (CCS) solutions. Based on the evaluation of current practice, Fugro determined that while both OWF and CCS projects can coexist, there are four key recommendations that must be followed to ensure the safety of future projects.

These key recommendations are:

1. Development of a (3D) characterization model for geological sites. Such a model can be used to determine the probability of an earthquake occurring directly below a wind farm.
2. Monitoring of CO₂ liquid injection to understand the effects on the pressure of the earth.
3. Installation of a seismic monitoring system to monitor the actual seismicity at the site.
4. In combination with point 3, implementation of a traffic light system. This traffic light system is a seismic risk management system with which, for example, activities can be stopped in good time.

The North Sea will play an important role in the energy transition. Both carbon capture and storage and offshore wind are crucial technologies for the Netherlands to achieve its climate goals. Current ambitions of the Dutch government include two CCS-projects (Porthos and Aramis) as well as 21 GW of electricity generated by offshore wind farms by 2030. This study offers valuable insight into the compatibility of these activities and under what conditions they can safely coexist in the vicinity of one another.

James Faroppa, Fugro's Director of Marine Geoconsulting Europe-Africa, said: "Through our expert teams' analysis, we were able to share valuable insights that ensure the assets of the new energy economy operate in a safe, sustainable and efficient manner. This study is testament to our ongoing support of the energy transition, and we'll continue to work closely with our clients and partners to expedite projects and build programs that further improve energy security, environmental sustainability and safety for all."

The results of this study will be used to inform regulatory decisions and guide future overlapping CCS and OWF developments.



ODE TO PROVIDE TOP-SIDE FEED SUPPORT FOR ERM DOLPHYN PROJECT

International technical service provider Offshore Design Engineering Ltd (ODE) is strengthening its hydrogen capability having been selected by ERM Dolphyn to provide topside FEED support to the commercial demonstration phase of the ERM Dolphyn (Deepwater Offshore Local HYdrogeN) project.

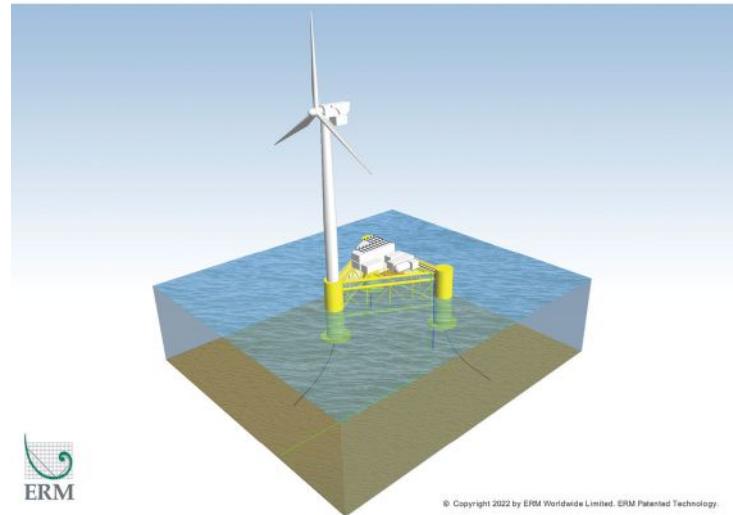
The ERM Dolphyn project seeks to produce green hydrogen at scale by utilizing moored floating substructures; each moored structure hosts an offshore wind turbine and localized hydrogen production facilities, producing hydrogen from seawater with offshore wind as its energy source. At the point of use, hydrogen produced from ERM Dolphyn is zero carbon.

The project has recently received additional funding for its demonstration phase from the UK Government's Department of Business, Energy, and Industrial Strategy (BEIS) as part of the Net Zero Innovation Portfolio Low Carbon Hydrogen Supply 2 Competition.

Across this phase of development, ODE is responsible for FEED engineering for the topside equipment, export pipeline and facility design. The FEED support delivered by ODE and its consortium members including Tractable and Vestas will facilitate the construction and operation of a 10 MW ERM Dolphyn demonstration unit in UK waters by summer 2025.

Frank Drennan, Head of Oil, Gas and Energy Transition for ODE, commented, "Producing clean, low-cost hydrogen at scale is widely recognised as a key enabler for the energy transition. With the potential to supply carbon-free energy to heat over 1.5 million homes, the ERM Dolphyn project will play a fundamental role in laying the path towards these goals. ODE is delighted to have the opportunity to work on this innovative project and to support development of the next generation of energy solutions."

David Caine, Partner at ERM said: "This support from the UK Government provides a welcome boost to the ERM Dolphyn project, as the hydrogen economy enters an exciting new phase of development. We are looking forward to working with ODE to deliver low carbon hydrogen as part of the energy transition that will help the UK to achieve its net zero goals."



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» The ERM Dolphyn project seeks to produce green hydrogen at scale by utilizing moored floating substructures.

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FET DELIVERS TWO ADDITIONAL WORK-CLASS TO OCEANICA IN BRAZIL

Forum Energy Technologies (FET) has delivered two work-class remotely operated vehicle (ROV) sales to Brazilian marine engineering company Oceanica Engenharia e Consultoria Limitada (Oceanica) to support its deepwater intervention operations and strengthen its offering to the energy sector.

The systems were manufactured at FET's UK facility at Kirkbymoorside, North Yorkshire and delivered in the first half of 2022.

FET supplied two Perry XLX-C work-class ROV systems, both designed to deliver high performance in challenging subsea environments adding fresh capability to the Oceanica fleet.

The 3,000-m rated compact 200HP XLX-C delivers high performance in a small form factor. The systems were supplied with active heave compensated Dynacon launch and recovery systems, as well as associated surface power and control installations.

FET has increased the power available on the ROV to suit the current specifications required by Oceanica and its prospective clients. It



» FET's team in Kirkbymoorside, North Yorkshire, UK. (Photo credit: FET)

boasts an impressive high pressure auxiliary hydraulic circuit, paired with a high payload capacity to carry additional tools and sensors.

The ROV systems will be utilized by Oceanica to support inspection, repair, and maintenance services in Petrobras' oilfields.

These new orders follow the successful integration of a Perry XLX delivered to Oceanica in 2020. This marked the first time Rio De Janeiro based company added a work-class ROV to its fleet in its 40-year history.

Kevin Taylor, FET's vice president - subsea vehicles, said: "We are very pleased that Oceanica has returned to purchase an additional two work-class ROVs from FET to increase its fleet following the successful sea trials of the initial XLX asset for a Petrobras project."

"These work-class ROVs are ideally suited to the deep and ultra-deep waters found offshore Brazil and can provide the required operational resilience, reliability, and performance standards expected in such a safety-critical sector."

"I'm also very proud that our team's flexibility has ensured the sea trials could progress despite obstacles presented by global coronavirus restrictions. We have continued to strengthen our footprint in Brazil and this second contract with Oceanica is a testament to our high-quality equipment and skilled personnel."

Andre Juca de Melo, Oceanica's director said: "For the past 40 years, Oceanica has been a leading provider of subsea construction, inspection, and maintenance services in Brazil. Transitioning into deeper waters is a natural development to us. Our first experience with Perry ROVs has proven successful so we continue to invest in state-of-the-art equipment in our pursuit to become the main subsea contractor in Brazil."

FET is known globally for manufacturing high quality, robust ROVs and associated auxiliary products for a number of industries ranging from oil and gas to renewables, defence, mining, and telecommunications.

TDI-BROOKS COMPLETES NUMEROUS GEOTECHNICAL PROGRAMS IN GULF OF MEXICO

Over the past few months TDI-Brooks has completed six Geotechnical Coring programs in the Gulf of Mexico for numerous operators from their research vessel, the RV Gyre. All of the programs included the deployment of a TDI-Brooks cone penetrating test (CPT), piston (PC) and jumbo piston corers (PC) and box corers (BC).

In some instances, the geotechnical coring supplemented AUV operations. These programs covered a wide range of operations including surveying in

channels off the coast of Galveston, surveying LNG export loading facilities, and the surveying of oil export pipeline routes.

One program included an Environmental Baseline Survey (EBS) including grab samples, CTD, rosette, niskin and plankton trawls.

All sediment and water samples were then sent to TDI-Brooks' geotechnical and chemical laboratories in College Station, Texas for analysis.



» RV Gyre. (Photo credit: TDI Brooks)



CSA OCEAN SCIENCES CONCLUDES ENVIRONMENTAL ASSESSMENT PROGRAM (EAP) OFFSHORE SURINAME

CSA Ocean Sciences Inc. (CSA) recently concluded an Environmental Assessment Program (EAP) for a major offshore energy operator in Block 58, a 5,841 km² area located approximately 115 km offshore north Suriname. The EAP included an Environmental and Social Impact Assessment (ESIA) for a three-dimensional (3D) seismic survey proposed in Block 58.

The technical components of the ESIA campaign were conducted and managed by a team from CSA's Trinidad office. The ESIA document describes the proposed seismic survey activities, which include possible streamer and/or ocean bottom node (OBN) techniques, relevant legislative and regulatory framework for seismic operations, and the existing baseline marine environment (physical, chemical, and biological conditions).

CSA's local Trinidad & Tobago personnel coordinated public consultation meetings, social baseline surveys, specialized supportive studies, and workshops to further inform the ESIA. Environmental and social impacts from seismic activities using OBN and/or 3D streamer technology were assessed from a risk-based perspective, prior to and after implementation of mitigation measures

to determine acceptability of residual risk. This assessment was conducted in collaboration with consultants and the operator via a Risk Assessment (RA) Workshop led by CSA subject matter experts.

"This ESIA required us to evaluate the potential impacts of a seismic survey campaign, both positive and negative, considering the use of streamer and OBN seismic techniques," said Candice Leung Chee, CEO, CSA Trinidad.

"Adding further complexity to the ESIA was the need to conduct acoustic modelling to assess the potential noise impacts on various groupings of mammals, before formulating appropriate mitigation measures to safeguard local populations. The ESIA also evaluated findings from a novel turtle density modelling study conducted off the Suriname coast, which further supported an assessment of potential impacts on various groups of sea turtles during and outside the nesting season."



CRP SUBSEA EXPANDS WITH NEW PRECISION ENGINEERED MANUFACTURING CELL

CRP Subsea has made a large investment in a new precision engineered manufacturing cell to support their increased manufacturing production demand. The purpose-built cell expands their machining capabilities by introducing a state-of-the art 5-axis CNC machine and a 3-axis turning center.

The new precision engineered manufacturing cell enables CRP Subsea to machine a wide range of polymer materials into complex shapes very efficiently and is suited to the most demanding applications. Having the enhanced capability in-house gives CRP Subsea the agility to easily support innovative ideas and customisation.

Ray Cann, Head of Operations at CRP Subsea said: "Investing in this equipment will allow us to provide products with the highest quality in order to maximize customer satisfaction whilst further reducing lead times. We will also be looking at developing innovative solutions in partnership with our customers."

The new manufacturing cell in Skelmersdale, Lancashire, will initially be used to produce the internal clamp bodies for Distributed Buoyancy Modules. The 5-axis CNC machine provides outstanding accuracy, efficiency, and cost effectiveness, along with exceptional quality and durability. In addition, CRP Subsea is also increasing its staff resource to support the expansion of the business.



» The new manufacturing cell in Skelmersdale, Lancashire. (Photo credit: CRP Subsea)

LITHIUM BATTERIES POWER REMOTE OCEANOGRAPHIC APPLICATIONS



By Sol Jacobs,
VP and General Manager,
Tadiran Batteries

Low-power remote wireless sensors are bringing enhanced data intelligence to all types of oceanographic applications, including buoys (drifting, moored, ARGO), mayday and other emergency systems, GPS and ARGOS tracking devices, current meters, transponders, harbor lights, acoustic releases, and seismometers, to name a few.

These low-power applications typically utilize industrial grade lithium batteries that deliver high specific energy (energy per unit weight) and high energy density (energy per unit volume) to pack increased functionality into ever-shrinking packages. As the lightest non-gaseous metal, lithium offers higher electrical potential to deliver higher voltage (2.7-3.9 VDC). Lithium cells also feature a

non-aqueous electrolyte that is less prone to freezing.

Numerous primary (non-rechargeable) lithium battery chemistries are available, with bobbin-type lithium thionyl chloride (LiSOCl_2) being widely preferred for ultra-long-life applications that draw average current measurable in microamps with pulses in the multi-Amp range.

Bobbin-type LiSOCl_2 cells are uniquely designed to harness the passivation effect, which reduces their annual self-discharge rate. However, due to their low-rate design, standard bobbin-type LiSOCl_2 cells cannot generate high pulses, requiring the use of a patented Hybrid Layer Capacitor (HLC).

The standard bobbin-type cell delivers low-level background current during 'standby' mode while the HLC delivers high pulses to support wireless communication. The HLC also features an end-of-life voltage plateau that permits 'low battery' status alerts.

Here are some real-life examples involving these batteries:

REDUCING THE SIZE OF A GPS/ICE BUOY PACK BY 90%

Oceantronics, a Hawaii-based producer of commercial radars, GPS systems and peripheral equipment, supplied GPS/ice buoys to NOAA/PMEL powered by bulky (54 kg) battery packs made with 380 alkaline D cells to provide one-year operating life for devices deployed at the North Pole Environmental Observatory.



» Oceantronics redesigned the battery pack for its GPS/ice buoy to reduce weight and size of the device by 90% (54 kg down to 3.2 kg), making it easier to transport via helicopter. (Photo credit: (Left) Sigrid Salo, NOAA/PMEL; (Right) Oceantronics)



» Left: Mike Prior-Jones prepares Cryoegg for deployment. (Photo credit: Mauro Werder). Right: Bobbin-type LiSOCl₂ cells were chosen for their high capacity, high energy density, extended temperature range, and high pulse capabilities. (Photo credit: Cardiff University)

To create a lighter and more miniaturized solution for monitoring Arctic icebergs, a custom pack was created that combined 32 D-size bobbin-type LiSOCl₂ cells and 4 HLCs to reduce size and weight by over 90% versus alkaline batteries. The redesigned pack increased operating life manyfold, survives 55°C, and meets UN standards for shipping hazardous goods.

In a similar application, scientists and engineers studying icebergs off Antarctica and their biological effects on the Southern Ocean used remotely piloted aircraft to drop asset-tracking tags on selected icebergs that transmitted their GPS coordinates via the Iridium satellite network. The battery had to weigh less than 500 g, survive a drop from more than 100 m, and operate reliably for up to one year at -30°C. The asset-tracking drop tags required 20 uA current in 'standby' mode with 1 A pulses when transmitting data and were powered by a 3.6 V, 2.4 Ah pack consisting of a single AA-size LiSOCl₂ bobbin-type cell and 2 HLCs. This solution weighed just 70 g and can operate at -55°C.

MONITORING DEEP SEA WATER CHANNELS

Researchers studying the impact of rising sea levels on deep water channels beneath glaciers in Greenland and Antarctica deployed a device developed by Cardiff University, the Cryoegg, to monitor changes in temperature, pressure, and electrical connectivity.

The Cryoegg utilizes the same 169 MHz Wireless M-Bus radio technology found in AMR/AMI utility meter transmitter units (MTUs) to transmit signals underwater, eliminating the need for bulky and expensive cables that can be easily damaged by glacial movement. The device is powered by hybrid bobbin-type LiSOCl₂ cells that deliver high capacity, high energy density, and high pulses, allowing data to be transmitted twice per day for up to two years.

REMOTE MONITORING OF FISH TELEMETRY DATA

VEMCO acoustic telemetry receivers and ultrasonic transmitters track the migratory activity of aquatic wildlife, warning beach goers if sharks or other predatory fish are near shore.

Fish are randomly tagged with 69 kHz and/or 180 kHz transmitters capable of operating at 500 m depths. A floating acoustic modem activates the transmitters then returns to a 'standby' state to minimize power consumption.

To transmit data through the OTN (Ocean Tracking Network) or AATAMS (Australian Acoustic Telemetry and Monitoring System) networks, these acoustic modems were powered by 24 D-sized bobbin-type LiSOCl₂ cells in combination with 12 HLCs, delivering 1600 Wh of energy and 9.5 years of single channel listening (5.5 year life for dual channel listening), and other functionality such as omnidirectional listening and fast acoustic 'wake up'. Using alkaline batteries would have reduced operating life to one year.

MEASURING SUB-SEAFLOOR FLUID PRESSURES

Shifting subterranean tectonic plates cause deadly earthquakes and tsunamis. To gain greater insight into this generally inaccessible domain, scientists and geophysicists collaborated with the Ocean Drilling Program (ODP) to install Circulation Obviation Retrofit Kits (CORKs) that measure temperature and pressure on the seafloor and also within sub-seafloor boreholes.

CORK units incorporated a wellhead data logger accessible by deep submersibles. Some CORKs were outfitted with inflatable packers to record conditions at varying depths within the borehole. The wellhead data loggers were powered by hybrid LiSOCl₂ battery packs that draw 4 mW continuous current in 'standby' mode and 100 mW pulses while sampling data at a rate of one second per minute. The monitoring devices were powered by a battery pack consisting of 6 DD-size bobbin-type LiSOCl₂ cells capable of delivering 750 Wh capacity (7.2V, 105 Ah) for up to 7 years. These devices drew a relatively small amount of peak current, so no HLC was required.

MID-OCEAN-BOTTOM BROADBAND SEISMOMETER

The Monterey Bay Aquarium Research Institute (MBARI) deployed Monterey Ocean-Bottom Broadband (MOBB) seismometers to detect low-frequency seismic activity at 1000 m depths and more than 50 km from shore for four-month intervals between servicing. The MOBBs required 2.2 W of continuous power with pulses exceeding 7 W and were powered by a 10 kW/hr battery pack consisting of 96 D-size bobbin-type LiSOCl₂ cells and 12 HLCs. For more information, visit: www.tadiranbat.com.

DEPOCEAN CHARTERS BATTERY-POWERED SUBSEA VESSEL

Ocean services provider DeepOcean has entered into a two-year time charter agreement with options for further extensions with Volstad Maritime for the M/S *Volantis* subsea construction vessel.

As part of the fixture to DeepOcean, the vessel will be upgraded with battery power notation before commencing the contract in the first quarter of 2023. The time charter will run until the end of 2024, with options for further extensions.

"DeepOcean has set a target to achieve a 45 percent reduction in CO₂ emissions before 2030. By 2040 we aim to be carbon neutral. Chartering vessels from vessel owners who share the same environmental commitment is key to this strategy," said Øyvind Michaelsen, CEO of DeepOcean.

DeepOcean is a world-leading ocean services provider, enabling energy transition and sustainable use of ocean resources. The company delivers subsea services within oil and gas, removal and recycling of subsea infrastructure, offshore renewables, mining of marine minerals, and to other ocean-based industries.

"We are very familiar with the *Volantis*. It is a flexible vessel that allows us to serve operators of oil and gas fields as well as offshore wind farms in a highly efficient manner. We also have the unique ability to provide a great range of high technology jet trenching solutions. Including the UT-1, considered the most powerful jetting



» *Volantis* subsea construction vessel. (Photo credit: DeepOcean)

trencher in the market, allowing for precise and highly flexible operations in varied environmental conditions, supported by a fleet of state-of-the-art vessels such as *Volantis*," added Øyvind Michaelsen.

The *Volantis* is a dynamically positioned multi-role subsea construction vessel, which incorporates a 150te active heave compensated subsea crane. The 107-meter long vessel is permanently mobilized, in addition to the powerful UT-1 trencher, with two high sea state work class ROVs as well as an observation ROV. In recent years the *Volantis* subsea construction vessel has operated in the US Gulf of Mexico and will continue to be utilized globally.

"In line with our long-term strategy towards zero emissions, we will be installing batteries on the vessel to reduce consumption and emissions. Volstad Maritime were one of the first offshore owners to achieve the ISO 50001 accreditation for Energy Management Standard. The installation of batteries on *Volantis* will take these efforts further forward and make the vessel even more attractive," says Eirik Syversen, Chief Commercial Officer at Volstad Marine.

SEA-KIT UNVEILS NEW H-CLASS USV FOR OCEAN SURVEY

Essex-based SEA-KIT International, a leading provider of low-carbon uncrewed surface vessel (USV) solutions in active operation across the globe, has revealed a new USV design that focuses on hydrography and environmental data collection.

The SEA-KIT H-class USV, with its retractable gondola and dual sensor deployment options, is a highly configurable design based on a wealth of operational data and feedback collected from the company's established X-class USVs. Several of these 12m vessels are currently operational in the Indian Ocean, North Sea, Red Sea and the Pacific.

The H-class features a composite hull for higher transit speeds, giving it greater range and endurance, as well as active stabilisers to minimise roll. The new design has 12-m and 15-m variants, with the 12-m version transportable in a standard shipping container for rapid, low-cost deployment. Both variants can be davit launched.

Ben Simpson, SEA-KIT CEO, said: "Although many of the H-class USV's features directly benefit hydrographic survey missions, this is a design that can perform many different

tasks due to its large gondola and ability to dip cages and tow sensors. The fuel-saving, speed and endurance benefits of the composite hull add to the value of these USVs as low-carbon, cost-efficient solutions for a wide range of maritime operations. This design is the next step towards our goal of zero emission vessels."

The H-class USV can accommodate a range of sensors as well as deploy a tow cage, SVP, MAPR, CTD and side scan sonar for deep-water and nearshore bathymetric and hydrographic survey missions. The vessel includes a Multibeam Echo Sounder (MBES), station holding and winch-deployed sensor payloads for versatile ocean survey capability.

SEA-KIT's H-class USV is designed to MCA Category 0 for extended, over-the-horizon capability and will hold Unmanned Marine Systems (UMS) certification from Lloyd's Register as well as Lloyd's Register approval for design and hull construction.



» SEA-KIT H-Class USV 12- and 15-m variants.
(Image credit: SEA-KIT International)

Schlumberger and Subsea 7 renew global subsea integration alliance

Schlumberger and Subsea 7 have signed an agreement to renew Subsea Integration Alliance for a further seven years.

Subsea Integration Alliance is a worldwide non-incorporated alliance between Subsea 7 and Schlumberger's OneSubsea® subsea technologies, production and processing systems business, to jointly design, develop and deliver integrated subsea development solutions through the combination of subsurface expertise, subsea production systems (SPS), subsea processing systems, subsea umbilicals risers and flowlines systems (SURF), and life-of-field services.

"The success of Subsea Integration Alliance is a result of the drive and commitment of both Subsea 7 and OneSubsea to deliver an enhanced experience and outcome for our clients," said John Evans, Subsea 7 CEO.

"Driven by the demonstrable benefits to clients of this mode of collaborating, integrated projects are expected to remain a significant component of the subsea market. We look forward to extending our relationship with OneSubsea as we address the opportunities of the offshore energy market."

Over the past seven years, the alliance has successfully combined the complementary capabilities and market-leading

technologies of OneSubsea and Subsea 7, and worked collaboratively with clients to design, develop and deliver integrated SPS and SURF solutions proven to optimize the cost and efficiency of deepwater developments.

The alliance continues to build momentum and, in recent years, has been awarded major greenfield projects in Australia, Brazil, Africa and Turkey, as well as significant tie-back work in the Gulf of Mexico and Norway. Since January 2020, Subsea Integration Alliance has won the majority of integrated SPS and SURF projects worldwide.

"Subsea Integration Alliance has proven to be a tremendous success," said Abdellah

Merad, EVP, Core Services and Equipment, Schlumberger. "Having been awarded 12 integrated projects and more than 130 early engineering studies around the world, it has helped—and will continue to help—customers achieve maximum value from their subsea developments through industry-leading innovation and expertise."



» The alliance between Schlumberger and Subsea 7 is focused on delivering integrated subsea development solutions. (Photo credit: Subsea 7)

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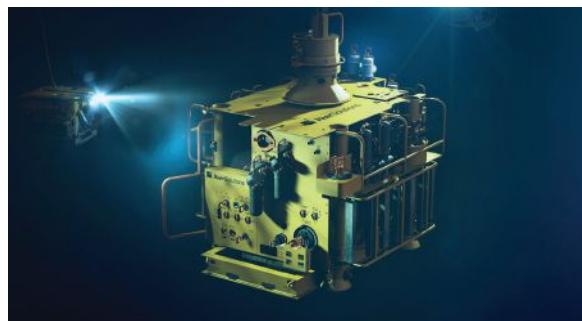
SUBSEA TREES TAKE ROOT ACROSS ENERGY TRANSITION

Aker Solutions is pioneering next-generation standardization of subsea trees as part of a wide-ranging commitment to boosting the global energy transition. Standardization of subsea trees offers the oil and gas industry the chance to build better, to build faster, and to simultaneously reduce its carbon footprint.

The components are central to offshore oil and gas systems and ongoing development is focused on better performance, sustainability, and future-orientation. Standardization offers multiple benefits to operators during constructions and throughout the project lifecycle, with knock-on benefits for total capital and operational expenditure. And by making oil and gas more efficient, and so less CO₂-intensive, subsea trees can make a significant contribution to decarbonization.

Branching Out

Subsea trees serve as a connection between wells and the infrastructure required to bring oil and gas to the surface and



» Aker Solutions believes standardized subsea trees deliver sector benefits. (Image credit: Aker Solutions)

OCEANTOOLS LAUNCHES NEW C7 COLOR SUBSEA CAMERA WITH LIGHT RING

OceanTools recently launched the new C7 color camera, adding to their extensive industry leading range of high specification subsea cameras. Differing from its sister products, the OceanTools C7 multipurpose subsea camera has an integral high intensity controllable light ring to illuminate the underwater environment, providing clear video footage at depths down to 6,000 m.

The compact C7 subsea observation camera offers an impressive 800 TVL resolution composite video output with a Wide Dynamic Range providing superb video quality under all lighting conditions. The integral light ring has 12 LEDs that can

provide light output of up to 2,250 lumens.

The unique design is manufactured from Grade 5 Titanium and features separate Sapphire windows for the camera and light ring, to eliminate reflected light.

Brian Hector, Technical Sales Manager at OceanTools, said: "I am very proud of the C7 addition to the ever-expanding family of high specification OceanTools cameras. The C7 has been designed with specific customers' requirements in mind and utilizes the latest CMOS sensor camera technology and high efficiency ultra-bright LED's in a very small 6,000-m package. We believe the C7 is the smallest

onwards to market. They are the precision engineered, high-pressure hearts beating in tandem across subsea production systems.

Traditionally, operators have approached subsea trees as bespoke engineering that reflects experiences, preferences, and history—project by project, field by field, region by region.

Flexible, Focused

Aker Solutions, working with an operator eager for change, developed a new concept that combines a uniform base unit with modules specific to a given project—providing flexibility within the framework of a standardized system.

The impacts are immediate. Production of these standardized units benefits from increased industrialization, which allows for reduced costs, lower emissions, and accelerated development schedules on the back of much shorter lead times.

Standardized subsea trees will also enable the circular economy. Components used for a given project can be retrieved, refurbished by Aker Solutions and redeployed in a new field or by a new operator.

Northern Lights

The technology also extends to the emerging carbon capture and storage sector, where the standard units are already being used.

At the Northern Lights project off Norway, for example, Aker Solutions will provide its subsea tree technology as part of a contract from operator Equinor covering the equipment required to inject captured CO₂ into a reservoir for permanent storage.

The landmark deal includes subsea tree, wellhead, flowbase and control systems as well as options for additional equipment at future installations. Technology will contribute directly to carbon reductions expected to be 1.5 million metric tons per year in the first phase. Operations are scheduled to start in 2024.

camera currently on the market to be able to offer very high-resolution SD video and integrated LED lamps making it truly versatile."



» The OceanTools C7 multipurpose subsea camera provides clear video footage at depths of 6,000 m. (Photo credit: OceanTools)

HIGH-SPEED USV TO UNLOCK NEW SURVEY WORKFLOWS AND BUSINESS MODELS

Marine survey systems, services and solutions specialist Subsea Europe Services has opened the rental book on its next-generation Uncrewed Surface Vehicle (USV) for marine data acquisition to IHO s-44 standards today. The MANTAS T12 USV, called Autonomous Surveyor, was built by Florida-based USV manufacturer MARTAC Systems Inc., with integration of the Subsea Europe Services integrated Hydroacoustic Survey System (iHSS), and is a uniquely lightweight, fast, and agile vehicle, deployable from any vessel with even the smallest deck crane. The MANTAS T12's performance optimizes marine data acquisition and enables pro-active, value-centric hydrographic survey business models.

At 12 ft long, with a draft of just seven inches and a clean, powerful all-electric motor and propulsion system, the MANTAS T12 performance specs are way beyond any current platform with the ability to conduct hydrographic survey to s-44 exclusive order standards, even under the harshest conditions and strong currents. In comparison to the process of mobilizing a crewed and expert staffed survey vessel, the speed and operational flexibility of the MANTAS T12 can significantly reduce the costs of marine data acquisition and allow for higher utilization.

"We are confident that our new turnkey survey solution will deliver immediate, tangible time and cost savings but looking further ahead, we believe that the application of fast, flexible autonomous vehicles will lower the cost per data package to where we can conduct surveys without a client commission, and that has the potential to transform how end-users look at buying and applying marine data," explained Sören Themann, CEO, Subsea Europe Services.

Subsea Europe Services expects the solution to enable significant reductions in Operations & Maintenance (O&M) costs for offshore oil and gas fields and wind farms, at first due to its unmatched ease of deployment and transit speeds. Forthcoming multibeam systems will allow high-precision data to be collected at speeds in the region of 16 knots while advances in AI will allow the MANTAS T12 to adjust its own survey plan according to the real-time data it receives from the hydroacoustic and positioning systems.

The cost per data package can be reduced further still when using a 'swarm' of MANTAS T12 USVs. MARTAC has already successfully demonstrated hydrographic USV 'swarms' in multiple exercises, showing that synchronized unmanned platforms can survey an area of the seafloor many times faster than a single manned platform.

"Speed is a key factor in optimizing marine surveys and providing more value to the end-customer," said Daniel Esser, Managing Director of Nicola Offshore, which will be one of the first survey companies to augment its survey services with the MANTAS T12.

"As an offshore specialist with our own high-speed survey vessels, we are very keen to see how this new USV can help us deliver more value for our clients and potentially offer new ways to work which could make it optimal to adopt lower-cost, more accessible marine data-as-a-service models in the future," added Mr. Esser.



» Autonomous Surveyor, a MANTAS T12 USV is ready for rent. (Photo credit: Subsea Europe Services)

E M P O W E R I N G

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NEW PERFORMANCE STANDARDS IN SUBSEA CONNECTIVITY



By Amy Brown,
CMO, BIRNS, Inc.

The subsea equipment market has seen some exciting new advancements recently, and as a result, industry interconnect manufacturers have been required to establish and meet challenging new performance standards due to demanding technical requirements of subsea products. Today's array of connectivity capabilities has grown as well, ranging from extreme depth and extreme cold to high performance optical and gigabit Ethernet data speeds. The result is a new set of standards for connectors and cable assemblies.

BIRNS has had a range of breakthroughs in subsea connectivity technology with new capabilities in coax, gigabit Ethernet data rates and optical fiber with the BIRNS Millennium™ series. This high performance, dry-mate range is designed for deep submergence applications to 6 km depth. The new connectivity technology is reducing many of the historical tradeoffs in function that had formerly been encountered in many marine connectors, like sacrificing open face pressure resistance when using coax, or Ethernet data rates topping out at only approximately 2 gigabits per second.

GIGABIT ETHERNET

Highly advanced subsea systems have become even more sophisticated, and there is now a need for data transfer capabilities to match. New defense, oil and gas, and research applications require unmanned vehicles capable of extended operations,

and to transfer huge amounts of real-time data from the seafloor, whether for minesweeping, ISR (Intelligence, Surveillance and Reconnaissance) or survey and inspection. In 2020, BIRNS introduced groundbreaking new advancements with 6 km-rated cable assemblies that produced, at pressure, consistent data transfer rates of a remarkable 9.4 ± 0.1 G/s. It's likely that the speed is actually far higher, as testing is simply limited by the current computer technology that is commercially available. Extensive performance testing proved that data consistently transmitted at this rate over the entire range of pressures from 0 to 8700 PSI/600 bar (6,000-m equivalent depth). These results were still maintained even when daisy-chaining five cables together.

This was developed originally for a customer requesting a solution that would come close to 10 G/sec for an extreme depth AUV system. Until recently, data transfer rates for commercially available underwater connectors had been limited to "Ethernet" speeds—that is, only around 1 G/s. It is unclear if testing of such connectors had actually been done, as objective quality evidence in the form of test data was not found. The new performance characteristics required would represent a full order of magnitude improvement over all existing connector products. The team developed an exclusive 52A-278 cable constructed for Cat 8.2 use. The BIRNS team also developed exclusive new proprietary termination protocols to further reduce loss and increase bandwidth for this unique cabling.



» BIRNS Millennium 3M-16, capable of 9+G/s. (Photo credit: BIRNS)

RADIO FREQUENCY (RF)

In applications from oceanographic, defense, and antennas to towed systems as well as manned and unmanned and autonomous vehicles of all types, coax connectors are widely used for GPS-frequency systems, large data and HD video and telemetry signal applications.

Tradeoffs had traditionally been found in the development and use of marine industry coax connector technology, requiring the sacrifice of open face pressure rating and often, speed and throughput. But BIRNS's new breakthroughs have provided the advantages of coax, without the drawbacks or limitations formerly associated with it; in other words, extraordinarily low insertion loss, incredibly high frequency capability, and even open face pressure resistance.

Designers of subsea RF connectors had been challenged with preventing the dielectric and/or center conductor from being extruded from the outer conductor or creating a leak path under pressure. The result was the general industry acceptance that coax subsea connectors simply could not withstand open face pressure at all based on design issues with controlling electrical impedance and



the overall challenges of performance in requisite dielectric materials.

However, in 2015 the BIRNS team developed completely new proprietary 50 ohm RF coax contacts that overcame these issues, and delivered advanced performance attributes, even including open face hydrostatic pressure to depths of 1,433 m. To achieve this, its engineers optimized transitions to prevent extrusion and minimize impedance discontinuities, and also incorporated seals made of low dielectric constant materials to prevent leakage under pressure.

These new coax connectors and cable assemblies also offer very low data transmission loss even at GPS frequencies. For example, the company has performed extensive testing, resulting in test data proving that at signal frequencies of 3GHz, BIRNS Millennium 1C cable assemblies provide ≤ 0.7 dB UHF insertion loss and $\leq 1.7:1$ VSWR (voltage standing wave ratio). (VSWR measures how efficiently RF power is transmitted.) At 1.5GHz, the BIRNS 1C has only .32dB loss and 1.17 VSWR, compared to data loss at 1.5GHz of two other commercially available RF connector brands reported at ~2.5dB and ~3.5dB, respectively.

In 2021, BIRNS launched yet another RF solution in the BIRNS 1V series, featuring a compact coax contact that offered 75Ω impedance in the same footprint of a 50Ω contact. With its extremely compact size, it fit into any of the many BIRNS coax pin configurations, offering a range of flexible, powerful new options in a small space. BIRNS has also developed 1B pressure-rated low-loss RF connectors, exclusively for the US Military, for use to SHF band Ku (18GHz). 1B connectors have previously been qualified for US Navy applications and have successfully completed US Navy

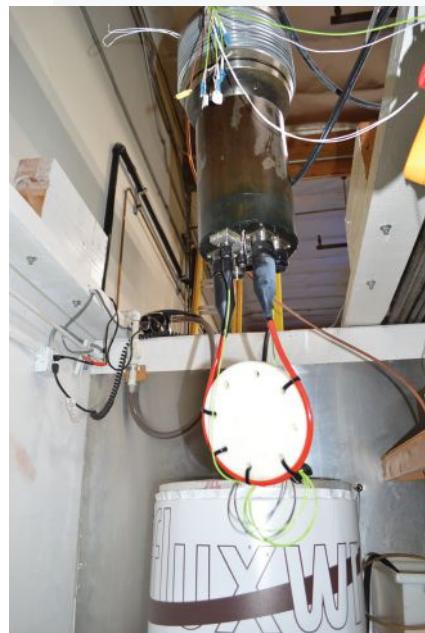
qualification including transmission and open-face in saltwater under conditions of cold ($27^\circ\text{F}/3^\circ\text{C}$) and hot ($100^\circ\text{F}/38^\circ\text{C}$) hydrostatic pressure.

OPTICAL FIBERS

Optical fibers are often used in systems that require greater bandwidth over longer distances, with a smaller footprint—smaller hull penetrations—for applications such as offshore oil and gas, towed arrays, side scan sonar systems, oceanographic instrumentation, and subsea scientific programs.

BIRNS Millennium new optical and electro-optical cable assemblies deliver high-performance data transmission, with designs qualified in cold-water high pressure testing and proven in service. Challenges can arise in manufacturing these assemblies such that can create discontinuity or if bend radii is too high, which can cause breakage or reflection in delicate fibers. Accurately aligning two fibers with diameters of only $8.7\mu\text{m}$ presents challenges, and failure to do so with precision can greatly affect optical loss. BIRNS developed optical fiber engineering protocols and termination methods that result in speeds of gigabits of data per second. Optical cable assemblies in the BIRNS Millennium series have low insertion loss (per ANSI/TIA/EIA-455) in single-mode of 0.5 dB max (0.10 dB typical) and multi-mode of 1.0 dB max (0.25 dB typical). These assemblies have been tested to demonstrate return loss of 35dB per minute.

In 2019, BIRNS was called upon to provide electro-optical cable assemblies capable of operating in extreme cold at 6 km. The team developed a new precision testing capability, an extreme low temperature, extreme depth testing system, allowing 48 hour+ continuous



» A BIRNS 3O-1F3 cable assembly during unique extreme cold, extreme depth testing at 6 km in a controlled $2^\circ\text{C} (\pm 1^\circ\text{C})$ environment. (Photo credit: BIRNS)

testing of connectors and cable assemblies at 6 km in a controlled $2^\circ\text{C} (\pm 1^\circ\text{C})$ environment.

LOOKING AHEAD

The subsea industry will continue to demand smaller, more efficient connectivity solutions that can do far more with less. Packing more capabilities into smaller and far more powerful connectors will continue to support systems that require extremely high-performance assemblies with 10 G/sec data rates, extremely low insertion losses, and maximum efficiency in transmissions and VSWR. Connector companies will continue to innovate and test these connectivity systems to meet the design demands of increasingly complex next generation subsea applications.

For more information, visit:
www.birns.com.



» 6 km-rated connector with a BIRNS 1C 50 Ω contact (left), with a BIRNS 1B contact for SHF band Ku (middle), a BIRNS 1V 75 Ω contact. (Photo credit: BIRNS)





» The new state-of-the-art subsea cable manufacturing facility in Cambois, near Blyth. (Image credit: JDR)

FINAL GRANT AGREEMENT REACHED FOR £130 M BLYTH SUBSEA CABLE FACILITY

JDR Cable Systems, the global subsea cable and umbilical supplier and servicer, has reached final agreement under the UK government's Offshore Wind Manufacturing Scheme on financial support for its new state-of-the-art subsea cable manufacturing facility in Cambois, near Blyth, Northumberland.

The agreement means JDR is on track to begin construction in summer 2022, with a planned opening in 2024. The new £130 million UK Export Finance (UKEF) Export Development Guarantee is set to create 171 high-quality local jobs on completion while safeguarding 270 jobs at JDR's existing facilities.



» Construction will begin in summer 2022, with a planned opening in 2024. (Image credit: JDR)

Business and Energy Secretary Kwasi Kwarteng said: "Our offshore wind sector is a major industrial success story that delivers cheaper energy for consumers and high-quality manufacturing jobs across the UK. Investments such as this from JDR, with government backing, are exactly the kind which our British Energy Security Strategy will attract, while reducing our exposure to volatile global gas prices."

The new facility is the first stage of JDR's plans to expand its product portfolio to support the growing global renewable energy market, adding high voltage export and long length array cables to its existing capacity and product capabilities.

Tomasz Nowak, CEO at JDR, commented: "Since our initial announcement in September last year, the UK has redoubled its commitment to net zero having hosted COP 26 and reaffirmed the importance of building out the country's renewable infrastructure and supply chain in light of the current gas and energy crises. Now more than ever it's critical to push forward with the UK's offshore energy ambitions and we are delighted to take this major step forward in delivering the new site at Blyth."

JDR has also announced a £3 million investment into its existing facility at Hartlepool, with the installation of a new vertical layup machine (VLM). The VLM is nearly double the weight capacity and increases production capacity at Hartlepool by approximately 25 percent, readying the facility for manufacture of array cables above its current 66 kV product range, with the addition of 132kV and 150kV cabling planned at the facility.

James Young, Chief Strategy Officer at JDR, said: "The energy transition will only accelerate, meaning more power from larger turbines, installed farther offshore and with higher voltage subsea cables to connect them. The North East of England is the ideal base from which to serve the largest offshore renewable energy market in Europe, and we're delighted to be able to announce these major investments in both Blyth and our existing facility at Hartlepool."

NEW VENTURE TACKLES CABLE RENTAL & LOGISTICS OPERATIONS

PASSER Group and Swan Hunter has agreed to merge their cable rental and logistics operations into a new company, PASSER LARS (Logistics And Rental Solutions), to create a leading player in the global cable handling and logistics rental market. PASSER LARS will have offices in the Netherlands and UK, in addition to PASSER Group's existing presence in Norway, Lithuania and China.

"The ongoing electrification megatrend will drive significant growth in connectivity infrastructure and offshore cables in particular. As projects grow in size, scope and complexity, there will be a need for larger entities with multidisciplinary competencies and financial capabilities to meet the growing demand from clients. Through the formation of PASSER LARS, we are creating a company that will be a driving force in the cable handling and logistics rental market going forward and a strong platform for growth, both organically and through further consolidation," both companies stated.

PASSER LARS will provide existing and new clients within the offshore energy markets with a comprehensive service offering of specialist offshore equipment rental, in-house design engineering, project management capabilities, cable logistics and transportation services, and project specific solutions.

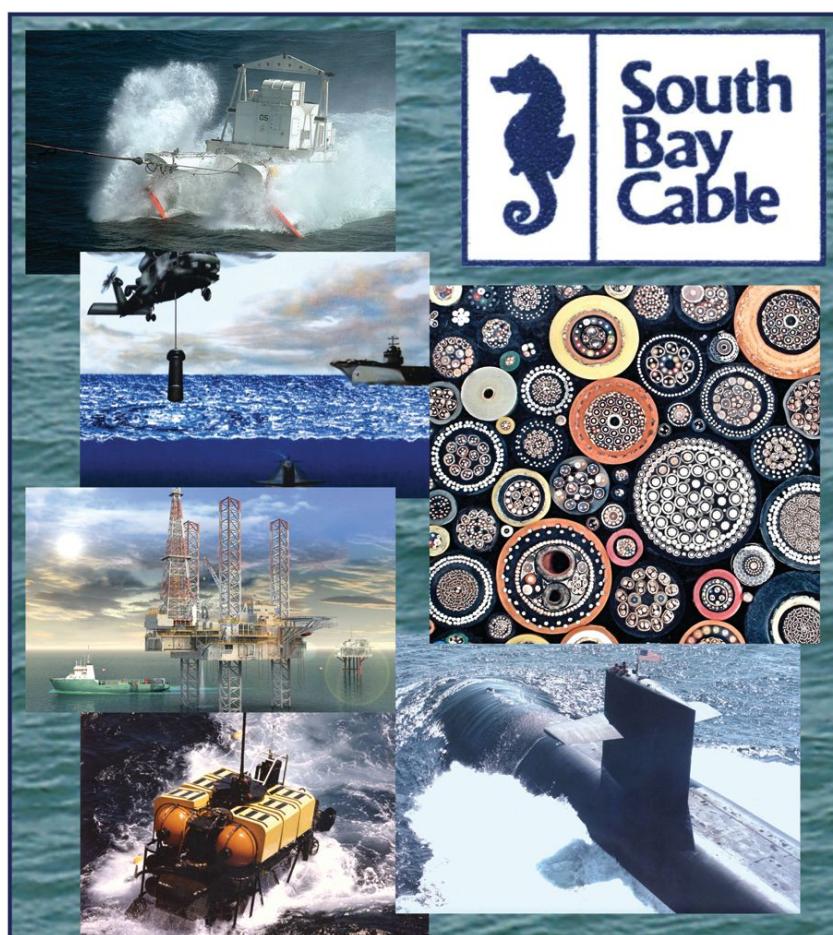
Gerard Kroese, Managing Director of Swan Hunter and the newly formed PASSER LARS, stated: "This merger is a very positive and logical next step for Swan Hunter and for the industry we serve. PASSER LARS's strategy will be to solidify its position as the global go-to provider of cable handling and logistics rental solutions—with a particular focus on high-growth renewable end-markets—through growing its asset base and further enhancing its value proposition



» PASSER LARS will bring cable handling and logistics rentals under one banner. (Photo credit: PASSER LARS)

towards clients. With the enlargement of our equipment pool, and uniting of our dedicated international engineering teams, will offer our clients very attractive and flexible options for their key project activities in Europe, USA, Asia, and beyond."

Petter Mangelrød, CEO of PASSER Group, stated: "This is an exciting and promising opportunity for the PASSER Group. We see a high level of synergies in both companies, and this merger allows us to double our efforts in providing a full suite of solutions worldwide to our clients. Our now strengthened in-house capabilities should place PASSER LARS where we wish to be, as a trusted and competent supplier to our international clients in the offshore energy industry."



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CABLE FOR GCI'S ALEUTIAN FIBER PROJECT

Almost 2,000 tons of specially-built subsea fiber has begun the journey from Europe to Alaska and its eventual home on the ocean floor along the Aleutian Chain.

The fiber, the foundation of GCI's 800-mile Aleutian Fiber project, will close the digital divide and bring transformative 2 gigabit residential internet speeds to some of the most remote communities in the nation, including

Unalaska, known to many reality-television fans as home to the popular show "Deadliest Catch."

The construction and delivery of the specialized fiber is a major project milestone amid production and supply-chain issues that have impacted the global economy in recent years.

"Subsea fiber, like what will be used in GCI's AU-Aleutians Fiber Project, isn't something that's just sitting in a warehouse, waiting to be loaded onto a plane for its next deployment, and it's not something you can buy from your local electronics store," said GCI Principal Portfolio Program Manager Rebecca Markley. "It takes a highly specialized facility to build hundreds of miles of armored, sealed fiber specifically designed and made to order for large-scale infrastructure projects. There aren't many companies in the world capable of meeting the material needs of a project like AU-Aleutians—and even if they can, it doesn't happen overnight."

Because there are so few companies that can build the hundreds of miles of armored, subsea fiber needed for its AU-Aleutians Fiber Project, GCI had to go all the way to Europe to find the right supplier. The production process began in fall 2021, after route surveys and analysis were complete, at NSW Cable facilities in Nordenham, Germany. While the cable production itself only took a couple months, it took considerably longer to gather the necessary materials.



» Cable production began in late 2021 at NSW Cable facilities in Nordenham, Germany. (Photo credit: GCI)

"Once we submitted our order for the fiber, NSW Cable began sourcing materials—and for 800+ miles of subsea fiber, that's a process that takes several months," said GCI Senior Staff Engineer Bruce Rein. "After they acquired the necessary materials—like fiber optics, steel wire for armoring, and copper for the buffer tube—they were able to build the fiber segments, including one single length segment that will be the longest non-repeatered fiber span in Alaska, once installed."

Non-repeatered fiber spans use higher-powered optical amplifiers at each end to transmit the signal, rather than a system of lower powered amplifiers placed at regular intervals along the fiber's length. This approach reduces the hands-on work required to maintain and upgrade the fiber and limits the risk of equipment failure, both of which are especially important in the remote areas served by the AU-Aleutians Fiber Project.

Once the fiber was built, GCI then tackled the challenge of transporting it from Nordenham, located at the mouth of the Weser River on the coast of the North Sea, more than 12,000 miles to the remote Aleutian community of Unalaska.

"Altogether, the subsea fiber needed for the AU-Aleutians Project weighs in at more than 3.7 million pounds with segments up to nearly 230 miles long—that's not just something you can load onto a plane," said Rein. "The only feasible way to get our fiber to Unalaska is by cargo ship. In addition to

being able to handle the sheer size, it also allows us to avoid cutting the cable into shorter segments, which would increase the number of splices needed before we could deploy it underwater and cost us a lot of time."

The fiber is currently aboard the 330-foot-long M/V Vertom Thea, as it makes its way through the English Channel, across the Atlantic Ocean, through the Panama Canal, and up

the Pacific coast to British Columbia where it will be loaded onto two cable installation vessels and complete its journey across the Gulf of Alaska to Unalaska.

The AU-Aleutians Fiber Project will run approximately 800 miles from Kodiak along the south side of the Alaska Peninsula and the Aleutians to Unalaska. The project is scheduled to deliver urban-level speed, service and reliability for the first time to the communities of Unalaska and Akutan by the end of 2022, Sand Point and King Cove by the end of 2023, and Chignik Bay and Larsen Bay in late 2024.

"While some GCI projects have required us to practically move mountains, the AU-Aleutians Fiber Project has practically required us to part the proverbial seas," said GCI Rural Affairs Director Jen Nelson. "The logistics of making a project like this possible are complex, but the end result of delivering transformational levels of connectivity to the Aleutians makes every foot of fiber and years of work worth it."

The project is expected to cost \$58 million. GCI was awarded a \$25 million grant from the U.S. Department of Agriculture's ReConnect program in support of the project. The company will invest \$33 million of its own capital to pay for project costs not covered by the ReConnect grant.

DESKTOP STUDY TO SUPPORT HAWAIIAN ISLANDS CABLE

The Research Corporation of the University of Hawaii (RCUH) and Ocean Networks, Inc (ONI) announced the award of a Desktop Study (DTS) for Cable Landing Station (CLS) Site Surveys. The notice to proceed was issued on May 23, 2022.

The scope of work for the CLS Site Surveys includes identifying potential beach manholes and landing points on Kauai, Oahu, Maui and the Big Island, as well as potential cable landing stations.

At minimum, two sites on each of the four island will be identified to ensure redundancy between islands. Work will also identify potential locations on Lanai and Molokai.

The industry standard study will identify suitable landing sites, landing stations, the safest submarine cable routing and the required cable specifications to build a new inter-island fiber optic network for the Hawaiian Islands.

University of Hawaii VPIT & CIO, Mr. Garret Yoshimi, said: "We are very pleased to have selected Ocean Networks. The Ocean Networks team has significant industry experience and specifically working in the Hawaiian Islands. The planned inter-island cable system will leverage the generational Federal investment in human and technological infrastructure, to support Hawaii's broadband initiative and position the Hawaiian Islands for long-term economic growth. The resulting network will be carrier-neutral, and sufficiently robust to support all manner of telecommunications carrier and enterprise traffic, including anticipated future high-capacity demands supporting healthcare, education, research, public service, commerce and government uses."

"We are delighted to collaborate with the RCUH and proud that ONI has been selected to perform this initial step towards the implementation of a new undersea cable system that will provide critical improvement to the broadband infrastructure for the state of Hawaii," added Cliff Miyake, VP Business Development at Ocean Networks.



FIBERHOME INSTALLS DOMESTIC PHILIPPINES CABLE

On May 26 2022, the vessel Fenghua 21, owned by FiberHome Marine Network Equipment Co., Ltd., finished a cable landing successfully at north of Siargao Island, in the Philippines.

The completion of cable landing marks that FiberHome has fully delivered five segments of phase II of PLDT DSCPA2 which has total length of 230 km. DSCPA2 is a full turnkey project containing approximately 20 segments and connecting more than 10 islands.

Relying on the ability of FiberHome Group in the whole optical communication industry chain, FiberHome Marine has become a marine network system supplier and general integrating contractor with independent intellectual property rights who

has integrated the R&D, design and production capacity of a full range of shore end transmission equipment, underwater system equipment, submarine optical cable and core devices. FiberHome Marine can provide seven major services including simulation design, desktop research, marine survey, license handling, product supply, installation and construction Maintain and support.

Fenghua 21 has nearly 7,000 tones water draft, and deploys professional equipment and software such as an advanced DP2 dynamic positioning system, the domestic first A-Frame crane, submarine buried plow, dual channels linear cable laying machine, and MakaiLay software system.

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DEFENSE OF THE SEABED: SECURING UNDERWATER INFRASTRUCTURE



By Joseba Tena,
Commercial Director, Forcys

From beluga whales being recruited to work as spies, to cabled infrastructure sabotage and the development of nuclear-powered underwater drones, recent world events have demonstrated the need for continual development of technology for defense of the seabed. Near-peer adversaries remain focused on innovating and delivering new technologies in order to improve their underwater domain capabilities, and nations and companies with critical assets and infrastructures on the seabed have to be able to keep pace in order to protect their security and operational capabilities.

In protecting seabed assets and infrastructure, defense systems need to be able to identify, categorize, and counter threats or the consequences could be catastrophic. As one example, offshore wind turbines, assets installed on the ocean floor, are vital for a nation's energy and connectivity needs, and damage to this infrastructure at a seabed level could severely compromise a country's safety and security.

AUTOMATED APPROACH

Automation in the subsea domain has made great strides in enhancing the protection of assets, providing the ability to monitor and assess conditions and threats at any given time without the need to send divers to conduct evaluations. Whilst the continuing development of automation is likely to see fewer seafarers out at sea in the future, proponents of autonomy argue this isn't replacing expert mariners with machinery. Rather, delivering increasing autonomy will ensure mariners can be more effective by freeing up the workforce to support vital operations that cannot be done autonomously.

The expectation is that automation will be the enabler of the future, with mariners working from headquarters commanding flotillas of robots, removing risk to human life, and solving some of the recruitment issues faced by maritime operators.

The autonomy these robots offer will ensure they can work across the whole underwater domain and support strategic decision-making while reacting to sensor data as required.



» Forcys supplies side scan sonar for GDMS' Bluefin AUV.
(Photo credit: Forcys)

But to be effective, robust command and control is required in ocean locations.

Forcys brings together global maritime defense capabilities and technologies under one umbrella. The company has 50 years' worth of experience in developing technology to meet the needs of those operating in the underwater domain, delivering technologies that provide secure acoustic and optical communications, improved navigation, sonars, and optical systems to improve situational awareness. Together, these technologies deliver the competitive advantage for navies and governments as they face ever-evolving subsea threats.

ENHANCING SITUATIONAL AWARENESS

As part of its underwater technological work, Forcys has been working on three specific projects to help navies ensure they are working with the most innovative marine solutions.

One of these solutions, Sentinel, is a counter-UUV system—technology which helps to protect people and assets through the ability to identify threats. Originally developed to detect, track, and classify combat divers, Sentinel is also capable of tracking underwater drones, a key area of focus for many leading navies as unmanned platforms become increasingly sophisticated and the size of the global fleet of platforms continues to grow.

Forcys has pioneered the development of underwater equipment that is used to position, sense, and communicate. Battery powered, these technical instruments can operate underwater for many years and are able to monitor and share data from their immediate vicinity. They can work as part of a network and interact with other underwater vehicles by using secure acoustic or optical communications, creating the mission flexibility that supports navies through a range of operational requirements.

Through an innovative buoy design, this underwater technology means the units can connect to the shore in real time. In deeper waters, an uncrewed surface vessel can be used to harvest data from these instruments at specific intervals. They provide persistence surveillance where it is needed and are easy to deploy and recover.

A third technological development that has been spearheaded by Forcys is the use of underwater vehicle payloads. These payloads can be used to improve situational awareness by integrating with autonomous vehicles or delivery systems to gather better, higher resolution data of the surrounding environment. This technology enables thorough surveys of the seabed and surrounding infrastructure, helping ensure decision-making is fast and based on accurate data. For example, Forcys' Solstice technology is a multi-aperture sonar that is used to detect and identify mines and other mine-like objects across a large seabed area.

SCALABLE FUTURE

It is clear that the technology is available to ensure the protection of critical national infrastructure—even on the seabed. Forcys' network-enabled systems provide a scalable design that can also be integrated with above-water systems to ensure there are no gaps in surveillance capability. And given the ever-evolving nature of naval warfare and defence, these innovative solutions are likely to become ever more in demand.

To find out more, visit: www.forcys.com.

FORCYS



➤ Forcys' Solstice technology is used for subsea detection and to identify mines and other mine-like objects. (Photo credit: Forcys)



» HII's Proteus LDUUV during a demonstration on June 8, 2022. (Photo credit: HII)

HII SUCCESSFULLY DEMONSTRATES COORDINATED MANNED AND UNMANNED OPERATIONS

All-domain defense and technologies partner HII recently announced the successful demonstration of capabilities enabling HII-built amphibious warships to launch, operate with and recover HII-built large-diameter unmanned underwater vehicles (LDUUV).

The research and development initiative between HII's Ingalls Shipbuilding and Mission Technologies divisions is among a portfolio of corporate led and funded internal research and development efforts aimed at advancing mission-critical technology solutions in support of HII's national security customers.

"HII is committed to advancing the future of distributed maritime operations and demonstrating our capability to support unmanned vehicles on amphibious ships," said Kari Wilkinson, president of Ingalls Shipbuilding, which hosted and partnered in the demonstration. "I am very proud of our team's initiative to strengthen the flexibility of the ships we build by anticipating the challenges and opportunities that exist for our customers."

"This is a great example of how HII can leverage expertise across divisions to develop unique solutions for customers," added Andy Green, president of Mission Technologies. "HII is focused on growing critical enabling technologies, like

unmanned systems and AI/ML data analytics, to help further enhance the capabilities of our national security platforms."

HII-built San Antonio-class amphibious warships have unique well decks that can be flooded to launch and recover various maritime platforms. The U.S. Navy has previously demonstrated the ability to recover space craft from the amphibious warship well deck.

HII's Advanced Technology Group, comprised of employees from across the company, performed the launch and recovery demonstration with a prototype platform called Pharos and HII's LDUUV Proteus. The demonstration took place in the Pascagoula River.

The demonstration involved having the LDUUV approach and be captured by the Pharos cradle, while Pharos was being towed behind a small craft that simulated an amphibious ship at low speed. Pharos was put in a tow position, then using a remote control, it was ballasted down in the trailing position allowing the LDUUV to navigate into Pharos. Once the unmanned vehicle was captured, Pharos was deballasted back up into a recovery and transport position. The demonstration also included ballasting down to launch the LDUUV after the capture.

Pharos is outfitted with heavy duty wheels to allow its transport maneuverability within the well deck of an amphibious ship for stowage on the vehicle decks. Pharos can be rolled off the back of an amphibious ship while using the ship's existing winch capabilities to extend and retract the platform from the well deck. The Pharos design is scalable and reconfigurable to fit various unmanned underwater or unmanned surface vehicles.

The Pharos design was conducted by HII, and three main partners supported the development. The University of New Orleans, in conjunction with the Navy, performed the initial model testing, and the prototype device was fabricated by Metal Shark in Louisiana.

HII is currently exploring modifications for other UUV's and participating in live demonstrations with the fleet within the next year. HII will use results from the Pharos demonstration to further mature concepts and continue to develop innovative national security solutions.

GREENSEA SYSTEMS LAUNCHES BAYONET OCEAN VEHICLES

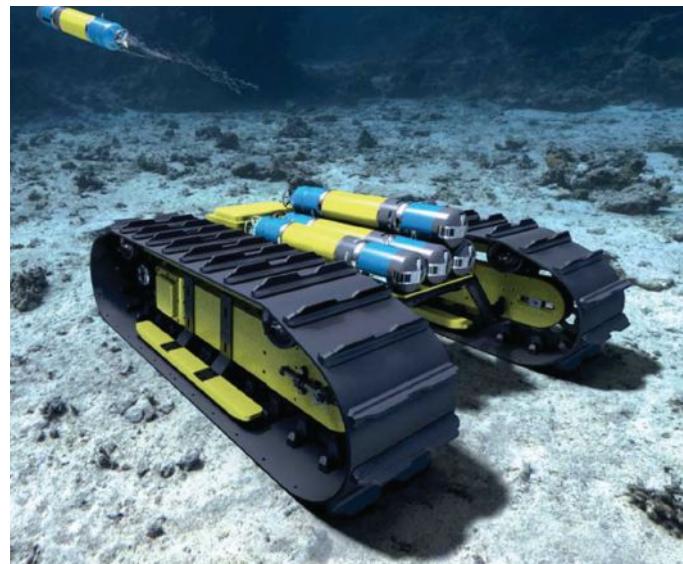
Marine robotics technology specialist Greensea Systems recently announced the launch of Bayonet Ocean Vehicles, a new company created to develop, manufacture, and distribute a line of amphibious robots.

Bayonet joins as an independent entity, acquiring and rebranding the IP and inventory of C-2 Innovations' crawling robot product line. Bringing together top talent from the industry, including the previous President and Principal Investigator from C2-i, the Bayonet team will be led by Ben Kinnaman and the Greensea Executive Team.

The company is based in Plymouth, Massachusetts, co-located with Greensea, in a newly renovated 17,000 sq.ft state-of-the art manufacturing facility with waterfront access for year-round testing and training.

On announcing the launch of Bayonet Ocean Vehicles Ben Kinnaman, founder and CEO of both Greensea and Bayonet commented: "We have been working with C-2 Innovations since 2018, providing them with a C2 software suite built on OPENSEA. The seafloor crawling robot systems they developed are unique because they fill a void in autonomous ocean systems as they can work in the surf zone and carry larger sensor payloads on the seafloor. Bayonet has the resources to scale and advance the product line, and strategically, the crawler product line complements Greensea's autonomy portfolio for defense applications."

The Bayonet product line will feature Greensea's fully open architecture software platform, OPENSEA, which includes



» Bayonet crawlers have been designed to transit along the ocean floor as well as on land. (Image credit: Bayonet Ocean Vehicles)

precision navigation, payload integration, autonomy, and over-the-horizon command and control. Bayonet has already secured several defense contracts as the platforms are being adopted into sensor placement and Explosive Ordnance Disposal missions.

The company will launch a commercial variant of the platform in summer 2022 focused on hydrographic survey, wind farm survey and maintenance, as well as coastal dredging support.

Deployable from land or water independent of weather, the range of Bayonet crawlers have been designed to transit along the ocean floor as well as on land, making them the only robotic platform in the world capable of working between 40fsw and the dunes on the beach as well as in the deep ocean. Their application includes amphibious operations and littoral warfare such as mine detection and clearance, seafloor, beach zone and river surveys, environmental monitoring and wharf inspections.

SEEBYTE AWARDED CONTRACT FROM DE&S TO PROVIDE C2 AND AUTONOMY FOR ROYAL NAVY MHC

SeeByte has been awarded a contract by Defence Equipment & Support (DE&S) agency to provide a range of command and control, autonomy and

software design services to the UK Ministry of Defense in support of all Mine Hunting Capability (MHC) and related programs.



SeeByte's to support the UK MOD's Mine Hunting Capability (MHC) and related programs. (Photo credit: ATLAS ELEKTRONIK UK)

The UK Ministry of Defense and SeeByte will collaborate in the development and delivery of the Command and Control (C2) and Autonomy architectures that will operate across the MHC program to enable best of breed solutions with evergreening throughout the lifecycle of the program.

SeeByte will also provide support and maintenance services for software products currently fielded by UK government agencies. These include their Multi Domain C2, Mission Level Autonomy and Automatic Target Recognition

(ATR) solutions that are already fielded, operationally proven and in-service with the UK, US and NATO Navies.

The RN's MHC program began in 2014 with the intention to deliver fully autonomous mine-hunting. SeeByte's initial two-year contract has the option for DE&S to extend the term for two additional years and their new office in Bristol will provide the ideal location to support the contract, offering job sustainability and further recruitment in both Edinburgh and Bristol.

NEW COMBAT SUBMARINE NOT SUSCEPTIBLE TO MODERN WEAPONS OR CYBER ATTACKS

The ability to carry out a mission with a combat submarine on the other side of the world within 24 hours has now become a reality with the NEYK N3 built by Ocean Submarine. The world's most manoeuvrable submarine features state-of-the-art-technology that allows it to complete missions even when faced with cyber-attacks.

"Modern weapons have entirely changed warfare," said Ocean Submarine CEO, Martin van Eijk. "Superiority is no longer assured for the party with the largest army; small manoeuvrable teams with tactical weapons are far more effective. This fact has been underlined by the recent destruction of the Russian flagship Moskva by two Neptune anti-ship missiles in the conflict with Ukraine."

It is exactly these kinds of scenarios that lay behind Ocean Submarine's decision to develop a compact submarine that has significant benefits over conventional vessels. "The NEYK is smaller but carries full equipment and weapon systems," added Van Eijk. "It can do anything that current submarines can and yet its crew only consists of 12 members. This means you need five times fewer people to operate one full submarine."

Ocean Submarine developed the NEYK N3 specifically to monitor or eliminate enemy targets, such as radar stations, rocket installations and command posts, unobserved. Thanks to its excellent stealth properties and extremely low noise profile, the submarine can also be used to land a team of Navy Seals undetected without the risk of being eliminated by modern weapon systems.

CYBER-ATTACK

"Even when cyber-attacks disrupt radio signals and make electronic equipment unusable, the NEYK N3 will continue to perform its tasks," explained Van Eijk. "Two independent systems are fitted to make this possible so the submarine doesn't rely on electronic equipment like the periscope, radar, sonar, sensors



» NEYK N3 Combat Submarine can be used worldwide within 24 hours thanks to air transport. (Image credit: Ocean Submarine)

and monitors. Where current submarines go blind, this will not be the case with the NEYK N3 thanks to its large pressure-resistant spherical dome. This 'glass cockpit' allows pilots to monitor other vessels and aircraft and respond quickly."

SPECIFICATIONS

The NEYK N3 Combat Submarine has a robust design with a length of 19 meters (63 ft) to 22 meters (73 ft) and excellent stealth properties. The electromotors are placed outside the pressure hull and power the propeller directly, producing a very low sound profile. The submarine can also turn on its axis in just seconds by switching the electromotors to the opposite direction. This allows the sub to avoid acute threats and launch torpedoes many times faster to eliminate hostile targets. In addition, the NEYK N3 can travel far longer distances underwater than conventional submarines thanks to its exceptional design, larger diving rudders and innovative energy supply solution. Moreover, it has a standard diving capacity of 300 meters (1,000 ft) which can be upgraded.

The NEYK N3 Combat Submarine can be equipped with various weapon systems. The primary and secondary systems are very versatile, featuring two launching tubes for all types of torpedoes, mines and missiles, and they can be equipped with various types of defence weapons. Patrol and attack missions consist of the standard payload 2 bow heavy-weight torpedoes plus optional additional payload of 8 flank torpedoes. The supersonic anti-ship missiles onboard can reach a speed of 0.75 Mach (900 km/h). Flying just above sea level, hostile radar systems will have no chance to eliminate these missiles, further ensuring their target precision.





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Underwater Minerals Conference

St. Petersburg, FL » October 2-7

<https://www.underwaterminerals.org/>

IWCS Cable & Connectivity Forum

Providence, RI » October 10-13

<https://iwcs.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/>

Offshore Wind Executive Summi

Galveston, TX » November 8

<https://www.offshorewindsummit.com/>

Floating Wind USA

San Francisco, CA » November 8-9

<https://events.reutersevents.com/renewable-energy/floating-wind-usa>

TMA BlueTech Week

San Diego, CA » November 14-18

<https://www.tmabluetech.org/bluetech-week>

EUROPE

Offshore Northern Seas (ONS)

Stavanger, Norway

» August 29 - September 1

<https://www.ons.no/>

Offshore Wind Power Substations

Bremen, Germany

» August 30 - September 1

<https://www.iqpc.com/events-offshore-windpower-substations>

Gastech

Fiera Milano, Italy

» September 5-8

<https://www.gastechevent.com>

Floating Offshore Wind

Aberdeen, UK » October 12-13

<https://events.renewableuk.com/fow22-overview>

ICOE - OEE

Basque Country, Spain

» October 18-20

<https://icoeoe2022donostia.org>

Deep Sea Minerals

Bergen, Norway » October 26-27

<https://events.geonova.no/event/deepseaminerals/>

Offshore & Floating Wind Europe

London, UK » November 2-3

<https://events.reutersevents.com/renewable-energy/offshore-floating-wind-europe>

Offshore Energy

Amsterdam, The Netherlands

» November 29-30

<https://www.offshore-energy.biz/offshore-energy-2022/>

Wind Power Finance & Investment Summit

New York, NY » October 4-5

<https://www.windfinanceusa.com/>

OTHER REGIONS

Submarine Networks World

Singapore » September 7-8

<https://www.terrapinn.com/conference/submarine-networks-world>

Asia-Pacific Decommissioning & Abandonment

Kuala Lumpur, Malaysia » October 4-5

<https://offsnet.com/da-apac>

Mediterranean Offshore Conference

Alexandria, Egypt » October 18-20

www.moc-egypt.com

ADIPEC

Abu Dhabi

» October 31 - November 3

<https://www.adippec.com/>

Telecoms World Asia

Bangkok, Thailand » November 2-3

<https://www.terrapinn.com/conference/telecoms-world-asia/index.stm>

Asia-Pacific Deep Sea Mining Summit

Singapore » December 2022

<https://www.asia.deepsea-mining-summit.com/>

IEEE Underwater Technology

Tokyo, Japan » March 6-9, 2023

https://conferences.ieee.org/conferences_events/conferences/conferencedetails/49729

SubOptic

Bangkok, Thailand » March 13-16, 2023

<https://www.terrapinn.com/exhibition/suboptic/>

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 Seanergy / June 15-17	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 Offshore Northern Seas / August 29-September 1	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, geo-technical technologies
SEPTEMBER Editorial: Aug. 22 Ad: Sep. 08	» Artificial Intelligence & Remote Marine Operations Offshore Energy / November 29-30 ACP WINDPOWER / October 18-19 ICOE/OEE / October 18-20	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 Oceanology Int'l Americas / February 14-16	Content Focus: Special Edition

DEEPOCEAN, SOLSTAD OFFSHORE AND ØSTENSJØ TEAM UP IN REMOTE OPERATIONS VENTURE

DeepOcean, Solstad Offshore and Østensjø Group have joined forces to fast-track the adoption of remotely managed services in order to drive down operating costs and emissions for the marine and offshore industries.

The three partners have established two joint ventures (JVs) to support the remote operations drive. One of the JVs, named Remota AS, will own and operate advanced onshore Remote Operations Centers, while the other JV will develop, own and operate unmanned surface vehicles (USVs).

"This is about taking the current experience, track record and technology and bring it to a bigger scale, thereby making it a more powerful offering to the ocean-based industries. Remota will have operations and turnover from day one, and we will immediately double the support capacity at the Remote Operations Center in Haugesund," said Øyvind Mikaelsen, CEO of DeepOcean.

The new partnership aims to challenge the offshore energy industry needs in terms of efficiency and enables a sustainable green energy transition. The first Remote Operations Center is fully operational, and with the addition of USVs the partnership has big advantages both on the cost and emissions side.

"Remote operations are key to unlocking huge emission reductions and cost savings from the marine and offshore industries. The new joint ventures aim to fast-track the adoption of new remote technologies, which in turn will make ocean-based industries even more sustainable," said Håvard Framnes, Investment Director of Østensjø.

The three partners will each own 33.33 percent in the two JVs that will own and operate the Remote Operations Centers and the USVs.

Remote Operations Center

The JV that owns the Remote Operations Center is called Remota AS and will be led by Sveinung Soma.

"With our unique Remote Operations Center and the backing of three leading international supplier companies, we believe that Remota can offer customers a world leading remote offering for marine and subsea operations. I genuinely believe it can transform how traditional ocean-based industries approach their offshore work," said Sveinung Soma, CEO of Remota.

Remota will offer remote operations and semi-autonomous maritime services to existing vessels, remote operations of remotely operated vehicles (ROVs) and USVs. In addition, the company's first Remote Operations Center will function as a control center for drone technologies.

Today the center operates DeepOcean's ROVs from Haugesund, Norway, and has been in operation since 2019. The Remote Operations Center has already remotely managed a significant amount of ROV operations in European waters, supporting clients with subsea installations in addition to inspection, maintenance, and repair (IMR) campaigns.

"Solstad, DeepOcean and Østensjø already have the technologies, competence, and assets in place, but teaming up will further enhance the capacity, growth prospects and market penetration of our remote operations offering. Operators of offshore energy assets have challenged the supplier industry to deliver even more cost-efficient services. This is our response," said Lars Peder Solstad, CEO of Solstad Offshore.

The center will operate independently of its three owners and offer its services to all operators, vessel owners and service companies worldwide. The center will initially offer its services to offshore shipping companies and ROV-operators



» (L-R) Sveinung Soma, Håvard Framnes, Øyvind Mikaelsen and Kjetil Ramstad

but aims to expand its service offering to other industries as well.

Unmanned vessels

In addition to the Remote Operations Center, the three companies will establish USV AS, a separate company for investing in USVs equipped with an WROV (Work-Class ROV) onboard. This type of vessel is capable of considerably reducing operating expenses compared to conventional vessels that are utilized for subsea inspection, maintenance, and repair work.

The concept of unmanned vessels contributes to all aspects of sustainable maritime operations and can be one way of fast-tracking the green transition within the industry. By enabling more efficient operations, slower sailing speeds and significantly reduced operating costs, it is not only sustainable in terms of reduced environmental footprint, but also in economic and social terms.

The USV technology has been developed by JV-partner DeepOcean, and the two other partners have been involved in the final stage of the development. It is estimated that the USV solution can reduce CO2 emissions by more than 90 percent compared to a conventional offshore vessel when conducting subsea operations.

"By introducing USVs, we are moving the captain onshore who will remain in control over the offshore operations. This is an excellent way of reducing cost and the CO2 footprint. By limiting personnel exposure to offshore operations, this also introduces a brand new safety aspect. It also represents a significant business potential for the JV," added Øyvind Mikaelsen of DeepOcean.

BiSN CELEBRATES MILESTONE WITH 300TH DEPLOYMENT WORLDWIDE TO SOLVE DOWNHOLE FLOW ISSUES

BiSN, a leading supplier of sealing solutions and technology to the global oil and gas industry, announced that it has completed its 300th deployment, helping operators around the world to effectively solve common downhole flow issues.

These operations, which were carried out on six continents, from Alaska to Australia, across The Americas, Europe, the Middle East, Africa and South Asia, took place in a range of challenging conditions. For every job, the BiSN team rose to the occasion, regardless of location, well deviation or type of well: onshore, offshore, high temperature or high pressure.

By providing critical production enhancement, intervention, completion, and plug and abandonment services using its patented Wel-lok™ sealing technology, BiSN reduced costs, improved production, and dramatically extended the life of hundreds of wells.

Sealing solution forms gas tight (v0) seal

How do they achieve this? Traditional sealing practices in downhole technology typically involve using unreliable elastomer and cement solutions that are not easy to apply or environmentally-friendly. By working with specially developed chemical reaction heaters to carefully melt unique bismuth-based eutectic alloys into plugs, BiSN developed its Wel-lok technology to create a bismuth plug that is not only safer, but much more reliable and easier to deploy. It makes it possible to form a gas tight (v0) seal and with a density that is 10 times higher than water it effectively displaces all wellbore fluids.

Deep, varied experience in the field

Paul Carragher, CEO of BiSN said: "As operators strive to address downhole flow issues safely, increasing production while reducing costs, we have made it our mission to help them achieve this. We have the extensive real-world experience in applying this method. As a result of carrying out more than 300 deployments globally, we know how to successfully use our technology to complete operations aimed at enhancing production, completions, plug and abandonment, and intervention. These jobs represent operations carried out for many repeat customers, illustrating the value and confidence they continue to place in our work."

To help operators tackle complex challenges downhole, BiSN draws upon its varied experience and services. These range from shutting off water production and isolating zones to setting a gas-tight plug, repairing damaged casing or tubing, and permanently sealing multiple annuli, among others.

The road ahead

While the company continues to provide downhole sealing solutions to new and existing customers in the US, Canada and

Australia, BiSN is actively expanding in Europe and Africa. The recent opening of its office in Aberdeen, Scotland and recruiting campaign are critical arms of this plan to become the leading supplier of downhole sealing solutions to the global oil and gas industry.



» BiSN's patented Wel-lok™ sealing technology helps reduce costs, improve production, and dramatically extend the life of wells. (Photo credit: BiSN)

SMD AND VAN OORD ENTERS INTO NEW PARTNERSHIP

In a bid to reduce downtime and improve efficiencies, world-leading subsea robotics design and manufacturing specialists, Soil Machine Dynamics (SMD) has entered into a parts and services framework agreement with marine contractor, Van Oord.

The partnership will see both companies sharing industry insight and knowledge to work together to radically change the way traditional customers, vendors and original equipment manufacturers (OEMs) work together.

Founded over 50 years ago, SMD has been a key player in booming industries such as telecoms and more recently, offshore wind. It has established a stellar reputation of designing and building



pioneering machines as well as delivering exceptional technical support. This step change into framework agreements is the beginning of a new service-led approach to complement its core business.

Liam Forbes, general manager of services at SMD, said: "Van Oord is one of the most progressive businesses we have had the pleasure of working with, it understands the need to think outside the box in order to stay ahead of the curve."

Rob Eddon, Key Account Manager at SMD was instrumental in setting up the agreement: "The three-year agreement means Van Oord can access SMD's OEM expertise, a set price list of all parts and services and 24/7 worldwide technical support. This will vastly reduce the cost and the time it takes to purchase, modify or repair parts.

"SMD delivered the Dig-It and Deep Dig-It trenchers to Van Oord in 2018 and 2019 respectively, any modifications or repairs they may need will now be conducted directly with our team whether that is routine maintenance or in an emergency situation. This new arrangement marks the start of a new era for SMD and should make the whole procurement process a lot more streamlined and improve industry processes now and in the future."

Van Oord Procurement Category Manager Jorn Bertens added: "Over the past few years we have been working together to see what improvements can be made within procurement, in alignment with our business unit for offshore wind, we came up with solutions to optimize the uptime of our equipment and to pave a path to a sustainable future. We discussed at length with key people at SMD how to create a partnership that is mutually beneficial and will eventually improve the industry as a whole and work jointly on sustainable solutions."

» New parts and services framework agreement will reduce the cost and time to purchase, modify or repair parts. (Photo credit: SMD)

OCEANWISE AWARDED SCOTTISH GOVERNMENT GIS MARINE DATA CONTRACT

OceanWise Limited, a global provider of marine and coastal mapping services, has been awarded a framework agreement for the provision of GIS Marine Data to the Scottish Government until 2026.

Janet Lockey, Key Account Manager for OceanWise said: "We are really pleased to be supplying our range of Marine Mapping Data products and services to the Scottish Public Sector, including Scottish Government, 6 public bodies and 15 local authorities. We have been working with this important customer for many years now and have built up a great relationship with those involved. We will be providing not only our flagship product 'Marine Themes Vector' but also our Marine Themes Digital Elevation Model (DEM), full range of Raster Charts and our Web Map Service."

The marine GIS framework feeds essential resources such as Marine Scotland Information (MSI) a "web portal that provides

access to descriptions and information about the Scottish marine environment while providing links to datasets and map resources that are made available by Marine Scotland and Partners."



BUREAU VERITAS AWARDS AIP TO THE MANTA, AN INNOVATIVE CLEAN UP VESSEL

Bureau Veritas, a world leader in testing, inspection, and certification, has awarded an Approval in Principle (AiP) to the MANTA, a pioneering vessel offering solutions for collecting and repurposing floating plastic waste in areas of high marine litter concentration, in the coastal waters of most affected countries and near the estuaries of major rivers.

This unique vessel, due to set sail at the end of 2025, was developed by MANTA INNOVATION, the integrated engineering design office of the NGO The SeaCleaners, with the support of naval architects at SHIP-ST and LMG MARIN.

The 56-m long MANTA will be equipped with an on-board factory including a waste-to-energy conversion unit. The vessel will be the first concentrated ecology and technology factory ship capable of collecting and processing floating ocean waste en masse before it gets fragmented, starts to drift, and penetrates the marine ecosystem in the long term.

The MANTA will be powered by a combination of renewable energy technologies to minimize its carbon footprint and achieve 50 to 75% energy autonomy. It will also serve as a state-of-the-art scientific laboratory for the observation, analysis and



» MANTA will be equipped with a waste-to-energy conversion unit.
(Image credit: SYNTHES3D for THE SEACLEANERS)

understanding of ocean plastic pollution and as an educational platform open to the public.

Bureau Veritas reviewed the overall structure, stability, and security plans of the MANTA, based on risk mitigation around new technologies and requirements.

Yvan Bourgnon, President & Founder, The SeaCleaners, commented: "This represents a major milestone for us and shows the solidity of our approach to tackle plastic pollution as we are about to enter a new development phase of the MANTA with the upcoming launch of the Call for Tenders to shipyards. More than 45,000 hours of study & development, involving 60+ engineers, technicians and researchers have led to this endorsement."

OCEAN FLOOR GEOPHYSICS COMPLETES ACQUISITION OF NCS SUBSEA

Ocean Floor Geophysics, Inc (OFG) has completed its acquisition of NCS SubSea, which provides ultra-high resolution 3D seismic data to the oil and gas and new energy markets via their market-leading P-Cable system.

With the addition of P-Cable technology, OFG now provides the broadest range of marine geophysical data technology and services available in the offshore market today, offering the widest range of sensor solutions from surface, AUV and ROV platforms, combined with unique multiphysics processing, integration, and interpretation capabilities.

OFG was assisted in this transaction by PGS, OFG's

largest shareholder and strengthens the strategic alignment collaboration between OFG and PGS. The PGS New Energy group, which services markets including carbon capture and storage (CCS), renewables (wind farms) and seabed minerals, works closely with OFG as a preferred supplier of ultra-high-resolution seismic, CSEM, magnetic and acoustic surveying products and services.

"OFG is delighted to complete the acquisition of NCS and its P-Cable ultra-high resolution 3D seismic technology. We have seen a significant market interest in P-Cable over the past few months in both traditional oil and gas markets for shallow imaging of

reservoirs and geohazards, as well as in new energy markets, particularly for offshore wind surveys. We look forward to offering P-Cable products and services to existing and new customers," said Matthew Kowalczyk, CEO of OFG.

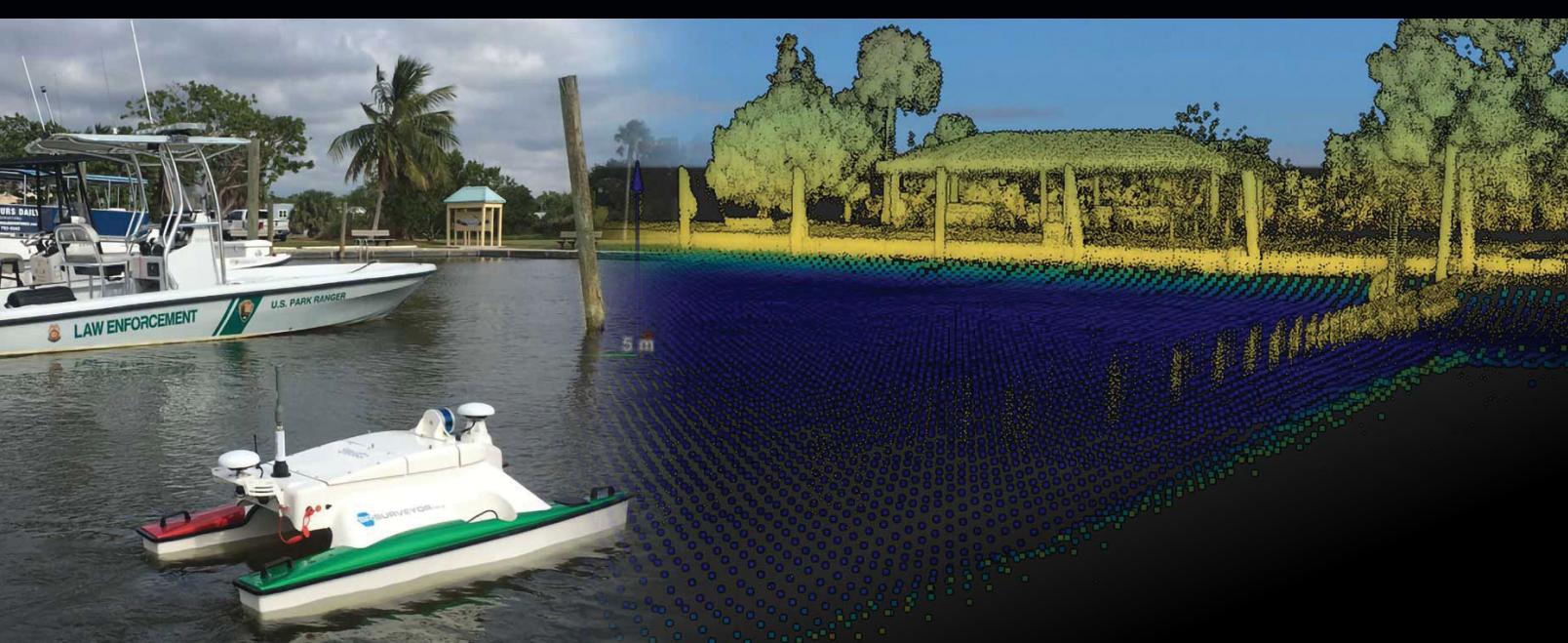
"This transaction further strengthens the PGS-OFG

partnership and expands our combined offering within conventional and New Energy markets. We are building OFG to be a preferred provider of marine site characterization and asset integrity services," added Artem Lytkin, Vice President at PGS New Energy and an Executive Chairman of OFG.

OFG Ocean Floor Geophysics

OFG, in partnership with PGS, completes the acquisition of NCS SubSea, the owner and operator of P-Cable ultra-high resolution seismic acquisition technology

A diagram showing various types of seismic source arrays, including surface, AUV, and ROV platforms.



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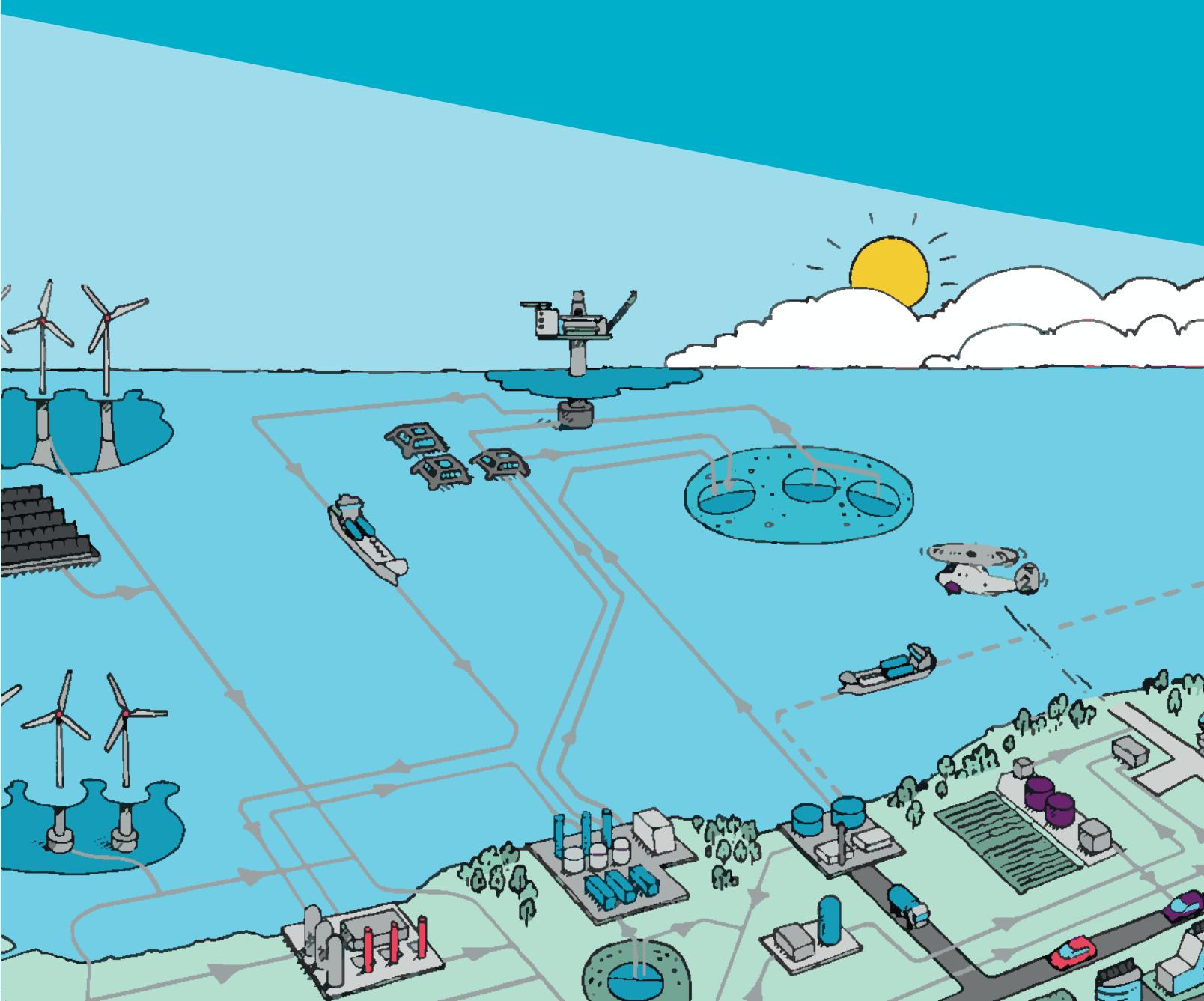


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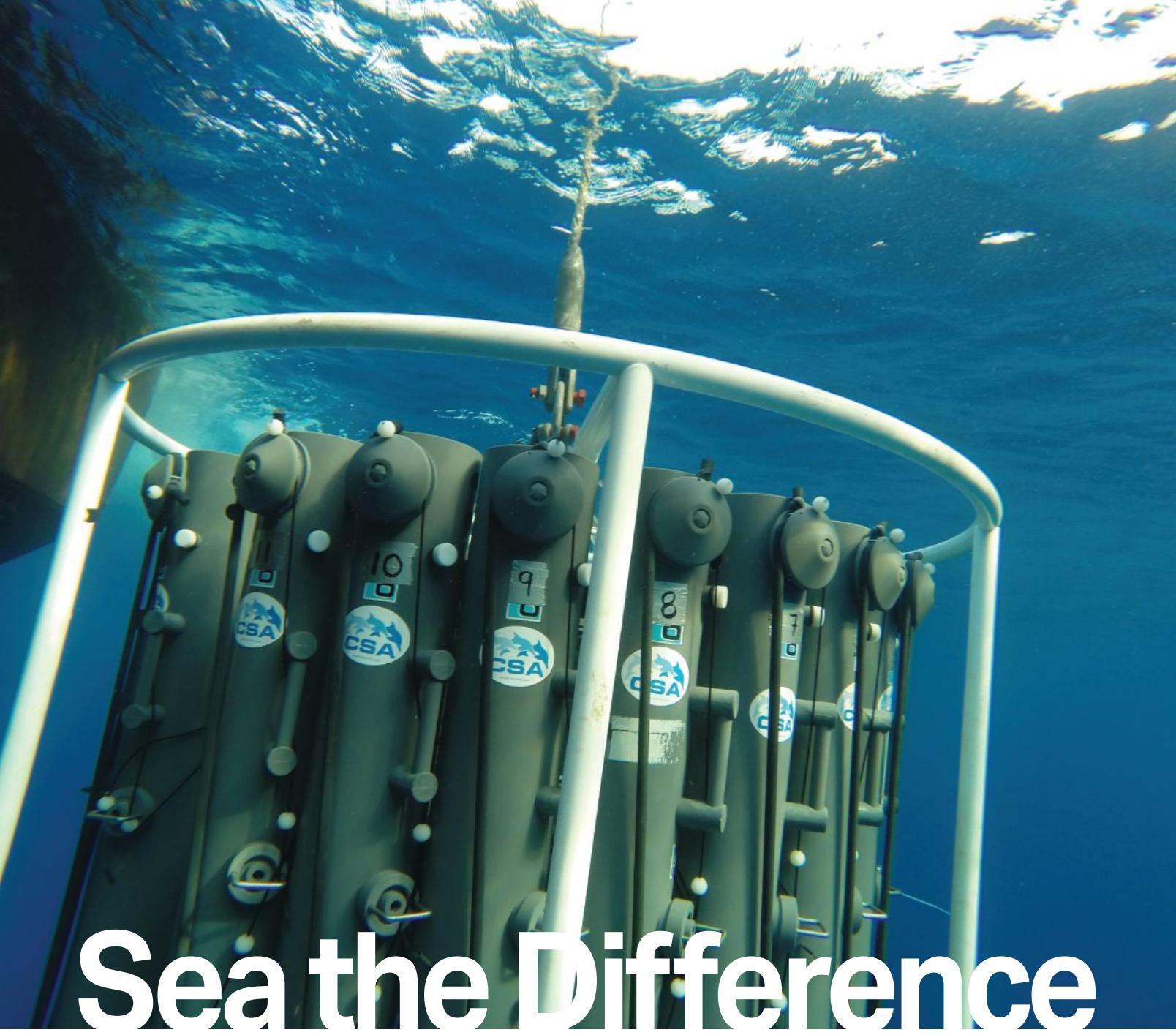
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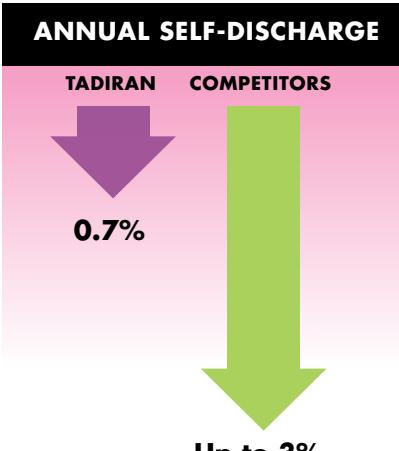


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