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21ST CENTURY MARINE SURVEY

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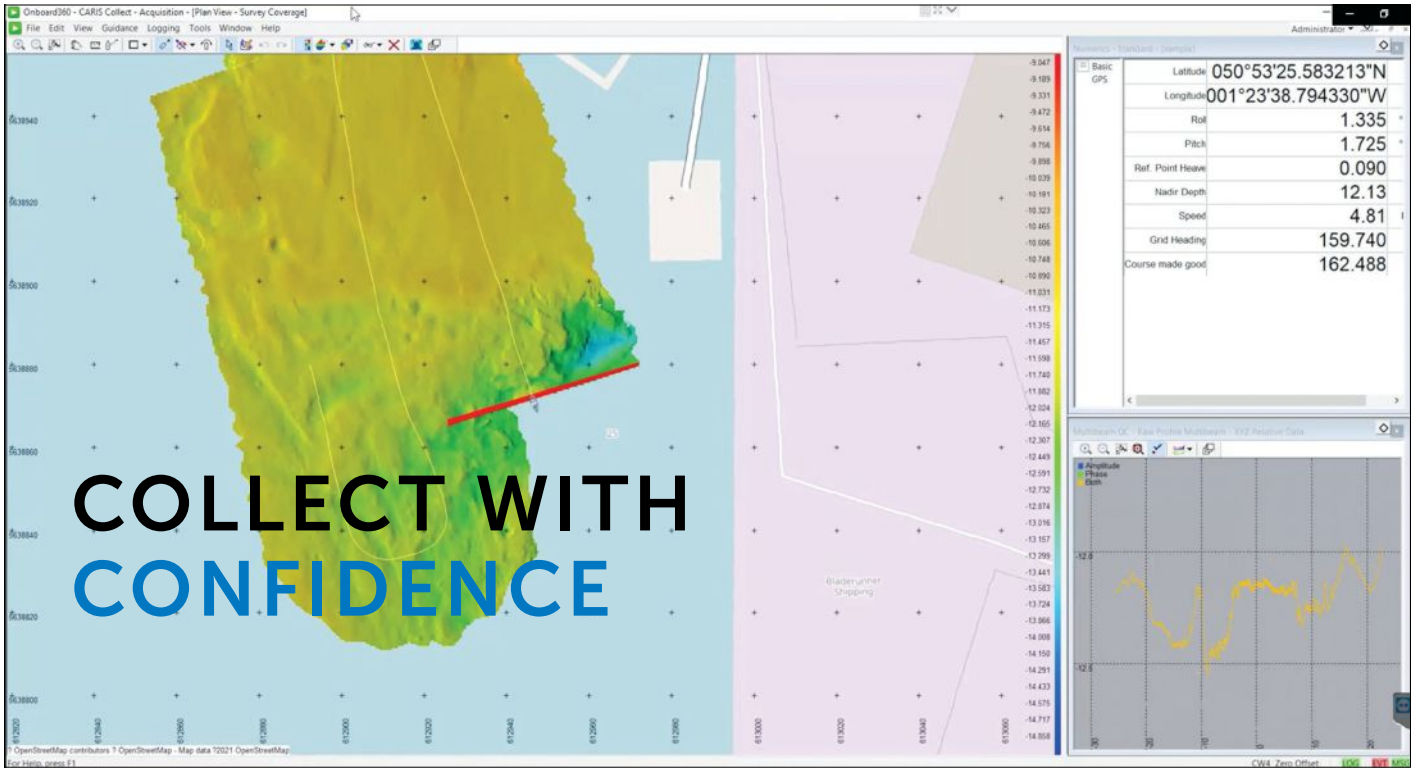

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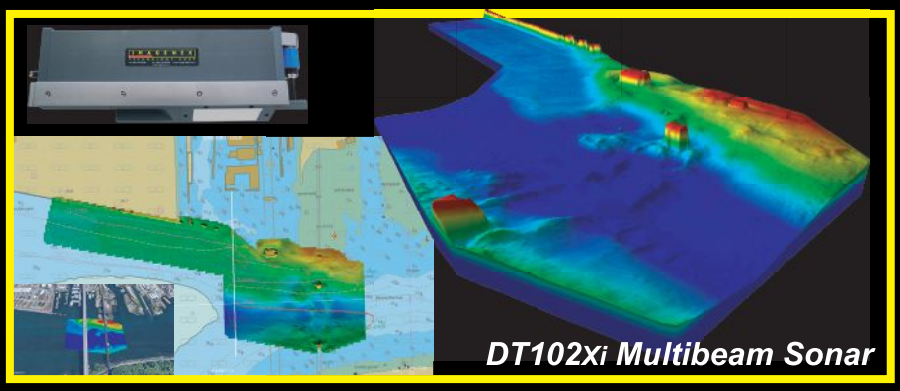

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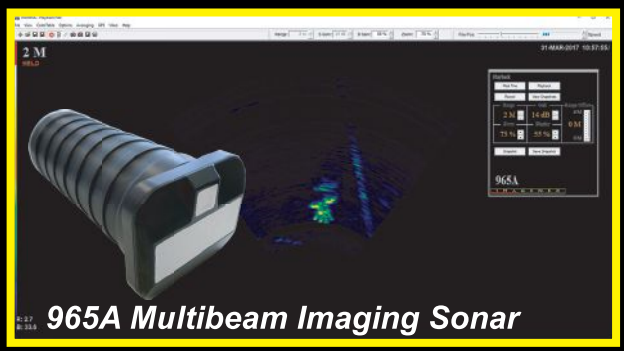

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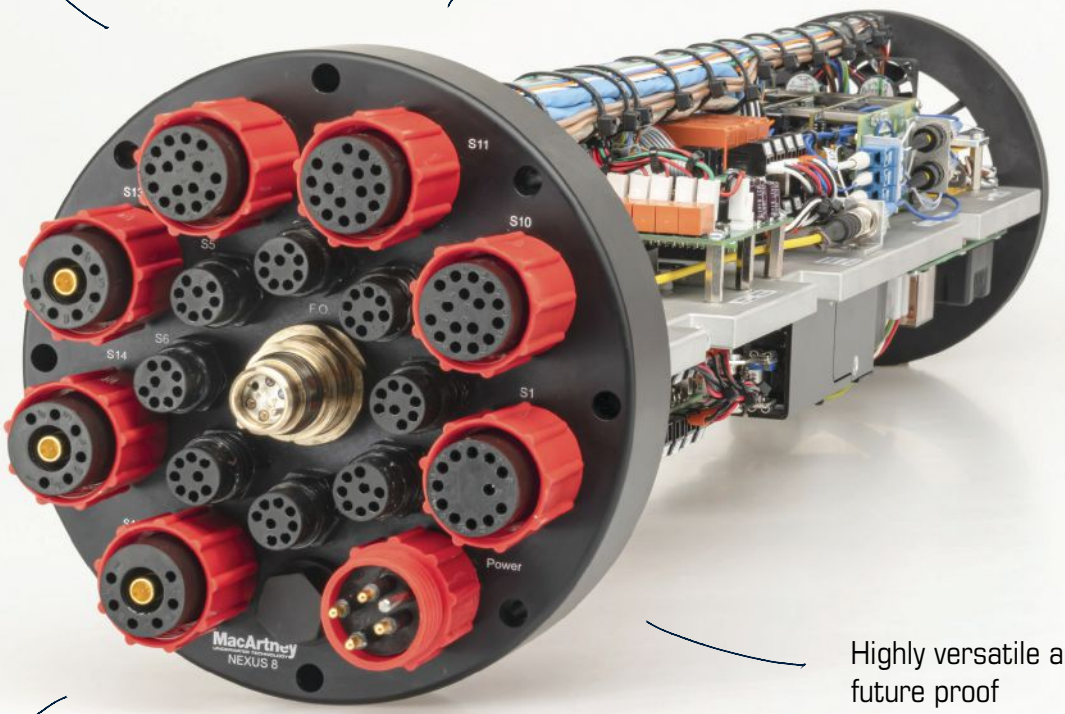

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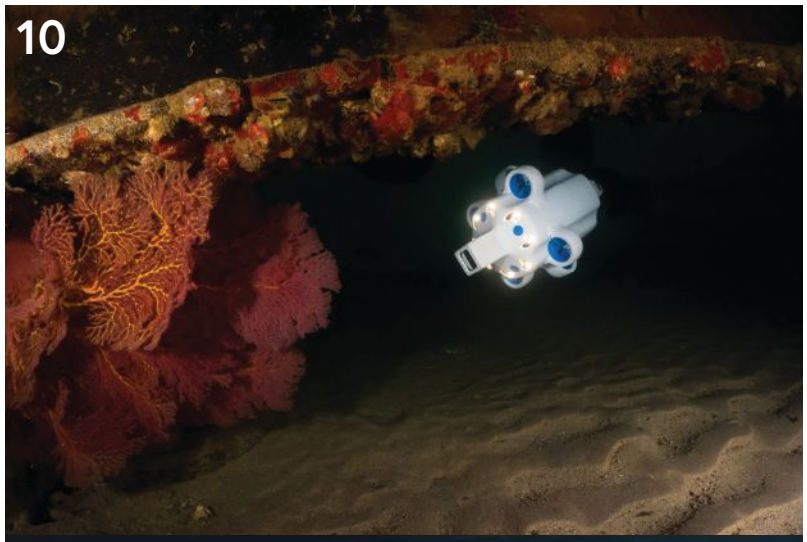

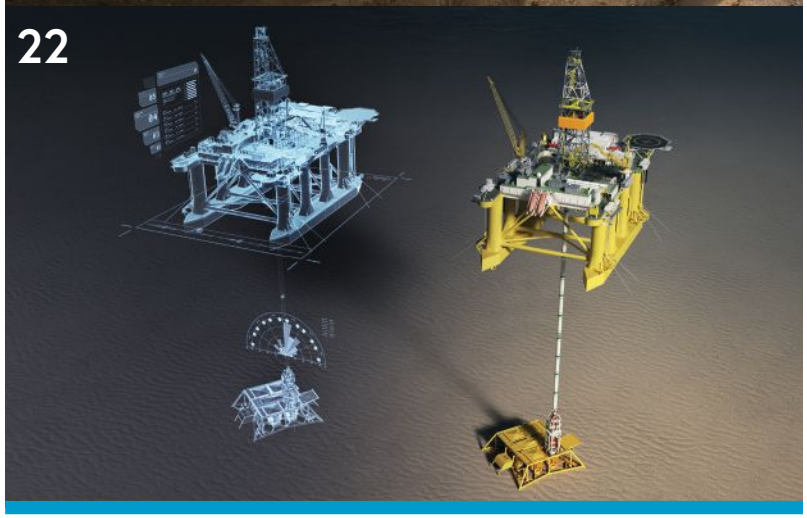

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ON THE COVER:
Hydrus, Advanced Navigation's new and fully autonomous micro-AUV, offers operators an easy-to-use and cost-effective platform for surveying shallow and mid-depth waters. (Photo credit: Advanced Navigation)

[WITH THANKS - Ed.]

From revolutionary micro-AUVs to enhanced digital twin technology and the advent of submarine SMART cables, March's ON&T showcases the very latest products and services fueling the rapid transformation of 21st century marine survey.

Our thanks, as always, go to our exclusive editorial —which this month includes Advanced Navigation, 4Subsea, Subsea Data Systems, and Sonardyne—for their expert opinion, insight, and dedication to designing, developing, and fielding the latest innovations in ocean technology.

In April our attention turns to the pressing matter of Green Energy. Happy reading!

Ed Keenan

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THE RAPID EVOLUTION OF MARINE SURVEY

By Jim Gardiner,
Valeport Research Scientist

As we continue our journey through the third decade of the 21st century, it is curious to think what a hydrographic surveyor or oceanographer from 100 years ago would make of the array of technology now at our fingertips.

Perhaps there would be more familiarity than you might first think—while the use of sound as a distance measuring tool underwater was still in its relative infancy back then, an early echosounder was successfully used to help select the route of a telegraph cable between France and Algeria in 1922.

Now, modern multi-beam echosounders produce tens of thousands of globally positioned depth measurements every second over wide swathes, 3D imaging sonars allow operations in zero visibility, we can position multiple moving or fixed objects underwater, and communicate with underwater vehicles and sensors using acoustic modems. It is, however, important to note that accurate and timely measurements of the sound speed structure through the water column are critical to any acoustic technology and this presents its own set of challenges as we move into the autonomous era.

ACCESS TO DATA FUELS PROGRESS

Our understanding of the structure of the world's oceans and the interactions between the atmosphere and bodies of water has been greatly assisted by the ability to make readings of temperature, salinity, sound speed and biogeochemical parameters at depth using sensors that can be fitted to moving vessels, underway winches, autonomous underwater vehicles, and even diving marine predators.

The ease and speed by which a position on the surface can now be obtained, even embedded into handheld instruments, in any conditions would likely mystify a surveyor working before even the first artificial satellite was launched. The accuracy of the positions obtained would simply not be believed, but again at least some of the underlying concepts might well have been heard of—a prototype radio direction finding system was installed on a vessel in 1906, the first use of radio navigation by an aircraft was in 1920.

Since then, we have seen countless stages of evolution including DECCA-Navigator, Syledis, MicroFix and Trisponder before the deployment of the Global Positioning System and the issue of Selective Availability that led to surveyors developing differential positioning techniques and modern real-time kinematic positioning and the correction services available today.

A NEW ERA OF MARINE SURVEY

Our platforms for surveying have also changed dramatically. We can map clear waters using aircraft fitted with LiDAR; search for unexploded ordnance, mines and munitions without risk to personnel using vessels controlled from over the horizon; send unmanned vehicles under the Antarctic ice; collect co-registered survey data using robot vessels operated from an office on the other side of the world; and even use data collected by members of the general marine community to help fill in the gaps in our understanding of the seabed and the waters of our planet.

Our research and survey vessels now have a bewildering array of available hydrographic, oceanographic, and geophysical sensing tools as well as being able to host a variety of robotic or autonomous systems.

Hopefully the hydrographer or oceanographer from 1922 would be both proud and amazed at how far we have come, and will wish us well as we continue to push the boundaries of what is possible as we move into the era of autonomy.

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A MICRO-AUV SET TO REVOLUTIONIZE UNDERWATER SURVEY

By Simon Harris
Marketing Content Writer, Advanced Navigation

Underwater survey has traditionally been a highly specialized realm. Technologies have improved to bring levels of automation to it and, in some scenarios, very successfully. This is particularly the case for large scale seabed surveys using side-scan sonar AUVs. Tethered ROVs have brought motion control and flexibility to shallower depths, however, with the limitations of requiring expert human pilots and an umbilical cord. These methods are logistically complex and very expensive and so require a better solution.

As an example of convergent technologies that have culminated in a step change within an industry, we can look at aerial drones. Their commercialization had expensive, specialist beginnings, however, now is accessible enough for many users to take advantage of. New applications that harness the efficiency, cost-effectiveness, and safety of this platform continue emerging.

"We have seen a revolution occur in the aerial drone market, where smaller, easy to use drones have opened new opportunities in applications previously restricted by cost. Hydrus intends to offer the same accessibility to the underwater world," according to Xavier Orr, Advanced Navigation CEO.

UNDERWATER DRONE REVOLUTION

Advanced Navigation is heralding an underwater "drone revolution" with Hydrus—an affordable and easy-to-use micro-AUV.

Why is it revolutionary? Hydrus turns the traditional means of photographic survey in shallow and mid-depth water on its head. Prior to Hydrus, users would likely need to organize a survey months ahead. This may entail hiring contractors to provide and operate one or more appropriate ROVs. A surface vessel, usually large and fitted with appropriate lifting equipment, plus crew. Logistics minimally include organizing crews and professional divers, clearances, insurance, equipment to be available at the same place and time and supporting ancillaries and consumables.

The list is long, and the cost builds rapidly, as does the carbon footprint. Bad weather or unforeseen events can scuttle plans and cause major pain

» *Obstacle avoidance enables navigating complex features without environmental damage. (Photo credit: Advanced Navigation)*

and financial loss. For organizations with a limited budget, this either breaks the deal or prevents participation altogether.

Environmental restrictions are also legion. Surveying in sensitive habitats and conservation sites may prohibit or restrict how current equipment can be deployed. Shallow water, lakes, or ice can also introduce additional operational expenditure to a project. These conditions, even places previously deemed inaccessible, present little problem to Hydrus.

Hydrus offers unprecedented accessibility, simplicity and minimal operational expenses. Its full autonomy, mission-based platform and inherent safety are class leading. Hydrus will allow marine researchers, environmental and conservation organizations as well as many existing ocean-based businesses and industries to be more efficient, cost-effective, and competitive. Underwater survey is traditionally difficult to undertake, logistically complex, and often inflexible. Hydrus changes that and blurs the lines that have previously made this technology exclusive to big budget operators.

To put this into context, a single person equipped with Hydrus and a laptop can perform a meaningful survey.

A ROBOT BEHIND THE LENS

Hydrus provides an eminent image-based survey solution via its in-built, cinema grade underwater camera. Artificial intelligence processing and learning is applied for constant, real-time image optimization and compensation for light fluctuation and turbidity. A high frame rate system is used to capture rapid movement and enhances machine vision capability. Image capture is deeply integrated with the navigation apparatus to natively geo-reference every image taken. Still image resolution is 12MP, with 4k 60fps video—both can be captured simultaneously.

For consistent lighting, multi-point illumination provides true-color regardless of depth and available spectrum, delivering consistent, detailed images. Focal length is controlled by acoustic ranging in the same plane as the camera, so Hydrus is always positioned at the correct distance during image capture.

In summary, Hydrus provides high-quality, geo-referenced imagery, autonomously.

» *Inspection of structures and footings is simple and repeatable. (Photo credit: Advanced Navigation)*

HYDRUS: REVOLUTIONARY DNA

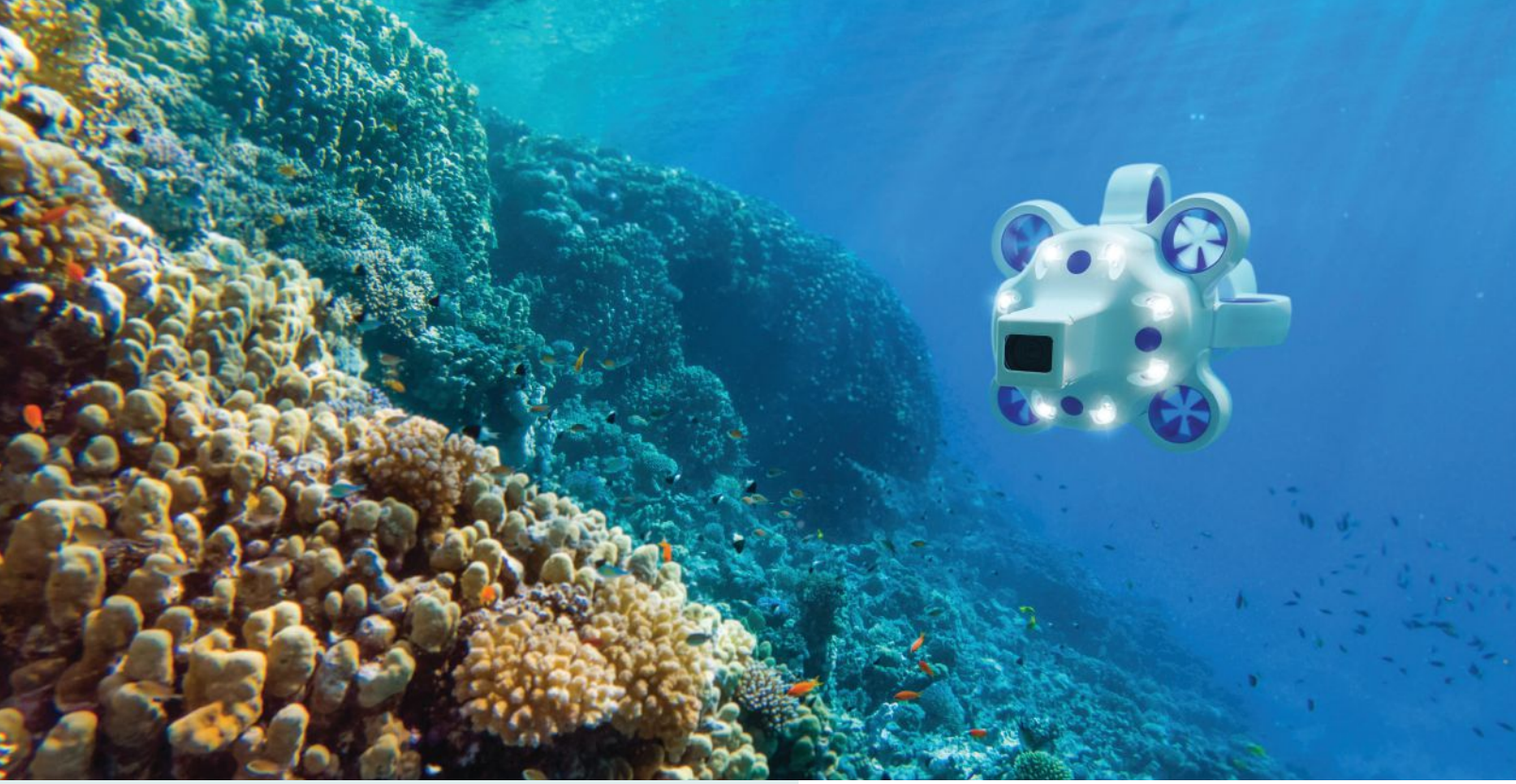
There are many parties interested in having eyes underwater that need a simple solution to a complex, expensive problem. Advanced Navigation recognized this need and conquered extensive engineering challenges to create a unique AUV that can be considered a self-contained survey team.

Hydrus represents a leap forward in expanding Advanced Navigation's expertise in inertial and acoustic navigation and converging them with sophisticated motion control and image capture. To achieve true autonomy in a package that meets market requirements, the engineering teams had to synthesize artificial intelligence processing with micro-electronics and innovative mechanical design. The challenge underpinning the design of Hydrus was to offer unparalleled performance and capability, with maximum portability.

Hydrus uses 3D coordinate mission plans to determine travel path, way points, and depth. The INS is tightly coupled to the DVL for following mission trajectory, regulating vehicle speed and maintaining distance from seabed and other objects. The AI assisted INS can "learn" mission conditions and attenuate vehicle movement to maintain position accuracy.

Optional Subsonus USBL positioning can provide additional navigation precision via a surface mounted GNSS Compass antenna. Hydrus is a scalable system, so several units can be deployed simultaneously, which will vastly improve large scale inspection campaigns. It also supports "solo" operation and has an in-built GNSS receiver that can provide an initial fix when the unit is at the surface—navigation from that point is fully autonomous.

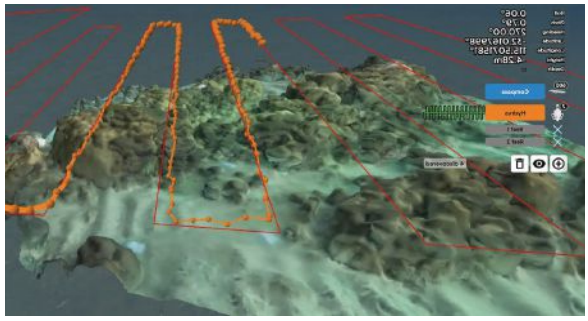
Two thruster arrays, at 90° orientation, provide omnidirectional movement. The impellers are hubless to be effective against obstruction by seaweed, rope etc. This overcomes a common problem with axle type units that are prone to jamming. The thrusters are used in varying combinations, speeds and rotational direction for "hovering" and stability against drift—this can be a major hurdle for other underwater vehicles that require constant manual interaction or must remain in full-time motion.



» *Extreme compactness and maneuverability are ideal for surveying delicate habitats. (Photo credit: Advanced Navigation)*

Obstacle avoidance is critical to protect delicate habitats, archeological features and sensitive objects and equipment. Hydrus multi-point and wide-angle DVL can detect objects from almost any direction and automatically adjusts vehicle trajectory to prevent collisions without deviating from the planned mission.

Data retrieval is conducted post-mission using out-of-water WiFi or in-water optical modem and can be imported into GIS (graphic information system) or post-processing software for generating Structure from Motion (SfM) 3D mesh objects. Users can wirelessly recharge Hydrus whilst transferring data to minimize mission changeover time. The micro-AUV is connectorless, with an aluminum and composite skeleton, and encapsulating polymer construction that is depth rated to 3,000 meters.

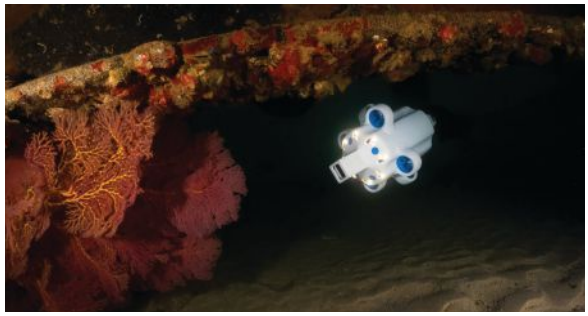


» *Hydrus mission planning software provides an intuitive, graphical interface. (Photo credit: Advanced Navigation)*

SYNERGIZING TECHNOLOGY & USABILITY

Keeping in theme of ultimate usability, Hydrus mission planning software is intuitive and requires no prior experience or training—users can deploy the robot "out of the box".

Operators can run payload software onboard, with direct access to the imaging, sensors and navigation system data. The processing capability is optimized for performing rapid AI driven automated object localization, classification, and analysis.

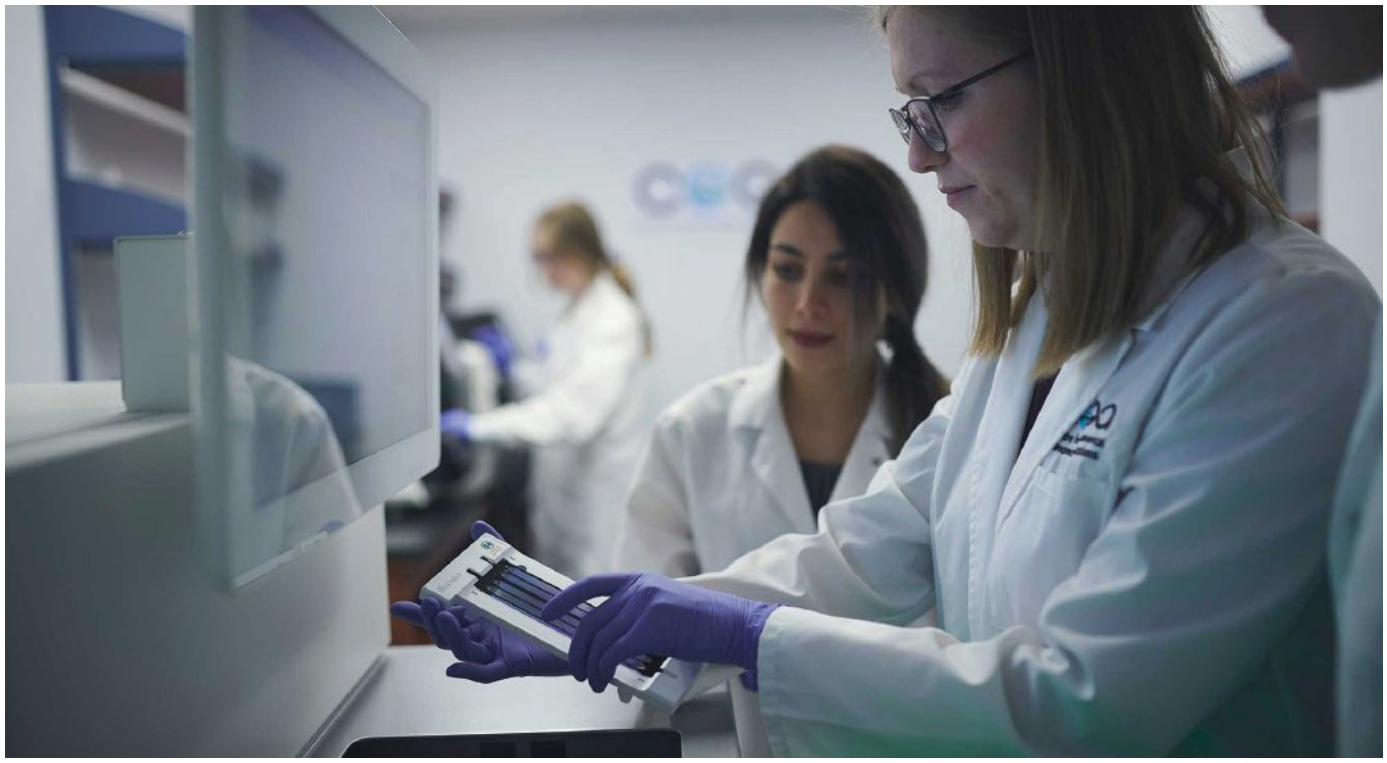


» *Smart illumination and 4k60fps camera capture vivid images. (Photo credit: Advanced Navigation)*

Hydrus brings full autonomy with the accessibility and affordability of the drone revolution into almost any underwater application. Its scope of application only begins with subsea survey and inspection. Hydrus is expected to bring unprecedented efficiency, safety, cost saving, and far simpler logistics to many interesting uses, including marine research and awareness, structural inspection, energy transition projects, habitat mapping, reef study, seagrass ground truth, biomass survey, and aquaculture, amongst many others.

ADVANCED NAVIGATION

To learn more, visit *www.advancednavigation.com*



» *eDNAtec and CEGA, its center of excellence, work collaboratively with clients and partners to develop eDNA products and services. (Photo credit: eDNAtec/CEGA)*

eDNATEC ADVANCES ENVIRONMENTAL GENOMICS STANDARDS WITH ISO CERTIFICATION

eDNAtec and its research center, the Centre for Environmental Genomics Applications (CEGA), headquartered in Newfoundland, has been certified to the ISO 9001:2015 standard of Quality Management System (QMS).

"We have always adhered to the highest standards of quality control and assurance at eDNAtec," said Dr. Mehrdad Hajibabaei, PhD, Founder and Chief Scientific Officer at eDNAtec. "But we also recognized that our clients and partners expect complete transparency in how we do that, and the ISO 9001:2015 certification fulfills this goal. I am proud of our team who worked tirelessly to achieve this important milestone during this challenging pandemic time."

International Consistency

The ISO (International Organization for Standardization) is a worldwide organization of member bodies that has developed QMS standards that are specific, measurable and consistent across international borders.

"Many of our clients have international profiles and the potential eDNA work scope—such as researching the impacts of climate change—could take us anywhere in the world," said eDNAtec CEO, Steve Barrett. "ISO 9001:2015 is the universal language of quality management and assurance that bridges borders and opens doors to new relationships and opportunities."

ISO 9001:2015 is built upon seven foundational principles that ensure stronger performance and better customer satisfaction, including engagement of people, customer focus, leadership, process approach, improvement, evidence-based decision making, and relationship management.

New Scientific Paradigm

eDNAtec and CEGA, its center of excellence, work collaboratively with clients and partners to develop eDNA products and services that enable industries, regulators or scientific organizations that require support for environmental stewardship or research purposes. Environmental assessments (EA) have traditionally relied on the collection and identification of organisms, which can be physically cumbersome and time-consuming.

"Our technologies represent a new scientific paradigm, in that we determine entire biodiversity in an ecosystem solely by collecting DNA samples from bulk samples such as water, soil or sediments," said Hajibabaei. "The whole process of collection and analysis of eDNA samples can be completed in a matter of days, not months."

To ensure repeatable and reliable quality results, eDNAtec has developed the EnviroSeq® Genomics Workflow at its CEGA facility. "EnviroSeq® is an end-to-end solution that has been hardened and tested through hundreds of genomics projects delivered around the world in harsh field conditions and remote locations. The EnviroSeq® workflow includes Biodiversity Assessment, Rare Target Detection and Bioindicator Species Detection. Every aspect is critical to ensure consistent quality and accurate results. This ISO 9001:2015 certification confirms that EnviroSeq® solutions are effective, reliable and robust," added Dr. Hajibabaei.

ISO 9001:2015 certification is the latest accomplishment in what has been a breakout year for eDNAtec.

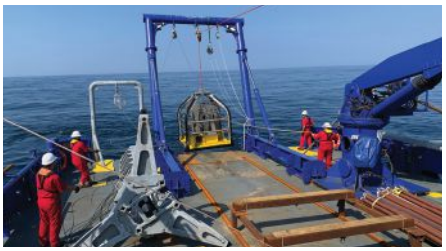
TDI-BROOKS ADDS DATEM NEPTUNE 5000 CPT TO GEOTECHNICAL CAPABILITIES

In the Summer of 2021, TDI-Brooks took delivery of a Neptune 5000 (N5K) CPT System from Datem.

TDI-Brooks conducted two projects with this tool on the East Coast of the US in 2021. The first program was conducted in October for an Offshore Wind Farm project. It involved the acquisition of approximately 90 PCPTs. The N5K CPT soundings for this project were acquired with a 5 cm^2 cone and achieved up to 5-m penetration in these mostly sand/gravel seafloors.

The second program was conducted in November for a pipeline design installation. For this program over 60 N5K CPT soundings were acquired using both 5 and 10 cm^2 cones. Most of these sites were 5-m pushes but others were up to 10-m pushes in a variety of sediment types from soft to sandy seafloors. This program also included some CPT pore pressure dissipation tests at selected sites. Both programs also included vibracoring (VC) with a Feritech FT550 and box core (BC) acquisition to support the environmental evaluation of the seafloors along the routes. One of the programs also involved seabed ROV and camera reconnaissance. Following completion of these geotechnical campaigns, TDI-Brooks shipped the soil samples back to their certified soil testing laboratory in College Station, Texas for the post-survey onshore testing and completion of factual testing reports.

The TDI-Brooks Neptune 5000 CPT System is a coiled rod system with a 35kN push capability. The system is easily mobilized on one of TDI-Brooks' US-based research vessels. It has a maximum penetration of 20 meters. It is an excellent tool for investigating seabed conditions prior to seabed installations such as pipelines, power cables and underwater constructions. The system has real time control and data acquisition and built-in automatic safety cut- outs making it perfect for shallow geotechnical assessments. This tool is designed for thrusting 5 cm^2 or 10 cm^2 digital cones. The unit can thrust up to a maximum of 70 MPa and has a depth rating of 3000 meters. Field results comprise penetration depth, cone resistance, sleeve friction, pore pressure, and inclination from vertical 20 times per second.



» *The N5K deployment on TDI-Brooks' multi-use oceanographic research vessel, R/V BROOKS McCALL. (Photo credit: TDI Brooks)*

In addition to the N5K CPT system, TDI-Brooks can provide gravity CPT (gCPT) unit for pipeline and cable route surveys in softer seafloor especially where a seafloor CPT may sink. The purpose of the gCPT tool is to transport a precisely calibrated memory cone penetrometer down to the seabed/lakebed to gather dynamic PCPT cone data from the mud line to 10+ m BML.

GLOBAL LEADERS IN PIEZOELECTRIC ACOUSTIC TOOLS & SYSTEMS

Sensor Technology was inaugurated in 1983, when company founders, Eswar and Shashi Prasad, transitioned Blue Mountain Pottery into a producer of a hi-tech ceramics called piezoceramics. In 1988, we expanded our product portfolio to include hydrophones. We purchased a second facility in Collingwood to meet growing demand, and operations have been expanding ever since. Following a change in ownership in 2011, Sensor Technology has been led by ambitious President and CEO, Niru Somayajula.

Under Niru's leadership, Sensor Technology has seen extensive growth over the last decade. In addition to the three facilities in Collingwood, we have nearly doubled our workforce and expanded our presence to the east coast of Canada in Dartmouth, Nova Scotia, with multiple offices at COVE and our new 10,000 sq. ft. Advanced Sonar Manufacturing Facility. Sensor Technology proudly remains a family-run Canadian outfit, which keeps the organization suitably agile and adaptable to spearhead advancements in acoustic technology.

SENSOR TECHNOLOGY
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SOUND SUPPLY CHAIN

Sensor Technology is a client-driven manufacturer of piezoelectric ceramic solutions, custom acoustic transducers, and custom hydrophones. We make bespoke acoustic tech products for listening and talking underwater, and these are the components that act as the acoustic heart of our customer's systems. We are proud to be a fully vertically integrated company and being in full control of each link in our value chain allows us to sell our products from any point in the supply chain. Collingwood is where we formulate the powder, produce our ceramics, and design our hydrophones and transducers. Dartmouth is where we manufacture our hydrophones and Transducers. All our formulations are made in-house and are proprietary navy standards.

INNOVATION, KNOWLEDGE & CUSTOMIZATION

We market to the Defense, Energy, Aquaculture, Hydrography, and Oceanography sectors of the ocean technology industry. So, whether you are looking for whales in shipping straight, mapping the ocean floor, monitoring aquatic environments, searching for oil and gas underwater, or looking for an enemy submarine, you can trust Sensor Technology to provide you with innovative, customized solutions with proven results. Our nearly 40-year history has operated with the same three core values: innovation, knowledge, and customization. These values have helped launch us into becoming global leaders in piezoelectric-based acoustic tools and systems.

FUTURE HORIZONS

Since the company's humble beginnings, Sensor Technology has been committed to designing and manufacturing the highest quality acoustic products, and that ethos has never changed. So, when we look to the future with our three core values in mind, we are excited for what is to come. We will be launching new thought leadership initiatives such as our new Sensor Technology Blog and our new Ocean Advisor Program. Also, at our newly acquired Advanced Sonar Manufacturing facility, we are designing our new systems electronics and firmware. In 2023, the manufacturing of these systems will begin, and the opportunities this opens for us will continue to fuel our fire. We are thrilled to further increase our footprint in one of the world's ocean technology hotspots, and we could not be happier to call the blue economy our home.

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

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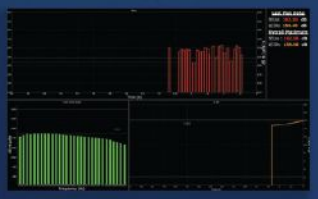

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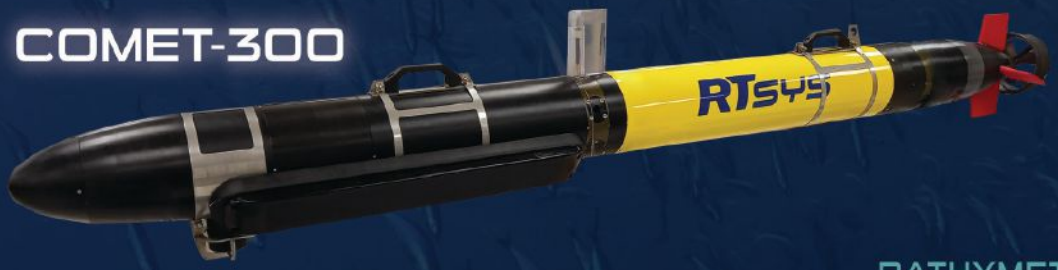

AUV

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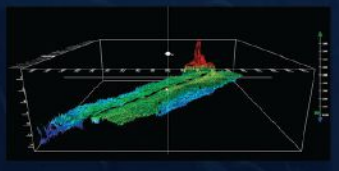
BATHYMETRY



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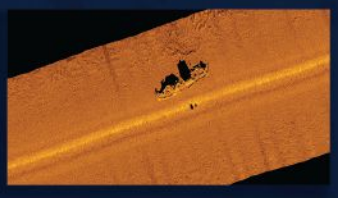
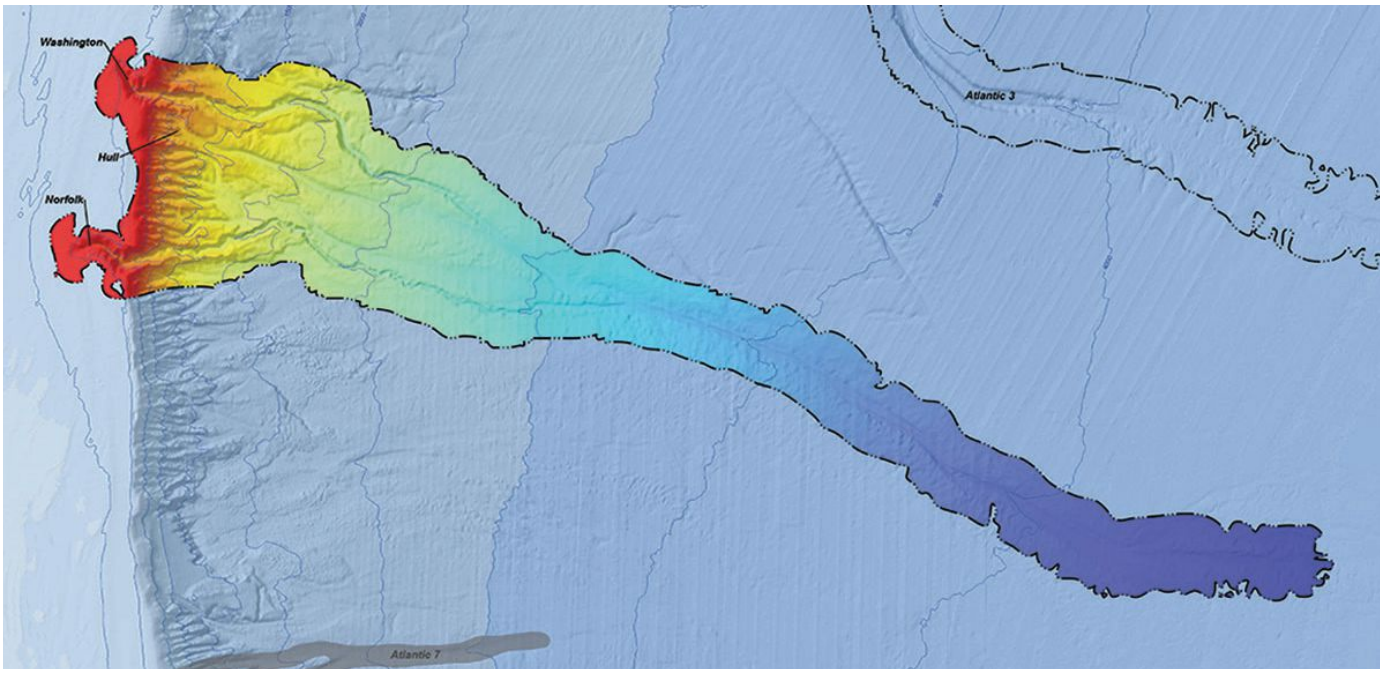


WATER QUALITY

rtsys.eu



CSA OCEAN SCIENCES AND BOEM TO PUBLISH ATLAS OF US SUBMARINE CANYONS

CSA Ocean Sciences Inc. (CSA) recently announced details of an exclusive new project in partnership with The Department of the Interior, Bureau of Ocean Energy Management (BOEM) to map and characterize medium-to-large submarine canyons in the US Exclusive Economic Zone (EEZ).

This comprehensive open-access depository of maps and seafloor data will prove instrumental to the development of national and regional Environmental Impact Statements (EISs), Environmental Assessments (EAs), ecological investigations, offshore leasing decisions, and President Biden's "America the Beautiful" initiative.

Extended Scope

The project serves as a follow-up to a similar collaboration between CSA and BOEM in 2019, which culminated in the publication of the *Large Submarine Canyons of the United States Outer Continental Shelf Atlas* (OCS Atlas), issued in November of the same year. The 2019 study initially identified approximately 700 Outer Continental Shelf (OCS) submarine canyons over 10 km long, 130 of which were categorized as "large" canyons (at least 75 km long, 1 km wide, and incised by at least 100 m). The project team then narrowed the focus to 71 of these large canyons—based on size, location, and availability of information—for detailed mapping and literature review.

"The 2019 OCS Atlas prioritized a certain group of the larger canyons within the OCS, and our task now is to produce additional definitive maps, complete with bathymetric contours, of many of the important medium-to-large submarine canyons that remain, including those beyond the OCS but within the 200-nm reaches of the US EEZ," explained CSA project lead Steve Viada.

Open-access data

As this decade of ocean exploration progresses, there is a growing need for an open-access online resource to help advance a series of multistakeholder ocean mapping initiatives, including the National Ocean Mapping, Exploration, and Characterization (NOMEC) and the National Strategy for Mapping, Exploring, and Characterizing the U.S. EEZ (Ocean Policy Committee, 2020).

To this end, CSA's deliverables will extend to the creation of an online geodatabase inventory, to be housed by BOEM, which will include a fully digital atlas with metadata and all supplementary information available as it relates to all medium-to-large EEZ and OCS submarine canyons.

"We are delighted to be collaborating with BOEM again to bring further clarity and understanding to the little studied world of submarine canyons," said CSA CEO Kevin Peterson. "An undertaking of this magnitude not only relies on the right subject matter experts for the job—select marine scientists with a working knowledge of the geophysics and biological ecosystems that define these seafloor canyons—but also the Geographic Information System (GIS) software and tools to present this information in the most intuitive and insightful way possible—CSA's continual investment in both makes us perfectly equipped to deliver."

The final delivery date for the completed scope of work is November 2022.

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

CSA Ocean Sciences

SEA-KIT EXPANDS PRODUCTION FACILITY TO MEET USV DEMAND

SEA-KIT International is expanding its Tollesbury production facility to deliver on a growing Uncrewed Surface Vessel (USV) orderbook. The news comes as Fugro, world-leading geo-intelligence specialist, snaps up SEA-KIT's latest 12-m X-class build for its growing Blue Essence fleet.

This build, SEA-KIT's sixth X-class, was originally planned as a fleet vessel for demonstration of the technology to new markets. It is set to be even more versatile and fuel efficient than its predecessors, which are now firmly established as safer, lower carbon solutions for offshore tasks on commercial operations around the world.

"Our current orderbook means we are moving from one to three production lines which brings enhanced manufacturing efficiencies. We are also significantly scaling up our production facility to accommodate multiple builds in readiness for future demand," commented Ben Simpson, SEA-KIT CEO.

New jobs are being created too. "Since 2019 we have steadily grown the SEA-KIT team, bringing together talented technologists with those experienced in offshore operations to create a unique blend of expertise. This latest expansion will create more new opportunities for people aligned to SEA-KIT's vision, which is to open new classes of technology to solve the problems of the future today. We are actively recruiting people who want to apply their skills to support the maritime industry's net zero targets," added Simpson.

SEA-KIT's latest X-class USV will have the flexible option of three different propulsion packages within one hull: diesel-electric, hybrid and hydrogen hybrid. The company also recently announced the build of an 18-m XL-class USV for Fugro, which will have three times the payload capacity of the 12-m design. These vessels will now be built simultaneously by SEA-KIT's experienced team at their bespoke facility in Tollesbury, on the UK's East Coast.

» *A previous SEA-KIT X-class USV leaving the facility in Essex. (Photo credit: SEA-KIT International)*

"We enjoy a fertile and thriving company culture that continues to attract and nurture talent," Simpson reflected. "The team here has already made sustainable, cost-effective USVs a critical part of our maritime future, ultimately contributing to the UK's clean maritime goals. Increasing our production capability and expanding the team will see us set to continue breaking new ground in the way we work offshore."

THE RUSSIA-UKRAINE WAR DOMINATES COMMODITY MARKET MOVES

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

CRUDE OIL:

$100+ per barrel of oil. Wow! The oil market finally delivered on prior forecasts for that threshold being reached this year. However, it took the invasion of Ukraine by Vladimir Putin's Russian troops to make it happen, not merely tight supply and strong demand. Obviously, there is some "war risk" premium in that price—but just how much? We will only know when the war is over, and some semblance of geopolitical normalcy returns—but no one can offer a timetable for that to happen.

Currently, the global oil market is in backwardation. That is when near-term barrels are valued more highly than those to be delivered in the future. In effect, the market is saying it prizes the immediate availability of barrels more than it worries about future supply/demand balances. The reason for backwardation is simple—Russia produces about 10 million barrels of crude oil per day, or roughly 10 percent of the world's output. It is among the top three global suppliers, along with the U.S. and Saudi Arabia. Of Russia's output, it consumes about half and exports the balance, including selling about 600,000 barrels per day to the U.S. Interestingly, in 2020, California refineries purchased 15 million barrels of Russian oil, something being highlighted in the debate over Governor Gavin Newsom shutting down oil drilling and production in the state.

The alignment of western countries against Russia, as reflected in the global financial sanctions, has yet to impact Russia's oil sales, but the population of potential buyers is shrinking due to the obstacles created by the financial sanctions in paying for the oil. Oil is priced and paid in U.S. dollars. There are financial workarounds that will be engineered, and Russia still has the explicit and implicit support of a handful of nations who use oil, principally China. (China is also a significant buyer of Russian natural gas and coal.) But these challenges are pushing oil prices higher.

Western governments are reluctant to sanction the purchase and use of Russian fossil fuels for the simple reason that we learned in the 1970s—twice—that if you suddenly remove a chunk of global oil supply, prices spike and economies sink. This is called shooting yourself in the foot!

Before Ukraine erupted, global oil markets were tightening as demand continued to grow faster than originally envisioned coming out of the pandemic. At the same time, supply growth has proven less robust as various OPEC members struggle with operational challenges while U.S. oil companies limit capital spending in adherence to financial discipline demands from investors. OPEC+ has just indicated it will not deviate from its plan to add only 400,000 barrels per day monthly back into the world's supply, at the same time capital markets reward oil producers who hold firm to their spending throttle. The result will be elevated, or possibly higher, oil prices until either economic activity craters, a resolution of the Russia-Ukraine war is found, or another supply source emerges such as Iranian oil.

NATURAL GAS:

Anymore cold weather? If not, the natural gas market is all about liquefied natural gas (LNG) shipments to Europe and producer willingness to boost gas drilling, i.e., boosting supply.

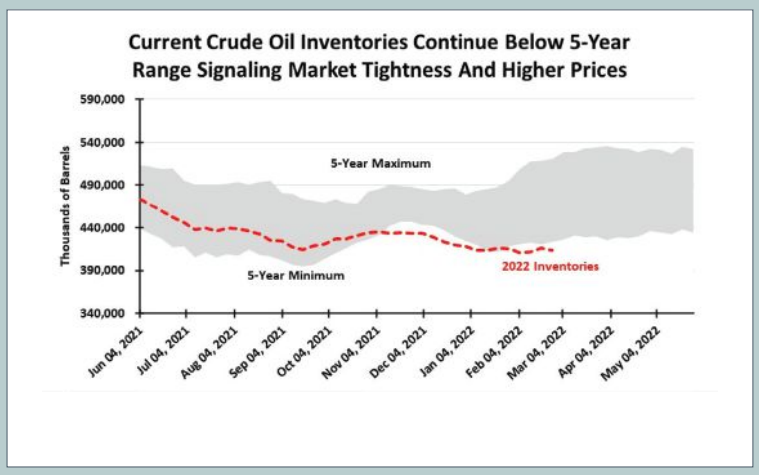
We are in the last month of winter demand, assuming Mother Nature does not have more cold and snow in her bag of tricks. Therefore, we will likely see gas prices reflect long-term gas market trends, which revolve around LNG's future output and domestic gas use in a low carbon economy. The Biden administration's embrace of climate as the

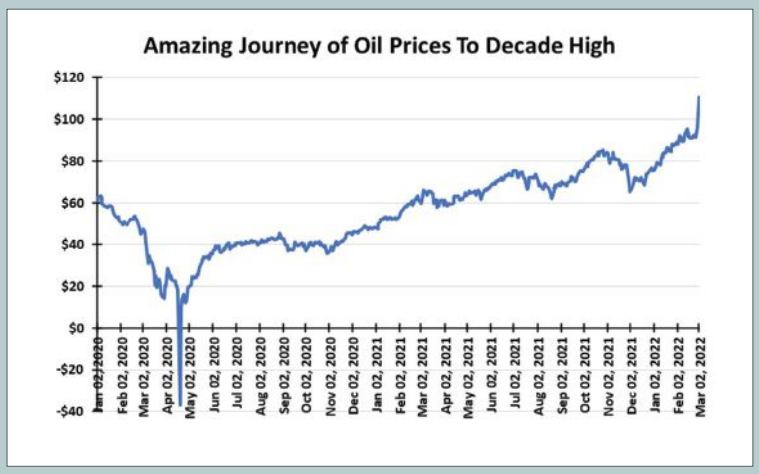
standard for all its policy decisions has weaponized the bureaucracy to fight any deviation from restrictive energy policies.

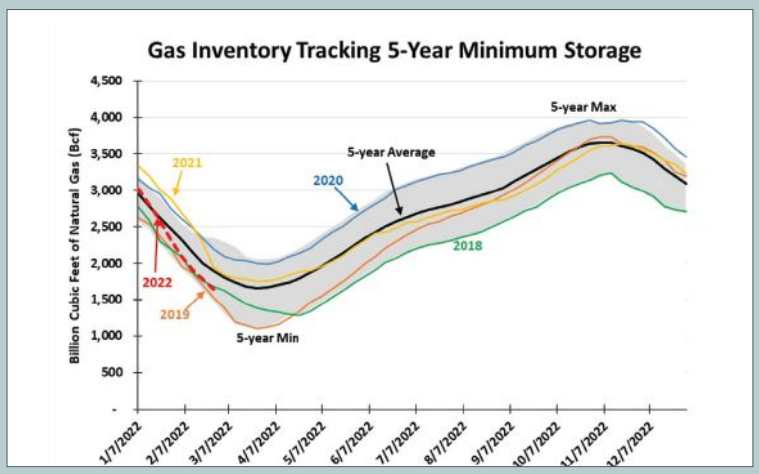
Telling the Supreme Court that the EPA's regulating carbon emissions under obscure provisions of the law is not a "major question" under the court's purview is the latest move to prevent intervention against the climate change movement. FERC's declaration that it will consider downstream carbon emissions when evaluating new pipeline permits and the Interior Department's decision to not appeal a federal judge's invalidation of the most recent offshore Gulf of Mexico lease sale, throwing the 5-year offshore lease plan into question, are further examples of government actions crippling our domestic petroleum industry. These steps, at a time when oil is over $100 a barrel and natural gas nears $5 per thousand cubic feet, counter the Biden administration's claim it is working to reduce inflation for the average American family.

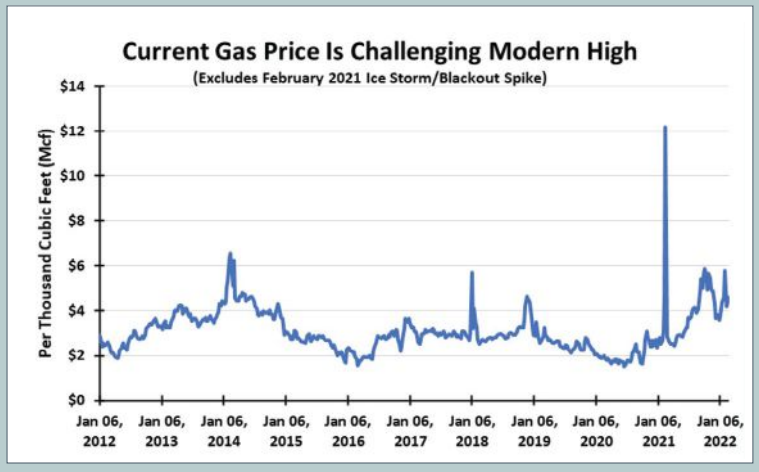
Rebuilding gas storage for next winter will be weighed alongside the opportunity to export more LNG to support Europe's gas diversification efforts. With European governments needing to diversify their gas supplies—including Germany advocating building two new LNG terminals—America's LNG will be in great demand. European governments fear Russia turning off its gas pipeline supply and devastating economies, therefore, they are begging for more U.S. LNG. There are reports of empty tankers waiting at terminals to load highly profitable cargos. That demand will moderate as winter transitions to spring and then summer, but the long-term case for U.S. LNG meeting European gas needs will remain solid. That demand will put a floor under domestic gas prices this spring, even if it is unseasonably warm.

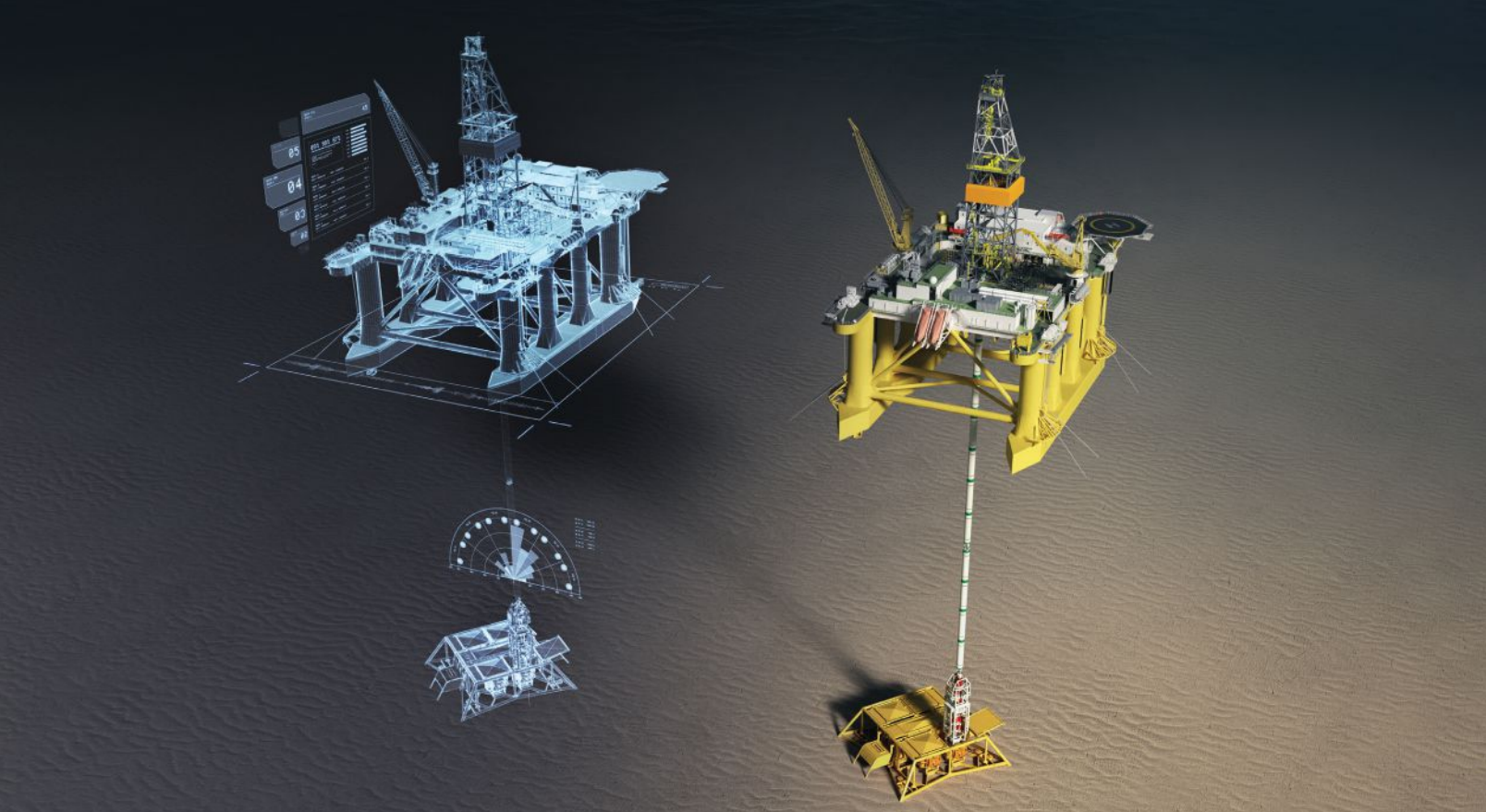
U.S. gas producers remain reluctant to boost drilling aggressively to avoid being targeted for reverting to their old "capital destructive" ways. Will we need more supply? Yes. Will we get more supply? Yes. The issue for gas futures prices is at what pace we get the additional supply relative to the expansion in LNG export capacity and further shifts away from dirty fossil fuels in our power generation business that boost domestic gas use. March is a tricky time to forecast gas prices, but we know that fundamental supply/demand dynamics favor more demand amid a questionable supply growth outlook. That is a recipe for healthy natural gas prices for the foreseeable future.











» *Advanced algorithms are used to analyze fatigue, well support and structural integrity on conductors, wellheads, BOPs and Christmas trees. (Image credit: 4Subsea)*

| FEATURE |

SMART MONITORING SOLUTION FOR SAFE & COST-EFFICIENT OFFSHORE OPERATIONS

By Peter Jenkins,
CEO, 4Subsea

Offshore energy assets are, by their nature, expensive to maintain. Traditionally, operators perform regular ROV inspections to monitor the condition of subsea infrastructure in a timely and controlled manner. The ongoing integrity management of wellheads, risers, mooring lines, subsea spools and manifolds, as well as the monitoring of pipelines and other subsea structures that support offshore energy platforms, makes tracking existing data a challenge. These methods lack efficiency and cost the operator critical time and spend.

To improve these methods, the industry has increasingly turned to digitalization to make data-informed decisions that measurably reduce risk and costs. For 4Subsea, this has culminated in the development of smart sensors that have accelerated the utility and reliability of digital twins.

The technology has been developed to perform the most challenging of engineering tasks. By providing data to track integrity status, inform key decision-making, and reduce the need for regular ROV inspections, smart sensor technology can extend the lifetime of assets beyond design life.

SWIM PASSES MILESTONE

Digital twin technology provides early warning and improved accuracy in structural health monitoring than traditional analyses, and its use has grown exponentially over the last decade.

Last year, 4Subsea hit a milestone of successfully completing more than 300 measurement campaigns across the North Sea following the launch of its digital twin technology, significantly increasing uptime and mitigating risk during well operations.

The SWIM™ (Subsea Wellhead Integrity Monitoring) system employs retrofittable subsea sensors to monitor and measure stability, load, fatigue, and structural integrity of the wellhead system during drilling operations. It utilizes autonomous sensors with a battery life of up to five years and can operate in water depths down to 3,000 meters.

Since it was first tested in 2010, the technology has identified wellhead integrity issues, such as shallow gas and water, conductor stability issues related to wash-out or fatigue challenges, on nearly a third (30%) of exploration and satellite wells monitored in depths less than 150 meters.

In its first five years of operation, SWIM™ performed around 80 measurement campaigns. This has grown three-fold since 2015, with over 250 campaigns successfully completed across the UK and Norwegian continental shelves.

ADVANCING DIGITAL TWIN CAPABILITIES

4Subsea expects the steep escalation to continue as the industry puts more trust in digital twin technology and the financial, logistical and environmental benefits it brings.

Advanced algorithms, combined with deep domain expertise, are used to analyze fatigue damage accumulation, well support and structural integrity on conductors, wellheads, BOPs and Christmas trees up to the floating drill rig. This critical data can be used to assess performance, provide prediction analysis and, importantly, rapidly inform decision-making to reduce risk and cost.

Data is shared in real-time via a user-friendly web application that is easily accessible to the rig crew and the onshore support team. In addition, measured data is securely stored and can be reused for future model calibration.

» *4Subsea's technology can be used to extend the service life of existing wind farms while helping to reduce operational costs. (Image credit: 4Subsea)*

Combining expert engineering and operational experience offers an industry-leading digital service, including advanced autonomous, retrofit sensor technology.

With SWIM™, operators can reuse critical wells and maximize the lifetime of wellheads by scheduling drilling operations based on well criticality, historically accumulated load on wellheads, and predictive models. The predictive models estimate the expected load on the wellheads from future planned drilling and intervention operations.

4Subsea has also developed the SWIM™ Live app, which provides live data streaming from sensors installed on the BOP and lower flex joint through integration with the BOP MUX umbilical. This allows real-time updates and the ability to optimize operations with instant insight.

AUTONOMOUS SENSORS FOR OFFSHORE WIND

To measure the dynamic strain of offshore wind turbines with high resolution and accuracy, 4Subsea has developed a new autonomous sensor that reduces the cost of operations and maximizes the life of offshore assets.

Unlike regular strain gage installations, 4Subsea's Smart Monitoring Sensor (SMS) Strain™ is an autonomous, retrofittable sensor that can be installed without special requirements such as the use of specialized technicians, equipment, or a clean environment. In addition, the technology can easily be installed by hand on the turbine tower or using divers or ROV for subsea installation, for instance, on the substructure.

SMS Strain™ is the latest of 4Subsea's autonomous sensors that help asset owners reduce the cost of operations and maximize life of assets when combined with data analytics and engineering specialists within the company. SMS Strain™ is the sixth sensor in 4Subsea's sensor product line, adding new capabilities to the company's existing offering that includes SMS Motion™, SMS Magic Hand™, SMS Gateway™, SMS ComCentral™ and SMS Guard™.

SMS Strain™ has extremely low power consumption, enabling continuous logging and data storage at 10 Hz sampling frequency for a full 12 months.

The SMS Strain™ sensors can be cabled to motion sensors like the SMS Gateway™ (topside) or SMS Motion™ (subsea) to provide fully synchronized strain and motion data. This gives a unique opportunity to assess structural loads in correlation with deflections and response frequencies which are critical parameters in wind turbine design. Furthermore, the sensors are made as true IoT sensors where that given access to power and the internet, they will automatically start sending data to the cloud where the data is processed, and insight from the data can be visualized to the customers.

The addition of SMS Strain™ has allowed 4Subsea to further simplify the complexity of the challenges faced by clients in providing informed data to develop optimal, tailor-made solutions. The sooner clients know the status of their asset, the larger the range of available options to either optimize or mitigate the findings. The key to unlocking this knowledge is increased understanding, which sensors deliver.

As the industry drives towards renewables, 4Subsea has seen accelerated growth within the wind energy sector, where their technology can be used to extend the service life of existing wind farms while helping to reduce operational costs. As the sector transitions to larger turbines in deeper waters and subsequently into floating turbines, the complexity increases.

This will increase the need for advanced analytical capabilities and the need for smart monitoring solutions to ensure safe and cost-efficient operations. For more information, visit: *www.4subsea.com*.

HEXAGON | VERIPOS EXPANDS SPAN GNSS+INS PORTFOLIO FOR DYNAMIC POSITIONING

Hexagon | VERIPOS has expanded its proven inertial solution SPAN GNSS+INS technology from NovAtel, also part of Hexagon, to dynamic positioning (DP) applications and vessels. SPAN technology delivers a deeply coupled GNSS and inertial navigation system (INS) that provides robust, reliable and continuous centimeter-level positioning for operators to maintain safety and maximize uptime. With a GNSS+INS solution, DP vessels can bridge outages in GNSS tracking and through short periods of radio frequency interference, jamming or spoofing.

VERIPOS is a leader in offshore high precision positioning, delivering reliable and trustworthy GNSS solutions like the LD900 receiver, PPP correction services and positioning visualization software. They demonstrate this expertise through SPAN technology's deep coupling of GNSS and inertial measurements. Deep coupling describes how inertial measurements enhance the signal tracking for GNSS solutions, leading to improved resiliency against GNSS outages and enabling rapid reacquisition in case of interruptions. SPAN technology builds system robustness against potential signal outages, interference or disruptions while optimizing operational efficiency.

"The robust positioning, heading, velocity and attitude measurements generated from a deeply coupled GNSS and inertial solution like SPAN technology is a game-changer to dynamic positioning operations," said Dr. David Russell, marine segment portfolio manager at Hexagon's Autonomy & Positioning division. "SPAN technology has a proven track record of bridging outages, enabling rapid reacquisition of signals and building a reliable and robust positioning system. It's the best option for vessels to ensure an added layer of resiliency and achieve continuous centimeter-level accuracy across all conditions."

SPAN GNSS+INS technology is compatible with commercial inertial measurement units (IMUs) and scalable with your LD900 GNSS receiver, Quantum visualisation software and APEX correction services.

» *aae technologies' Nexus 2 USBL system. (Photo credit: aae)*

APPLIED ACOUSTICS DELIVERS TWO NEXUS 2 ADVANCED USBL SYSTEMS TO GEOXYZ

Family-run subsea acoustics experts, applied acoustics has partnered with GEOxyz, a specialist marine company, implementing the Nexus 2 USBL systems with 2780 directional transceivers on their survey vessels, with unmatched increases in speed and performance.

The improved reliability and accuracy of the Nexus 2 has been matched with as little downtime as possible, meaning they can deliver results in a fast and effective manner without wasted time and money.

Wim Van Huele, Tender Manager, GEOxyz, said: "You want your operations to be as inexpensive as possible, with as high margin as possible, and as little downtime as possible, and aae's equipment delivers this. In the case of the Nexus 2, the ease of integration into the whole spread of equipment used in our operations meant it was very easy to train staff quickly on the new systems."

GEOxyz, who are based in Belgium, with operations around the North Sea and the Baltics, provide comprehensive offshore geophysical, geotechnical, and hydrographic surveys mainly in renewables, and oil and gas sectors.

"We were extremely confident that the Nexus 2 systems would deliver the levels of accuracy and performance required, and the feedback from the team at GEOxyz only reinforces our need to champion exceptional performance and quality in geophysical and geotechnical surveys. We are delighted with the impact the Nexus 2 USBL system continues to have," said Hollie Moran, Sales & Marketing Manager at aae technologies.

aae technologies, established in 1989, continues to grow its reputation as an innovator in the sector, but also prides itself on delivering a personal approach to sales and partnerships. Offering 24/7 remote support and ongoing training, the team continues to innovate and design award-winning engineering and solutions for the marine industry.

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SCIENTISTS DEPLOY GLOBALSTAR SPOT TRACE TO MONITOR CURRENTS AND BIODIVERSITY IN THE WORLD'S OCEANS

Globalstar Europe Satellite Services Ltd, a wholly owned subsidiary of Globalstar Inc., recently announced that German research institution The Helmholtz Center Hereon is using SPOT Trace satellite GPS trackers to conduct worldwide oceanography research.

Hereon has designed and engineered innovative ocean drifter devices built around SPOT Trace which monitor ocean surface currents and reveal how biodiversity levels change in the world's major rivers and seas. "Our purpose is to understand in greater detail the surface flow of water and organisms around the globe," explained Dr. Jochen Horstmann, scientist at Hereon. "We already have a reasonable idea of how currents work from satellite imagery and numerical models. However, we need reliable measurements of surface currents to better understand their processes and to improve our models."

The researchers use surface floats, or drifters, fitted with an underwater sail suspended at half a meter depth. These drifters report their position and therefore track the near-surface currents.

"As researchers, we always strive to get best possible value for money in the equipment we use, not only for us but for those governments, institutions and private individuals who fund our work. We needed drifters that were economical, but when we looked at what devices were already available, these were typically very expensive, so we decided to build drifters ourselves," added Horstmann.

Horstmann and his colleagues knew they needed to build drifters capable of capturing and transmitting data even in extreme ocean conditions: "Our drifter needed to be robust enough to endure the elements, in particular severe wind conditions and waves."

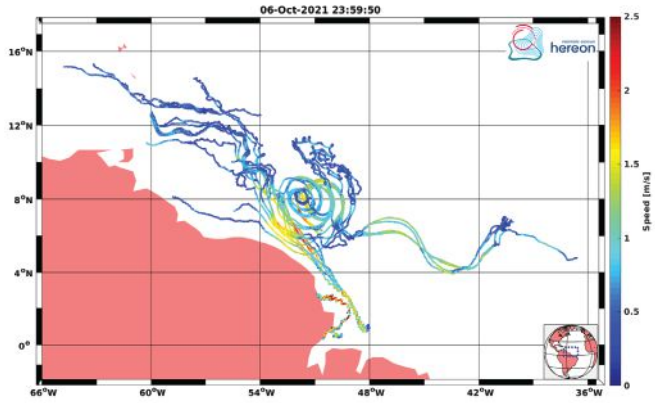
Position information is transmitted every five minutes via the Globalstar satellite fleet in Low-Earth Orbit (LEO). "By looking at the data transmitted by the SPOT Trace-equipped drifters, we can see where water and the organisms being carried flow and how biodiversity is affected," Horstmann explained.

Hereon is also collaborating with the EU-funded Atlanteco project. Dr. Paulo Calil, a fellow scientist with Hereon, explains the Microbiomes experiment, which is the focus of Atlanteco.

"Over a billion microorganisms live in every liter of seawater, and thanks to plankton, the ocean absorbs 25% of the CO2 emitted by humans," explains Dr. Calil. "But while an essential cog in the great climate machine, the functioning of this microbial world remains largely unknown. Our oceans are changing; they are becoming hotter on the surface because of climate change, and they are becoming more stratified," Calil explained.

Changes in ocean currents affect transport and connectivity patterns. Hereon's studies are helping researchers to understand how currents interact with plankton.

"There are widespread consequences of changes in currents for marine



» *Satellite-enabled SPOT Trace tracks movement of currents and helps scientists monitor biodiversity. (Image credit: Globalstar)*

productivity, which in turn affects carbon levels and the whole 'machinery' of the ocean, as well as weather patterns," he added. Additionally, many areas can be impacted economically, such as for fisheries.

Hereon's drifters have shown that the organisms travel extremely far, due to intensifying currents.

For example, in the South Atlantic, swirling eddies that form on the southern tip of Africa are seen to spread species all the way to eastern South America.

SPOT Trace's energy-efficient devices are playing a crucial role here: "Even after 150 days in the ocean, the drifters continue to send data, despite being subject to some rough conditions, waves and strong winds—we're delighted and really impressed with SPOT Trace," commented Horstmann.

Physical oceanographers, microbiologists, biologists, geneticists, and biological oceanographers are all benefitting from this research.

"We are extremely proud that Globalstar technology is

» *Compact rugged SPOT Trace. (Photo credit: Globalstar)*

playing such a significant role in enhancing our understanding of the natural world, and how climate change is impacting our oceans and the biodiversity of life in them," added Mark O'Connell, General Manager EMEA and APAC at Globalstar.

With its reliable tracking capabilities, robust physical properties including compact rugged design and long battery life, combined with its economical price, SPOT Trace has been widely embraced in the scientific community worldwide. Oceanographers across the globe are using SPOT Trace to gain a better understanding of the world's seas, conduct oil spill research and monitor pollution.

CODA OCTOPUS INTRODUCES THE 3D TOUCH CONTROLLER SOLUTION

Coda Octopus has announced the introduction of its 3D Touch Controller solution. The 3D Touch Controller solution is integrated within its software suite of products and brings significant simplification, intuitiveness, and ease of use to operators of Coda Octopus' real time 3D sonar suite of products and rotators.

The 3D Touch Controller solution is particularly effective for repetitive interactive tasks and pre-defined solutions such as cable laying, block placements, bridge inspections etc.

Users can now by touch of the 3D Touch Controller operate the sonars and/rotator units independently of the software interface.

The key benefits include:

1. Simplification of operation of the sonar, rotators, and software.

2. Immediate Visual indication of status (on/off) and level (Gains and Thresholds) using the illuminated buttons and rotary controls without having to use or be near the software.

3. Quick access to logical controls on this 3D Touch Controller

4. Hands free operation of our top end software allowing control of the devices with other software applications running and displayed on the computer system

5. 3D Touch Controller is completely independent of software state or current use: no need to have appropriate software control windows in focus to use the controls and further allows a second operator to control the sonar and rotator independently of the software processing and visualization tasks.

This capability is integrated and accessible across the range of our software products including our control and visualization software packages:

- Underwater Survey Explorer ("USE")
- USE PIPE CORE
- Construction Monitoring System Software
- 4G USE®
- 4G USE® DAVD Edition.

» *3D Touch Controller solution is ideal for repetitive interactive tasks such as cable laying and bridge inspections. (Photo credit: Coda Octopus)*

NEW YORK BIGHT OFFSHORE WIND SALE SETS HISTORIC RECORD

The US Department of the Interior recently announced the results of the nation's highest-grossing competitive offshore energy lease sale (at the time if writing) in history, including oil and gas lease sales, with the New York Bight offshore wind sale. These results are a major milestone towards achieving the Biden-Harris administration's goal of reaching 30 GW of offshore wind energy by 2030. The lease sale offered six lease areas totaling over 488,000 acres in the New York Bight for potential wind energy development and drew competitive winning bids from six companies totaling approximately $4.37 billion.

A recent report indicates that the United States' growing offshore wind energy industry presents a $109 billion revenue opportunity to businesses in the supply chain over the next decade.

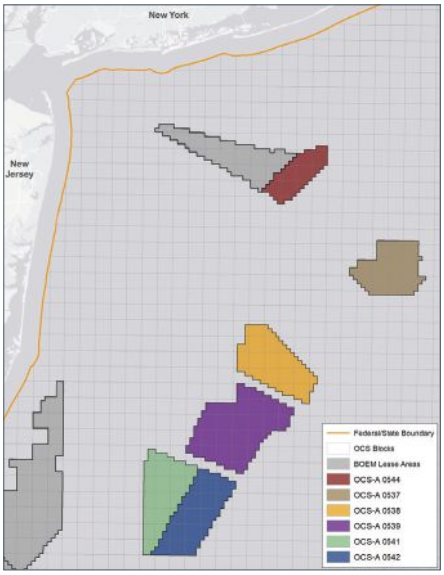
"This week's offshore wind sale makes one thing clear: the enthusiasm for the clean energy economy is undeniable and it's here to stay," said Secretary Deb Haaland. "The investments we are seeing today will play an important role in delivering on the Biden-Harris administration's commitment to tackle the climate crisis and create thousands of good-paying, union jobs across the nation."

The provisional winners of today's lease sale are:

Provisional Winner	Lease Area
OW Ocean Winds East, LLC	OCS-A 0537
Attentive Energy LLC	OCS-A 0538
Bight Wind Holdings, LLC	OCS-A 0539
Atlantic Shores Offshore Wind Bight, LLC	OCS-A 0541
Invenergy Wind Offshore LLC	OCS-A 0542
Mid-Atlantic Offshore Wind LLC	OCS-A 0544

A map of the lease areas auctioned can be found on the BOEM website.

Before the leases are finalized, the Department of Justice and Federal Trade Commission will conduct an anti-competitiveness review of the auction, and the provisional winners will be required to pay the winning bids and provide financial assurance to Interior's Bureau of Ocean Energy Management (BOEM).



The New York Bight offshore wind leases include innovative stipulations designed to promote the development of a robust domestic U.S. supply chain for offshore wind energy and enhance engagement with Tribes, the commercial fishing industry, other ocean users and underserved communities. The stipulations will also advance flexibility in transmission planning. Stipulations include incentives to source major components domestically—such as blades, turbines and foundations—and to enter into project labor agreements to ensure projects are union-built.

"We must have a robust and resilient domestic offshore wind supply chain to deliver good-paying, union jobs and the economic benefits to residents in the region," said BOEM Director Amanda Lefton. "Because we understand the value of meaningful community engagement, we are requiring lessees to report their engagement activities to BOEM, specifically noting how they're incorporating any feedback into their future plans."

On January 12, Secretary Haaland, New Jersey Governor Phil Murphy, and New York Governor Kathy Hochul announced a shared vision for developing a robust offshore wind energy domestic supply chain that will deliver benefits to residents of New York and New Jersey and the surrounding region, including underserved communities. This collaboration will serve as a model for future engagement and establish the U.S. as a major player in the global offshore wind energy market.

To advance the Interior Department's environmental justice and economic empowerment goals, lessees will be required to identify and make efforts to engage with Tribes, underserved communities, and other ocean users who could be affected by offshore wind energy development. The Department will hold companies accountable for improving their engagement, communication and transparency with these communities.

These additions are intended to promote offshore wind energy development in a way that coexists with other ocean uses and protects the ocean environment, while also securing our nation's energy future for generations to come.

BOEM initially asked for information and nominations of commercial interest on 1.7 million acres in the New York Bight. Based on BOEM's review of scientific data and extensive input from the commercial fishing industry, Tribes, partnering agencies, key stakeholders, and the public, BOEM reduced the acreage offered for lease by 72% to avoid conflicts with ocean users and minimize environmental impacts. BOEM will continue to engage with the public, ocean users, and key stakeholders as the process unfolds.

The Administration has already made significant progress toward creating a pipeline of projects. It has approved and celebrated the groundbreaking of the nation's first two commercial-scale offshore wind projects in federal waters: the 800-megawatt Vineyard Wind project and the 130-megawatt South Fork Wind project. BOEM expects to review at least 16 plans to construct and operate commercial offshore wind energy facilities by 2025, which would represent more than 22 GW of clean energy for the nation.

In addition, this past fall Secretary Haaland announced a new leasing path forward, which identified up to seven potential lease sales by 2025, including the New York Bight and offshore the Carolinas and California later this year, to be followed by lease sales for the Central Atlantic, Gulf of Maine, the Gulf of Mexico, and offshore Oregon.

ECO WAVE POWER FINALIZES THE PRODUCTION OF 10 FLOATER **UNITS** FOR INSTALLATION AT THE PORT OF JAFFA, ISRAEL

» *The EWP-EDF One Project's floaters are installed from land. (Photo credit: Eco Wave Power)*

Eco Wave Power Global AB has announced that it had finalized the production of all floaters required for the EWP-EDF One Project, and commenced installation of the floaters to the sea wall in the Port of Jaffa, Israel.

The project's next steps include the complete installation of all 10 floater units, a test run in real conditions, and the official connection of the power station to the grid. The system functionality and capacity tests are expected to be conducted by the end of Q2 2022.

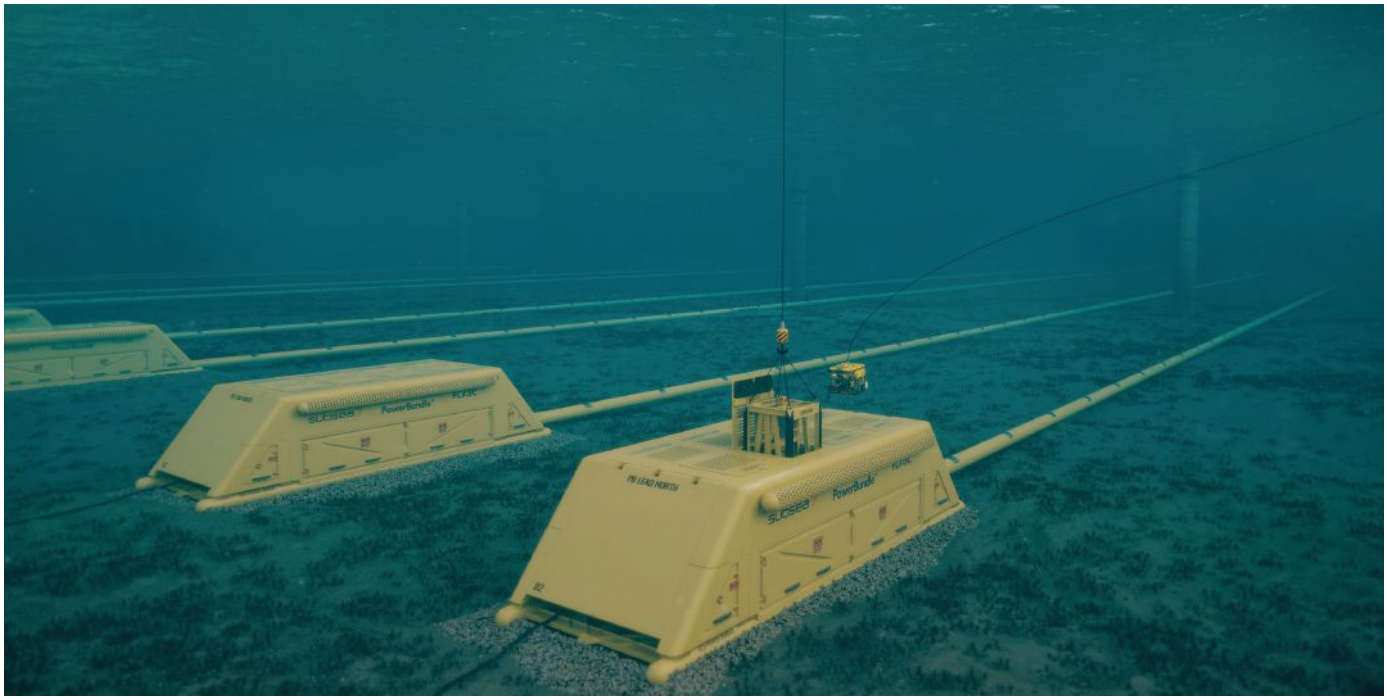
"The installation of the first floater is a significant progress toward the first grid-connected wave energy array installation in Israel," stated Inna Braverman, CEO of Eco Wave Power. "Preparation for the installation of all remaining floaters on the external side of the Jaffa Port breakwater is in advanced stages and we are relishing over the prospect of being operative soon in the Mediterranean waves."

The installation of the floaters will be completed from the land side, as opposed to the traditional use of expensive ships and divers for equipment installation in offshore wave energy installations.

"Our goal is to generate electricity during the third quarter of this year," added Braverman. "This is a key milestone in the overall development of the Eco Wave Power technology, and we believe that the results are expected to enable us to take important steps toward the commercial rollout of our pioneering technology."

When completed, the EWP-EDF One wave energy project will include 10 floaters connected to one conversion unit, which is already installed onsite. The EWP-EDF One conversion unit is located on land, similar to a normal power station, which enables easy access for operation and maintenance.

The floaters and supporting structures were constructed and are being installed in Israel by Lesico, which has more than 50 years of experience in providing engineering, construction, operation and maintenance services for infrastructure projects, while conducting research and development for clean-tech technologies.



» *The PowerBundle concept is a collaborative, scalable, and robust offshore energy storage solution. (Image credit: Subsea 7 /FLASC)*

SUBSEA 7 AND FLASC SECURE UK BEIS FUNDING FOR OFFSHORE ENERGY STORAGE TECHNOLOGY

Subsea 7 and technology partner FLASC B.V., have been awarded a grant from the UK government Department for Business, Energy and Industrial Strategy (BEIS) for £471,760, to further develop an innovative offshore energy storage system.

Funding has been awarded as part of the Longer Duration Energy Storage (LODES) competition, which recognizes the transition to increasing wind generated renewable energy and presents growing opportunities for storage systems that support a secure, flexible and reliable electrical power supply.

The PowerBundle concept will combine FLASC's proprietary Hydro-Pneumatic Energy Storage (HPES) technology and Subsea 7's proven subsea pipeline bundle technology, resulting in a scalable and robust offshore energy storage solution.

Liam Macintrye, Subsea 7 Strategic Director - Energy Transition, said: "We are very pleased to have our innovative solution recognized by BEIS, as it builds on our proactive participation in the energy transition. The development of energy storage solutions plays a crucial role in the future of intermittent renewable power sources, and the interconnectivity of our energy systems. We believe such systems will not only unlock additional grid connected offshore wind, but it could also play a valuable role in decarbonizing oil and gas assets."

Daniel Buhagiar, Co-Founder and CEO of FLASC B.V., added: "This funding support from UK BEIS provides a major boost to our technology development initiatives, and we are extremely proud to have been selected in this pioneering and highly competitive funding program; one of the first specifically targeting Longer Duration Energy Storage. Beyond the financial support, this also confirms our view that offshore energy storage technologies have a key place in the energy transition, working alongside onshore solutions towards a cleaner and more robust energy system."

The competition will be delivered through two phases. In phase 1, projects will be expected to mobilize their proposed technologies to prepare for potential deployment on the UK energy system. Successful proposals will receive further funding for phase 2, to build and test a grid connected full-system demonstrator of the proposed technology and qualify it through testing. A formal stage gate review will take place between phase 1 and phase 2 of the competition. Work has already commenced for phase 1.

Greg Hands, Energy & Climate Change Minister, said: "Driving forward energy storage technologies will be vital in our transition towards cheap, clean and secure renewable energy.

"It will allow us to extract the full benefit from our home-grown renewable energy sources, drive down costs and end our reliance on volatile and expensive fossil fuels. Through this competition we are making sure the country's most innovative scientists and thinkers have our backing to make this ambition a reality."

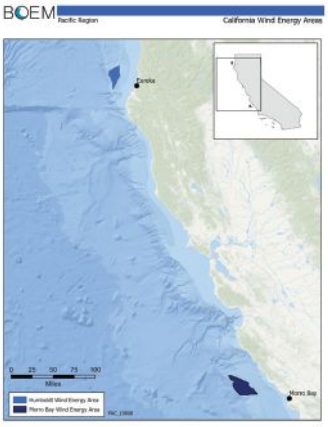
TOTALENERGIES ENTERS CASTLE WIND JV TO EXPLORE 1 GW DEVELOPMENT OF OFFSHORE WIND IN CALIFORNIA

TotalEnergies has joined Trident Winds Inc. in the Castle Wind LLC joint venture for the development of a 1 GW offshore wind project off the coast of Morro Bay, off the Central California Coast. The Company entered the JV and acquired the shares previously held by EnBW North America.

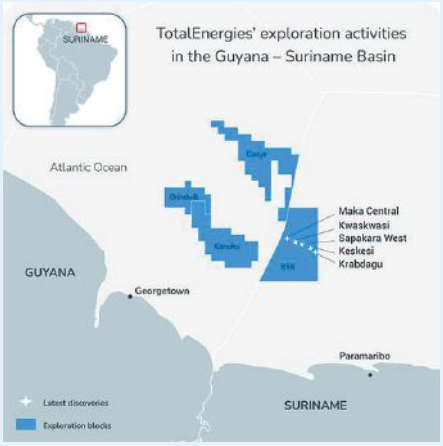
Castle Wind is poised to participate in the anticipated Bureau of Ocean Energy Management lease sale in late 2022.

"TotalEnergies is pleased to bring our global expertise in deploying efficient, large-scale offshore assets to Castle Wind in California. The work completed by the teams in the last years has laid a solid foundation with the local communities, and we look forward to working with them to bring clean energy to the state," said David Foulon, Head of U.S. Offshore Wind at TotalEnergies. "This partnership in Castle Wind is another important step for TotalEnergies to contribute to the U.S. offshore wind industry ramp-up and fulfill its global ambition of becoming a top five producer of renewable energy worldwide by 2030."

"Castle Wind welcomes TotalEnergies with its deep commitment to renewable energy to the joint venture and the project team," said Alla Weinstein, CEO of Castle Wind. "We have come a long way since first identifying the opportunity for offshore wind development in California in 2016 and stand today at the precipice of a generational opportunity to secure California's clean energy future. We are excited to begin the next chapter of this journey. TotalEnergies' experience and expertise, with over 10 GW of offshore wind projects under development, will be invaluable as we work towards making offshore wind a reality in California."



TotalEnergies has been a long-time renewable energy player in California as the majority shareholder of San Jose-based SunPower since 2012. In February 2022, TotalEnergies purchased SunPower Corp.'s Commercial & Industrial Solutions business, integrating the team of nearly 300 and further enhancing its footprint in the solar industry. The Company has offices in San Francisco and Los Angeles.



TOTALENERGIES AND APA CORPORATION MAKE ANOTHER SIGNIFICANT DISCOVERY OFFSHORE SURINAME

TotalEnergies and APA Corporation have made a significant new oil and associated gas discovery at the Krabdagu-1 well, in the central area of Block 58, offshore Suriname. This follows previous discoveries at Maka, Sapakara, Kwaskwasi and Keskesi, and the successfully tested Sapakara South-1 appraisal well.

Located 18 kms south-east of Sapakara South, Krabdagu-1 was drilled at a water depth of 780 meters and encountered approximately 90 meters of net oil pay in good quality Maastrichtian and Campanian reservoirs.

"This successful exploration well at Krabdagu-1 is a significant addition to the discovered resources in the central area of Block 58. This result encourages us to continue our exploration and appraisal strategy of this prolific Block 58 in order to identify sufficient resources by year end 2022 for a first oil development," said Kevin McLachlan, Senior Vice President, Exploration at TotalEnergies.

Drilling and logging operations will continue, using the Maersk Valiant drillship. DST operations will be carried out on Krabdagu-1 to appraise the resources and productivity, and at least three further exploration and appraisal wells are planned to be drilled in 2022 on the block.

TotalEnergies is the operator of Block 58, with a 50% working interest, while APA Corporation holds the remaining 50%.

WORLD'S FIRST OFFSHORE CHARGING STATION COMPLETES SEA TRIALS

Oasis Marine Power Ltd has completed the first stage of testing of their offshore charging station, hailing the design a success. This product was the first design under development and is the first of its kind globally to reach sea trials. It offers to revolutionize renewable energy use for the maritime industry.

The Oasis Power Buoy is an offshore mooring and charging station with a zero-emission power source fed from wind turbines. Initially aimed at Wind Farm Crew Transfer Vessels (CTVs), the Oasis Power Buoy provides the critical need for offshore charging of hybrid and all-electric vessels.

Current diesel-powered maintenance vessels are responsible for the majority of CO2 emissions from an operational wind farm. The Oasis Power Buoy makes zero-emission vessels viable for the industry, facilitating major carbon and cost reductions.

Sea trials were held in the Port of Cromarty Firth, Scotland during January 2022 in the first of a series of tests.

"I am delighted with the results of the testing. We have proven that the concept is viable and are now working to optimize the design. What we have achieved is a world first, and this is a great progression towards dramatically reducing the carbon footprint of the maritime industry. Thanks to Cromarty Firth Port Authority and PSG Marine & Logistics Ltd for their valued assistance with these trials," said George Smith, Oasis Marine Power Director.

» *The Oasis Power Buoy will now undergo further testing and optimization, including sustained sea trials. (Image credit: Oasis Marine Power)*

ICR INTEGRITY SELECTED FOR CATAPULT OFFSHORE RENEWABLES COHORT

» *Drone inspection of an offshore substation. (Photo credit: ICR)*

Following a competitive process, ICR Integrity (ICR), global provider of specialist maintenance, integrity and inspection solutions, has been selected for participation in the second Fit for Offshore Renewables (F4OR) North East Scotland program, funded by the Energy Transition Zone (ETZ).

ICR has a proven track record in the offshore renewable energy sector, including experience using its Quickflange™ and Technowrap™ repair technologies at offshore wind substations. Both cold work technologies create zero emissions during installation and bring the benefit of cost and time reduction as well as resulting in less POB to renewables clients. The company's drone inspection business unit, Sky-Futures™, has also delivered offshore wind turbine and substation inspections since 2014 within the UK, Belgium and Denmark for major clean energy companies. The F4OR program will enable continued investment and focus on ICR's ongoing strategic support for the energy transition.

The 12–18-month program is governed by the Offshore Renewable Energy Catapult (OREC), working with a senior Industry Advisory Group, and follows a range of regional F4OR programs, rolled out across the country since 2018. Reputable companies that have been selected, ranging from SMEs to Tier 1 contractors, work together in a cohort in order to improve and develop their corporate profile and competence in the sector, leveraging each other's expertise.

Britney Houvet, Business Development Director, ICR, said: "We are entering 2022 with a really positive outlook and this fantastic news comes at a time when we continue to strengthen our focus on cleaner energy markets. We are building a pipeline of projects within these existing and emerging industries supporting our ongoing expansion globally and are excited to build on our track record. We have experience working in multiple clean energy industries including on-line leak sealing and specialist on-site machining in biomass with tier one contractors and Sky-Futures™ recently completed methane detection surveys on seven European biogas sites together with its partner SeekOps®.

"ICR continues to invest in its international partner network and has successfully focused on environmental, social and governance (ESG) initiatives during 2021, including the launch of online training for international customers and partners to assist in the reduction of footfall on offshore assets and client sites."

ICR operates in global locations including Europe, MENA, Australia, ASEAN and North America.

» *Subsea Europe Services' fully electric Mantas T12 USV ready to collect high accuracy hydrographic data from May 2022. (Photo credit: Subsea Europe Services)*

SUBSEA EUROPE SERVICES WINS SIX-FIGURE FUNDING TO ACCELERATE AUTONOMOUS SURVEY DEVELOPMENT

A new round of funding has strengthened hydroacoustic technology specialist Subsea Europe Service GmbH's commitment to taking autonomous technologies to the next level for marine survey applications.

The investment boosts the company's unique approach which focuses on the integration of new generation smart, AI and machine learning enabled hydroacoustic systems with diverse survey platforms including AUVs, USVs, and crewed vessels as survey motherships.

Subsea Europe Services is working with several autonomy-focused partners globally and the first fruits of these collaborations will be shown as early as April 2022, during demonstrations of a new solution created with MARTAC Inc., and based on the high-performance Mantas T12 USV with a tightly integrated hydrographic survey payload.

The solution is expected to be ready for operation in May, with short, on-demand surveys at offshore wind farms projected to drive demand for the combination of a high-speed USV and increased autonomous payload functionality.

"The autonomous and unmanned platforms available today are incredibly advanced, but survey technology payloads are still complex systems that require an experienced and professional operator to utilise properly," said Sören Themann, CEO, Subsea Europe Services.

"This investment is a platform for our on-going autonomy R&D, which aims to unlock more agility and efficiency through the seamless integration of survey system and platform to create a single, holistic solution that ultimately, will collect more data, of higher quality and at a faster rate than traditional survey operations," added Luis Carlo Soto, Survey Manager, Subsea Europe Services.

ALLSEAS TAKES DELIVERY OF SEATOOLS DEEP-SEA MINERAL COLLECTION EQUIPMENT

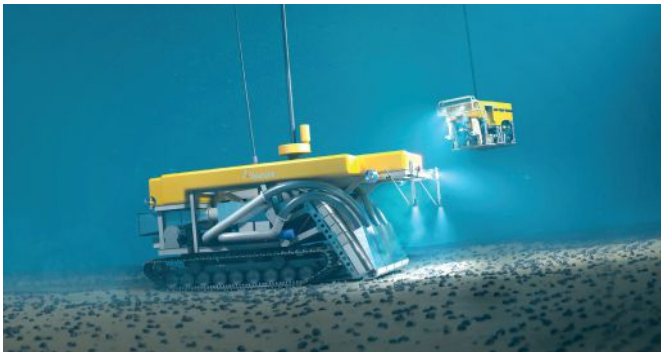
On behalf of its client Allseas, subsea technology company Seatools recently completed the engineering, manufacturing, and qualification of the electronics, instrumentation, and hydraulics for Allseas' pilot polymetallic nodule collection vehicle. The vehicle will be part of a pilot nodule collection test conducted by Allseas, which is scheduled to take place in 2022 in the Pacific Ocean.

Allseas developed and manufactured the core nodule collection technology and surrounding mechanical assembly for the 70+ tons tracked subsea vehicle in-house. Seatools brought the nodule collector alive by the delivery of the entire hydraulic, electronic, and control system. This included the entire development trajectory including design, building, qualification, and testing.

Although Seatools could draw upon its experience and toolbox developed through similar kinds of projects from the past, still a significant part of the project concerned the development and qualification of new technological elements. For instance, in order for Allseas to be able to extensively monitor and control the equipment, process, and environment, Seatools extended its technology base with a new range of sensors. According to Seatools standards, rigorous qualification and factory acceptance testing on both component as well as system level provide a high degree of assurance on the proper functioning of the entire vehicle infrastructure during the upcoming trials.

Rutger Bosland, Project Manager Polymetallic Nodule Collection at Allseas said: "Completion of the hydraulic, electronic and control system for our subsea nodule collection vehicle is a major milestone in the preparation of our pilot mineral collection operations. The complexity of the scope and timeline for delivery has challenged Seatools to step up and deliver a high-tech solution capable of excelling at water depths up to 5,000 meters."

Jan Frumau, Managing Director at Seatools, added: "It makes us feel honored to play a prominent role in this pioneering project. The rigorous engineering approach has resulted in space technology quality levels and we are of the belief that we have equipped Allseas with state-of-the-art ROV and subsea technology. Seatools' contribution underpins the value of our multidisciplinary engineering approach, and confirms our strength in high-end, mission-critical subsea equipment for leading offshore contractors such as Allseas."



» *The polymetallic nodule collector will be part of a pilot test conducted by Allseas in 2022, in the Pacific Ocean. (Image credit: Allseas)*

MODUS SUBSEA COMPLETES WORLD'S FIRST HAUV SUBSEA AUTONOMOUS DOCKING

In a world's first, MODUS recently completed the successful autonomous docking of one of its hybrid autonomous underwater vehicles (HAUV) to an Equinor Subsea Docking Station (SDS) as part of an Equinor funded test scope in the North East of England.

The HAUV system, based on a Saab Sabertooth AUV, successfully docked subsea to the SDS without any operator intervention and the entire operation was monitored live from the MODUS Command and Control Center located at its headquarters in Darlington, utilizing a secure data network and free space optics at the test site.

"This is one of the last technology enablers to be proven allowing the use of resident subsea drones to become a reality across the sector. MODUS has positioned itself at the forefront of subsea technology and innovation with a vision to offer full autonomous solutions at net zero," said Graeme Jaques, Sales Manager.

Representatives from Equinor's technology and drone implementation team were present to witness this significant milestone.

MODUS is a subsea services contractor with a specialist division (MODUS AUTONOMY) developing fully automated, low cost, carbon zero inspection and maintenance services using subsea resident hovering AUVs.

» *MODUS HAUV 6 degrees of freedom hovering AUV system capable of surveying and inspection to depths of 3,000 m. (Photo credit: MODUS)*

» *The MODUS Command & Control Center allows operators to remotely pilot the HAUV and upload & initiate fully autonomous missions. (Photo credit: MODUS)*

SEAMOR MARINE LAUNCHES NEW DSL ADD-ON MODULE

SEAMOR Marine recently developed a new technology that allows Ethernet-powered sensors to run on non fiber-optic ROV tethers. Smaller than a travel mug, the new DSL module is an add-on component that plugs into the ROV and provides up to 100-megabit Ethernet for standard twisted-pair cables or copper tethers. The Ethernet capabilities of the DSL module enable ROVs to run multi-beam sonars, DVLs, IP cameras, and other sophisticated Ethernet-enabled peripherals.

"The DSL module opens up a whole new world of sonars and other third-party tools that previously required a fiber-optic tether. Now, at a very reasonable cost, ROV users will be able to integrate more complex or advanced sensors that require Ethernet to communicate, and they can do so with their existing set up," said Robin Li, President of SEAMOR Marine.

Easy dockside reconfigurability allows users to switch between a fiber-optic and twisted-pair tether on the same vehicle.

» *The Saab Seaeye Cougar XTi. (Photo credit: Saab Seaeye)*

INTELLIGENT COUGAR FOR JAPAN'S OFFSHORE RENEWABLES

Japan's growing offshore wind industry is gaining a Saab Seaeye Cougar XTi underwater robotic vehicle for cable burial inspection and other roles.

Kaiyo Engineering has acquired the 2,000-m rated Cougar, incorporating intelligent control architecture, for deployment from a 250-ton mother ship, the Kaiyo Maru.

The ship is one of a fleet of vessels belonging to Kaiyo Engineering, the only privately owned research and observation company in Japan.

The Cougar XTi adds to Kaiyo's portfolio of Saab Seaeye robots, which includes a Leopard and a Falcon.

In addition to its cable inspection role, the Cougar will also be used by Kaiyo Engineering to cover additional Leopard work.

Worldwide, Saab Seaeye robots play a dominant role in offshore renewables, as they are technologically suited for the challenges involved in building and maintaining structures and interconnections.

With its six powerful thrusters, the Cougar XTi can hold steady in cross currents and operate with precise manoeuvrability whilst fitted with a wide array of equipment.

Kaiyo's Cougar comes with four Imenco cameras, a Tritech SeaKing sonar, Nortek DVL and station-keeping software, and a five-function heavy duty manipulator with camera.

Its intelligent iCON™ behavior-based ecosystem endows each device with its own microprocessor for individual control and real-time feedback, in a modular future-flexible system that allows for further development and innovation.

The entire Kaiyo Cougar XTi operational configuration includes a launch and recovery system (LARS), tether management system (TMS) and 20 ft control cabin and workshop.

Supporting the successful acquisition of the Cougar and other robotic systems is Saab Seaeye's distributor in Japan, Marimex Japan K.K.

OCEANTOOLS LAUNCHES WORLD'S MOST POWERFUL DYE, LEAK & CEMENT DETECTION SYSTEM

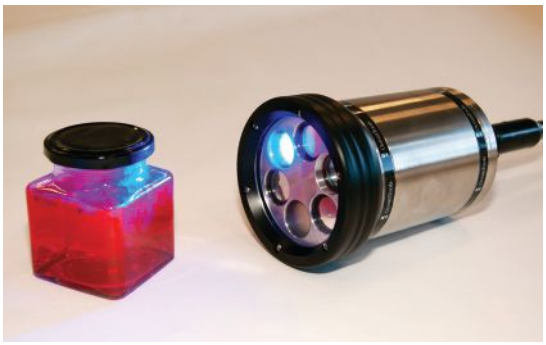
OceanTools recently launched the world's most powerful dye, leak & cement detection system, the D10 DyeTector.

Based on the successful OceanTools D7 & D8 DyeTectors, proven on numerous subsea campaigns globally, the D10 contains optical components to detect the three primary dyes used for underwater detection—rhodamine, ultraviolet and fluorescein. As well as being able to find leaks from subsea infrastructure, the D10 can be used to detect dye added to cement during drilling operations.

Available for rental or purchase, the OceanTools D10 DyeTector has a compact titanium and sapphire viewport, with a standard depth rating of 6,000 meters. The D10 is controlled by an enhanced version of the user-friendly software that was developed for the earlier series of DyeTectors. The software displays the detected dye in a clear and unambiguous scrolling display with the ability to record data and set thresholds to automatically trigger alarms.

Kevin Parker, Managing Director, OceanTools, commented: "We are thrilled to launch this world leading DyeTector. With the ability to detect all three dye types in a single unit, the D10, offers our customers a reliable solution providing them with the confidence it will detect any leak or dye they're trying to find."

OceanTools also currently have in development a 1,000-m depth rated unit, even more compact in size to provide a solution for Observation Class ROV market.



» *OceanTools D10 DyeTector. (Photo credit: OceanTools)*

» *HOS Warland. (Photo credit: DeepOcean)*

DEEPOCEAN ENTERS INTO CHARTER AGREEMENT WITH HORNBECK OFFSHORE

Ocean services provider DeepOcean has entered into a firm charter agreement with Hornbeck Offshore for the *HOS Warland,* a multi-purpose service vessel supporting the US Gulf of Mexico.

The *HOS Warland* will extend DeepOcean's capabilities in the larger construction-end of the market through higher specification equipment installed onboard the vessel.

The vessel has been part of DeepOcean's offering for some time but will now be secured through a time charter. This will enable DeepOcean to provide even better support to the fast-paced requirements of the IMR market, and to construction and installation projects that are managed, engineered and executed by DeepOcean's in-house team.

"The *HOS Warland* in combination with DeepOcean's subsea engineering, equipment and expertise will enable us to bundle our services for customers in a highly cost-efficient way. The versatile spread will be well suited for IMR and installation projects through utilizing its 250-ton crane and dual work-class ROV set-up. The vessel will also serve as a platform to deploy further DeepOcean service lines in the future," said Tony Stokes, DeepOcean's President – Americas.

The vessel is a DP2 310ES Multi-Purpose Service Vessel which compliments the suite of DeepOcean's subsea services. She is owned and operated by Hornbeck Offshore.

The 340-foot length, 76-foot beam *HOS Warland* features over 10,000 square feet of unobstructed deck of 10T/m^2 load capacity with 250te crane capability.

"The vessel is designed to meet the high standards demanded by our offshore oil and gas customers. We are delighted to be working with Hornbeck Offshore to continue offering their high capability vessels to the market," added Tony Stokes.

RCMP AND SEAMOR DEEPEST RECOVERY AND ARCTIC FIRST

Workplace accident in Nunavut, Canada, a bulldozer broke through the ice and was submerged to a depth of 160 meters. A highly skilled team of Canadian Police underwater investigators responded with SEAMOR Marine's Chinook ROV, recovering the victim's body from inside the bulldozer on the Arctic Ocean floor. It was the Canadian Police's deepest underwater recovery in history and first operational dive above the Arctic Circle.

"My heart goes out to the family, friends and co-workers of the operator," said Robin Li, President of SEAMOR Marine. "It's a devastating tragedy. We commend the efforts and technical skill of the police team on this difficult recovery mission, and we're grateful that our ROV could make it possible for the victim to be returned to his family."

The accident occurred at Bathurst Inlet in Western Nunavut during the widening of a 170 km ice road between the port facility and the Back River gold mining project site. The conditions at this remote location were extreme: 5ft to 6ft thick ice, air temperatures of -41°C with a windchill of –53°C, and a 160 m submerged depth well beyond the capacity of most divers.

After a failed attempt with another ROV, the British Columbia Royal Canadian Mounted Police (RCMP) requested assistance from the RCMP National Underwater Recovery Training Centre (NURTC). The NURTC team arrived and deployed SEAMOR's 6-thruster Chinook ROV.

"The recovery and investigation were done at significant depths and latitude, both of which was one of the most, if not the most complex recovery to date for the RCMP," reported British Columbia RCMP Superintendent Jim Elliott.

On the first day of the operation the Chinook ROV navigated to the bulldozer door using the integrated underwater GPS (USBL) and onboard multibeam sonar, live HD video cameras and specialized lighting. Then, with the help of the attached Blueprint Labs 5-function Alpha Arm and a rope cutter jaw, the Chinook ROV cut through a polysteel line and cleared away the other entangled ROV.

The second day of the operation involved opening the bulldozer door, the point where the other ROV had failed. Using a second arm to manipulate the door handle down 90 degrees, the Chinook ROV successfully opened the door and retrieved the bulldozer operator's body.

"Our 'Fab' accomplished all tasks required and worked like a champ above the Arctic Circle," said Jay White, coordinator at the NURTC and leader of RCMP national diver training program.

The team at the NURTC affectionately named their SEAMOR Chinook ROV 'Fab' after Fabrice Gevaudan, an RCMP diving colleague and friend who lost his life in the line of duty. The crew that named 'Fab' was the same crew that deployed 'Fab' to help complete this Nunavut recovery mission, the deepest recovery in RCMP history.

"We are proud to assist RCMP teams like this one who push the limits of what is possible with hard work and advanced tools, and we sincerely hope the successful recovery in Nunavut will help bring comfort and closure to the family of the bulldozer operator," added Li of SEAMOR Marine.

» *Fab, the SEAMOR Chinook ROV in the Arctic Circle. (Photo credit: SEAMOR Marine)*

VERLUME WINS INNOVATION AND TECHNOLOGY AWARD AT SUBSEA EXPO AWARDS

Intelligent energy management and storage technologies specialist, Verlume, has won the award for Innovation and Technology at the 2022 Subsea Expo Awards.

Organized by the Global Underwater Hub, the Subsea Expo Awards recognize the companies and individuals who are leading the way in the global underwater sector.

Within the Innovation and Technology category, which recognizes excellence by a company in developing new technology and bringing it to the market, Verlume won the award for its flagship Halo seabed battery energy storage system. The Halo system is an easily installable, autonomous seabed battery storage solution with integrated intelligent energy management, specifically developed for the demanding underwater environment.

Richard Knox, Managing Director and Founder of Verlume, said: "We are honored to have won the Innovation and Technology award. It is a demonstration of the fantastic effort that the whole team has put in, particularly over the last few years against the challenges of COVID-19 and remote working."

"I would like to dedicate this award to the team at Verlume and say thank you to everyone that has supported us on our journey since we started the company. I look forward to engaging with the wider energy industry as we continue to innovate with our core technologies of intelligent energy management and storage."

Founded in 2013, Aberdeen-based Verlume uses its core technologies to enable clean, resilient and integrated energy systems. The company's first commercial deployment of the Halo system will take place later this quarter at the US Navy Wave Energy Test site off the coast of Hawaii, where it is part of a wave energy project for the C-Power SeaRAY autonomous offshore power system.

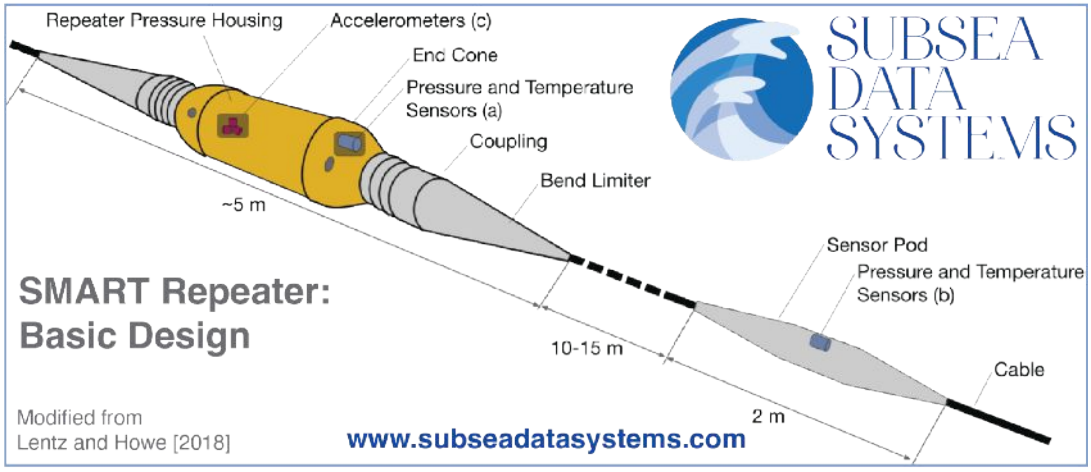
Paul Slorach, Verlume's Business Development Director, added: "It is great to be able to say that our Halo system is now a piece of award-winning technology. With the recent launch of the new Verlume company name, this award win is a fantastic start to the next phase of our company's ambitious growth plans."

» *Halo seabed battery energy storage system. (Image credit: Verlume)*

SMART CABLES FOR SCIENTIFIC DATA COLLECTON

By Matt Fouch,
President,
Subsea Data Systems

& Stephen Lentz,
Chief Technology Officer,
Subsea Data Systems



» *An example of a SMART repeater. (Image credit: Subsea Data Systems)*

In December 2021, Subsea Data Systems (SDS), a new partnership between Samara/Data and Ocean Specialists, Inc., announced that it had received funding from the National Science Foundation's Small Business Innovation Research (SBIR) program to develop SMART (Sensor Monitoring and Reliable Telecommunications) Cable technologies. SMART is an initiative built on the concept that adding sensor components to commercial submarine fiber optic cables used to carry Internet traffic can simultaneously collect seismic and oceanographic data without interference to the cables' primary function.

While SMART Cables have been discussed for years, we are proud that NSF's support has enabled us to move quickly to produce the first SMART repeater sensor system prototype.

We anticipate completion of the prototype within the next few months, qualifying us to apply for an SBIR Phase II grant from NSF. The prototype system will be the first step in developing solutions which system suppliers can, in turn, offer to cable system operators.

This effort, along with several parallel developments in 2021, has propelled the SMART concept forward in unprecedented ways. These new advances have catalyzed interactions across a broad range of entities that would benefit from SMART technology. We are watching cable suppliers, developers, and operators move forward with ideas and projects that could make SMART Cables a reality within the next few years.

A NEW ERA OF SUBSEA INFRASTRUCTURE

Now that there is a concrete effort to develop SMART cable system, we have adopted the Technology Readiness Level (TRL)

scale, first developed by NASA and now also used by the US Department of Defense and the European Space Agency to evaluate the development path. The TRL scale ranges from the level of concept (TRL1) to operational (TRL9). The table below shows our assessment of SMART Cables' present development and the effort needed to achieve a fully operational status:

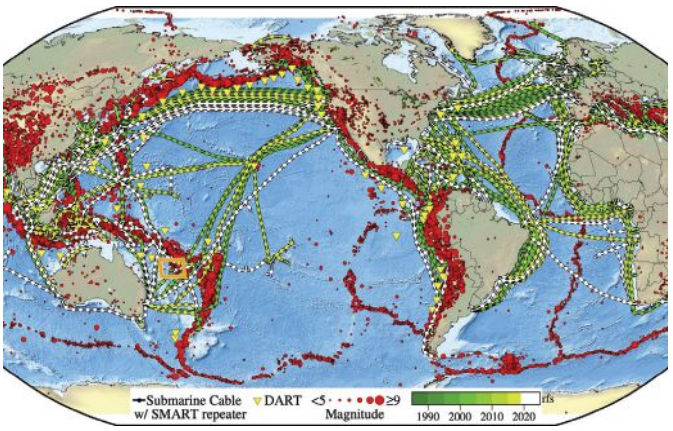
Level	Definition	SMART Repeater Requirements	SDS Development Status
TRL1	Basic principles observed and reported	Objective of seabed sensors in submarine cables stated; Existing sensor types identified; Telecom cables identified as key enabler.	Completed
TRL2	Technology concept and/or application formulated	Technical challenges and potential solutions identified.	Completed
TRL3	Analytical and experimental critical function and/or characteristic proof-of-concept	Electrical and mechanical design concepts developed and assessed.	In progress; 2022 completion
TRL4	Component and/or breadboard validation in laboratory environment	Benchtop demonstration including streaming to data repository.	In progress; 2022 completion
TRL5	Component and/or breadboard validation in relevant environment	Prototype testing in shallow water.	2023 objective
TRL6	System/subsystem model or proto-type demonstration in a relevant environment	Sea trial of SMART sensor system mounted in repeater housing.	2024 target
TRL7	System prototype demonstration in a space (subsea) environment	12-18 month trial of system with multiple SMART repeaters.	2025 target
TRL8	Actual system completed and "flight qualified" through test and demonstration	Prototype system delivered and commissioned.	2025 target
TRL9	Actual system "flight proven" through successful mission operations	First "generally available" product delivered and commissioned.	2026-2027

SMART REPEATER SENSOR DEVELOPMENT STATUS

At SDS, we are currently working on TRLs 3 and 4 in tandem. While a functional benchtop prototype will enable us to achieve TRL4, we also plan to work with system suppliers to define design elements that will allow our sensor package to be incorporated into telecommunications cable systems. We expect this work to propel our development status to at least TRL5 before the end of 2023, at which time we plan to be conducting field trials. Further, more realistic trials, will be needed to achieve TRLs 6 and 7. Trials and demonstrations are essential to build the confidence of not only system suppliers but also potential users and operators of SMART Cables.

FUNDING THE FUTURE

We know that the SMART concept will need further Research & Development (R&D) investment at every step along the way. Furthermore, funding for Operations and Maintenance (O&M) will be needed at later stages and through the life of each deployed system. While the tenets of social responsibility may garner some support from telecom cable operators, we expect that much of the funding will need to come from outside sources, including governments, NGOs, and charitable foundations. However, we ultimately hope to see SMART Cables become self-supporting by providing valuable data for disaster mitigation, geologic and oceanographic research, and cable protection.



» *SMART cables could provide data for disaster mitigation and trigger early tsunami warnings. (Image credit: B. Howe)*

At SDS, we are encouraged by the increased interest in SMART Cables over the past several months. We believe that the initial funding for the first SMART systems will start a virtuous cycle of funding and new projects, and we look forward to continuing the rapid push to make SMART Cables a reality.

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

SUBSEA DATA SYSTEMS

» *Prysmian's new submarine power cable plant will be based in Brayton Point, MA. (Image credit: Prysmian)*

PRYSMIAN FINALIZES PURCHASE OF US CABLE MANUFACTURING SITE

Prysmian Group is moving ahead with its project for a new submarine power cable plant in the United States. Prysmian Group and CDC Commercial Development Company recently announced the signing of the contract for the purchase by Prysmian of the site identified in Brayton Point (Massachusetts).

The final acquisition of the site is subject to securing state permits for the construction of the new plant. Prysmian Group's total investment to build the new plant will amount to around $200 million.

Finalization of the plans for the US localization of the production footprint of submarine cables also entails confirmation of the award of the projects for cabling the Commonwealth Wind and Park Wind City offshore wind projects, for a total of approximately $900 million, by Avangrid Renewables, a subsidiary of AVANGRID. The Notice to Proceed is yet to be issued.

"We are very pleased with the agreement reached with CDC and the progress of our project to build a new plant in Brayton Point," commented Hakan Ozmen, EVP Projects Business at Prysmian Group. "I would like to extend particular thanks to the Massachusetts state government for its attention to this important project, which will make it possible to convert the area home to the former Somerset coal plant to production in support of the energy transition in the USA. The new plant will allow us to provide even closer support to our customers and gain a strong competitive advantage in a market expected to undergo sharp growth, with the goal of 30 GW of new capacity to be installed by 2030 under the Biden Plan."

"For the past four years, Brayton Point LLC has worked to reposition and prepare Brayton Point Commerce Center for offshore wind and other port-related activities. We are pleased Prysmian Group will bring excellent jobs and investment to Somerset by building a high-tech cable factory. Prysmian is an ideal partner because its undersea cables will fulfil the regional commitment to a clean energy future and establish Massachusetts as an offshore wind energy hub. This is a milestone agreement for the region and we expect to announce additional tenants to join Prysmian at Brayton Point Commerce Center," declared CDC Executive Vice President Stephen R. Collins.

"AVANGRID is proud to be a leader in the U.S. offshore wind industry and deliver transformational investments that create quality jobs, support local economies, and advance the development of a local supply chain for the growing U.S. market," said Chairman and CEO of Iberdrola and Chairman of AVANGRID Ignacio Galán. "Today marks a historic milestone in the United States' and Massachusetts' transition to a clean energy future, as we celebrate this agreement to build a new cable manufacturing facility at Brayton Point. Drawing on Iberdrola's global offshore wind experience, we are uniquely positioned to help states like Massachusetts capitalize on the opportunities presented by this new industry."

ROTECH COMPLETES DE-BURIAL AND POST-LAY BURIAL OFF FRANCE

Rotech Subsea has completed an important HDD exit de-burial and post-lay burial of a key subsea cable off the French Atlantic Coast. Contracted by a leading submarine cable player, the sector-leader in Controlled Flow Excavation (CFE) and suspended jet trenching mobilized its specialized trenching and sand wave clearance TRS2 tool in late Q3 2021.

Deployed from a support vessel A-frame, the cutting edge TRS2 tool operated in water depths ranging from 5-12 m with currents ranging from 1.0-2.0kts and maximum sea state of 0.5 m Hs. Soil conditions were very fine sand.

The TRS2 successfully de-buried the HDD from 4 m below seabed, excavating a 10x25 m box section in a grid pattern. The two center lines were exposed and kept open in three further passes.

For the cable burial the TRS2 was again deployed by A-frame off the stern of the vessel with two deck winches used to position the tool. The cable was successfully lowered to 2 m TOP.

Rotech Subsea Director of Subsea, Stephen Cochrane, commented: "The TRS2 jet trencher was selected for this project due to its unrivalled jet power and flow capabilities. In fact, it's the only non-contact system available in the marketplace capable of carrying out the scope of work. With both phases of this vital duct de-burial project completed ahead of schedule with client specification for de-burial and burial achieved with ease, this marked another very successful deployment for the TRS2."

» *The TRS2 tool operated in water depths ranging from 5-12 m, where soil conditions were very fine sand. (Photo credit: Rotech)*

With enhanced capabilities, Rotech Subsea's CFE suite of tools is firmly established as the method of choice for cable trenching in Europe and beyond. The Aberdeen-based contractor's in-house research, development and engineering team has created a suite of 15 non-contact CFE, Suspended Jet Trenching tools. Further game changing enhancements were unveiled in January 2022 with the introduction of the new RS1-3 jet trencher. This latest next generation tool has been purpose-built for cable trenching, boasting higher soil cutting capabilities than existing tools.

OFC PAPER: IMPROVING SUBMARINE CABLE CAPACITY USING SDM

As our world becomes increasingly connected, communication infrastructure must scale to meet the growing demand. Critical parts of that infrastructure are submarine cables connecting networks between continents.

These submarine cables operate in an environment where space is a luxury. One of the biggest challenges in designing next-generation submarine cables is how to increase data capacity without increasing the cable's size. Even a simple change, like adding more fiber pairs, comes with additional power requirements that complicate the design.

Pierre Mertz and Siddharth Varughese are part of a team behind a submarine cable field trial that succeeded in transmitting data at a record 307.2 terabits per second without any required size increase. They presented their results at the Optical Fiber Communication Conference and Exhibition (OFC), San Diego, California.

The team achieved this record on the transatlantic cable Dunant and employed a nascent technology called space-division multiplexing (SDM). With SDM technology, each fiber pair operates at a lower optical power and signal-to-noise ratio.

JAPAN'S ARTERIA JOINS PAN-ARCTIC FIBER CABLE PROJECT

Finland's Cinia Ltd and Japan's ARTERIA Networks Corporation have announced a joint effort to build a fiber optic cable system linking Europe and Asia through the Arctic region.

ARTERIA is joining the earlier announced team of Cinia and Far North Digital as the leading Japanese partner to develop and build the Far North Fiber project.

The Finnish network, cybersecurity and software solutions provider Cinia and ARTERIA Networks Corporation, a Japanese company focused on telecommunications infrastructure development and operations have signed a Memorandum of Understanding (MoU) to build a submarine fiber optic cable. The joint network will run from Japan, via the Northwest Passage, to Europe with landings in Alaska and the Canadian Arctic. European landings are planned in Norway, Finland and Ireland.

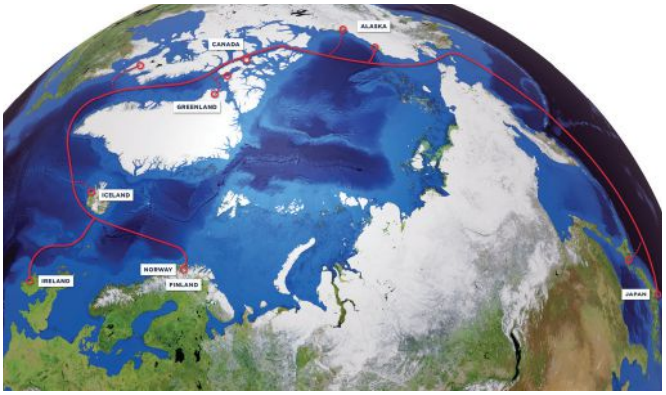
In December 2021, Cinia and North American Far North Digital LLC announced a joint effort to build a subsea cable linking Asia and Europe. ARTERIA as the Asian partner is now joining the project to pave the way for building a network on the Japanese side, which will be the gateway in Asia. The planned 14,000-kilometer cable system greatly reduces the optical distance between Asia and Europe, thus minimizing signal latency.

"Far North Fiber will be the first multicontinental cable system and the first Pan-Arctic system. First of its kind very often causes a paradigm shift. Cinia is very pleased to have all three continents represented in the development team, and I warmly welcome ARTERIA to join the project with Cinia and Far North Digital," said Ari-Jussi Knaapila, CEO of Cinia.

The cable system will support the positive development of digital economies both in national and international level and further between continents. Security and environmental friendliness are some of key areas guiding the system development.

Koji Kabumoto, Representative Director, President & CEO of ARTERIA, commented: "The Far North Fiber project is an epoch-making project to build the last remaining submarine cable route connecting Europe with Japan and Asia at the lowest latency and will greatly contribute to the further development of the digital infrastructure environment in Japan regions such as Hokkaido. In addition, the new international network realized by the Far North Fiber will be able to create new demand for connectivity in a wide range of fields such as industry, academia, and culture in Europe, Japan, and Asia."

The targeted Ready for Service of cable is by the end of the year 2025. Cost estimate for project is approximately 1 billion euros. Industry leader Alcatel Submarine Networks has been chosen as the lead EPC partner for the project.



PRYSMIAN TO DELIVER FIRST UK-GERMANY INTER-CONNECTOR

Prysmian Group has been awarded a contract worth around €1.2 billion by NeuConnect Britain Limited and NeuConnect Deutschland GmbH for the turnkey design, manufacturing, installation, testing and commissioning of a 725-kilometer submarine interconnector that will directly link the German and UK electricity grids for the first time.

» *CLV Leonardo da Vinci. (Photo credit: Prysmian)*

This 1400 MW submarine and land cable system will connect two of Europe's largest energy markets, promoting the efficient use and integration of renewable energy generation resources in both Germany and the UK.

Prysmian will provide the complete cable system to be operated at ±525kV HVDC utilizing mass-impregnated (MI) paper insulated cables, and include fiber optic cables on the land and selected submarine sections, complemented with state-of-the-art cable monitoring systems that shall support the monitoring, maintenance and services to be provided during the warranty period.

The submarine and land power cables will be manufactured at Prysmian's center of excellence at Arco Felice factory near Naples, Italy. Offshore installation activities will involve three of the Group's own cable laying vessels including Leonardo da Vinci, Cable Enterprise, and Ulisse. Commissioning of the project is scheduled in the second half of the decade.

SUMITOMO & SEAWAY 7 COLLABORATE ON OFFSHORE WIND PROJECTS

Sumitomo Electric Industries Ltd. and Seaway 7 ASA have signed a Memorandum of Understanding outlining their intention to collaborate on offshore wind projects in Japan and the wider Asia-Pacific region.

The collaboration will focus on providing robust, competitive, and localized turnkey engineering, procurement, installation and commissioning (EPIC) solutions for submarine cable projects. Sumitomo Electric will contribute its in-depth knowledge of the regional market and accumulated experience in the design and manufacturing of submarine cables. Seaway 7 will provide its state-of-the-art installation services with an extensive track record of successfully completed submarine cable system projects for offshore renewables, oil and gas, and utility markets globally.

The Japanese and Asian offshore wind market is expected to grow substantially in the next decades, based on a mixture of both bottom-fixed and floating offshore wind projects, and has already attracted a significant number of local and international offshore wind developers.

The collaboration between Sumitomo Electric and Seaway 7 will enable them to provide a unique service to meet the need for a one-stop-shop EPIC submarine cable solution for the regional offshore wind market. The two companies are committed to supporting customers who seek to reduce greenhouse gas emissions for a sustainable future by combining their extensive global experience with localized solutions.

Yasuyuki Shibata, Managing Executive Officer of Sumitomo Electric, said: "We are delighted to form this strategic collaboration with Seaway 7 to jointly contribute towards the decarbonization of the regions for decades to come."

Stuart Fitzgerald, CEO of Seaway 7, added: "The intended partnership with Sumitomo Electric builds on our existing long-term business relationship and is aimed at introducing our combined expertise and capabilities into the emerging offshore wind market in Japan and the wider Asia-Pacific region, which is in high demand for competitive and reliable solutions."

» *Sumitomo Electric's and Seaway 7 will pool expertise to deliver state-of-the-art, turnkey EPIC solutions for submarine cable projects. (Photo credit: Seaway7)*

SUBCOM, SEA-ME-WE 6 CONSORTIUM ANNOUNCE CONTRACT IN FORCE

SubCom and the Southeast Asia-Middle East-Western Europe 6 consortium (SEA-ME-WE 6) has an-nounced that a contract is in force and implementation has commenced for the supply and installation of a new 19,200 km undersea cable system connecting South East Asia, the Middle East, and Western Europe at 12 locations from Singapore to France.

The addition of the new, high-speed cable system will improve the diversity along the route and enable consortium partners to provide more advanced, high-capacity services to customers.

"With this new cable system, our partners will be able to meet and exceed capacity demands across multiple regions," said Mr. Yue Meng Fai, Chairperson of the SEA-ME-WE 6 Management Committee and Senior Director, Consortium Cable Engineering, Singtel. "This new, reliable and resilient system encompasses some of the most advanced transmission technologies in the world and will improve access to services for everyone along this route."

A leader in high fiber count submarine cables, SubCom will utilize SL17-SDM cable, supporting up to 24 fiber pairs (FP). Production of the cable and equipment will take place at SubCom's manufacturing campus in Newington, NH, USA.

The system consists of three segments: an undersea segment from Tuas (Singapore) to Ras Ghareb (Egypt), a terrestrial segment from Ras Ghareb (Egypt) to Port Said (Egypt), and another undersea segment from Port Said (Egypt) to Marseilles (France). The fiber pair capacities for each network segment have been individually designed, together with the segment fiber pair counts, resulting in multi-Terabits end-to-end capacity whilst optimizing the overall system price.

Leveraging SubCom's industry-leading 18kV power source technology, SEA-ME-WE 6 is designed to maintain operations with single-end feed power in the event there is a far-end fault. Single-end power source capability is critical for the reliability and overall resilience of a system, particularly of extended length. SubCom's system powering expertise and continued investment in research and development enables the company to support complex deployments requiring additional cable lengths.

To reliably support as much as 24FP on a trunk or branch port, SubCom will utilize its Enhanced Branching Unit (eBU), which provides flexible electrical power and optical fiber routing with shore-based telemetry control. The eBU latching power switching provides advanced internal management features for unit and user protection that include repair states, configurable restricted states, and a configurable power-down state that is selected for optimum system re-activation.

"SubCom is honored to drive the design, manufacture, and deployment of SEA-ME-WE 6, a system that will reach more than 11 countries and benefit hundreds of communities beyond," said David Coughlan, CEO of SubCom. "We maintain the industry's most advanced technology portfolio and marine installation capabilities, all of which will contribute to a successful project on behalf of the SEA-ME-WE 6 Consortium."

The system is expected to be ready for service by the first quarter of 2025.

CHECK THE TECH

» *Sonardyne has introduced a new secure, wireless underwater initiation capability for the careful disposal of sea mines. (Image credit: Sonardyne)*

WIRELESS INITIATION FOR NAVAL MINE DISPOSAL

As emerging marine technologies continue to improve the overall safety of offshore operations, one area of naval security has come into sharp focus of late: underwater mine clearance.

Navies around the world continue to invest in a new generation of uncrewed or autonomous systems designed to help enable remote deployments and significantly mitigate the risks—to people, assets, and critical missions—associated with long-established underwater mine counter measures (MCM) and explosive ordnance disposal (EOD) exercises.

This shift in product engineering and resource allocation signals a new era for at-sea safety and efficiency, in which traditional crewed MCM/EOD platforms and activities may be phased out by an increasing smart ecosystem of uncrewed assets designed and manufactured by expert marine technology developers.

INITIATION TRANSPONDER 6

Sonardyne is one such outfit looking to accelerate the acceptance of remote systems for the careful disposal of sea mines with the introduction of a new secure, wireless underwater initiation capability.

Speaking exclusively to ON&T, Tom Rooney, Technical Sales Manager – Defence at Sonardyne, said: "As Navies seek to enhance their remote operations capabilities, Sondardyne understands that this requires us to reconsider the in-field playbook for MCM and underwater ordnance, and adjust the mission toolkit accordingly."

The company's new Initiation Transponder 6 (IT 6) is case in point. Designed to be connected directly to a remotely deployed, non-electric mine neutralization device, such as a Cobra MDS from ECS Special Projects, the IT6 allows EOD teams to send a wireless, acoustic command from their vessel, safely initiating a shock tube detonator. Recent demonstrations were conducted over distances in excess of 1,000 meters away.

SECURE, WIRELESS INNOVATION

IT 6 is based on Sonardyne's field-proven Wideband 2 digital signal technology, which offers a reliable and long-range underwater wireless communications link. The development of IT 6 means that service personnel no longer need to hardwire mine neutralizers up to signal relay buoys on the surface and are not restricted to good weather and daylight for setting up an initiation operation.

"Underwater acoustic command and control is a core Sonardyne capability, so we designed IT 6 to equip field operatives with a versatile solution for wireless deployment—in all weather conditions, day or night—and to help facilitate a more reliable and secure approach to MCM/EOD than the traditional methods of involving shock tubes, fuses or detonation lines," added Rooney.

At just 357 mm tall, 55 mm in diameter, and with a weight of only 0.10 kg, IT 6 is compact, lightweight, and designed to be placed by a clearance diver or remotely operated vehicle (ROV) for both high order detonation and low order deflagration. It features multiple layers of security to prevent unintended activation, including a hydrostatic switch, which only allows the unit to be armed when a pre-determined depth has been reached.

TOPSIDE SUPPORT

Operations using IT 6s are controlled using Sonardyne's new rugged Deck Topside case and cabled dunker. Environmentally rated to IP67, the case features a daylight readable interactive 7-inch resistive touch screen and rechargeable battery, for when operating from small combat craft with no external power.

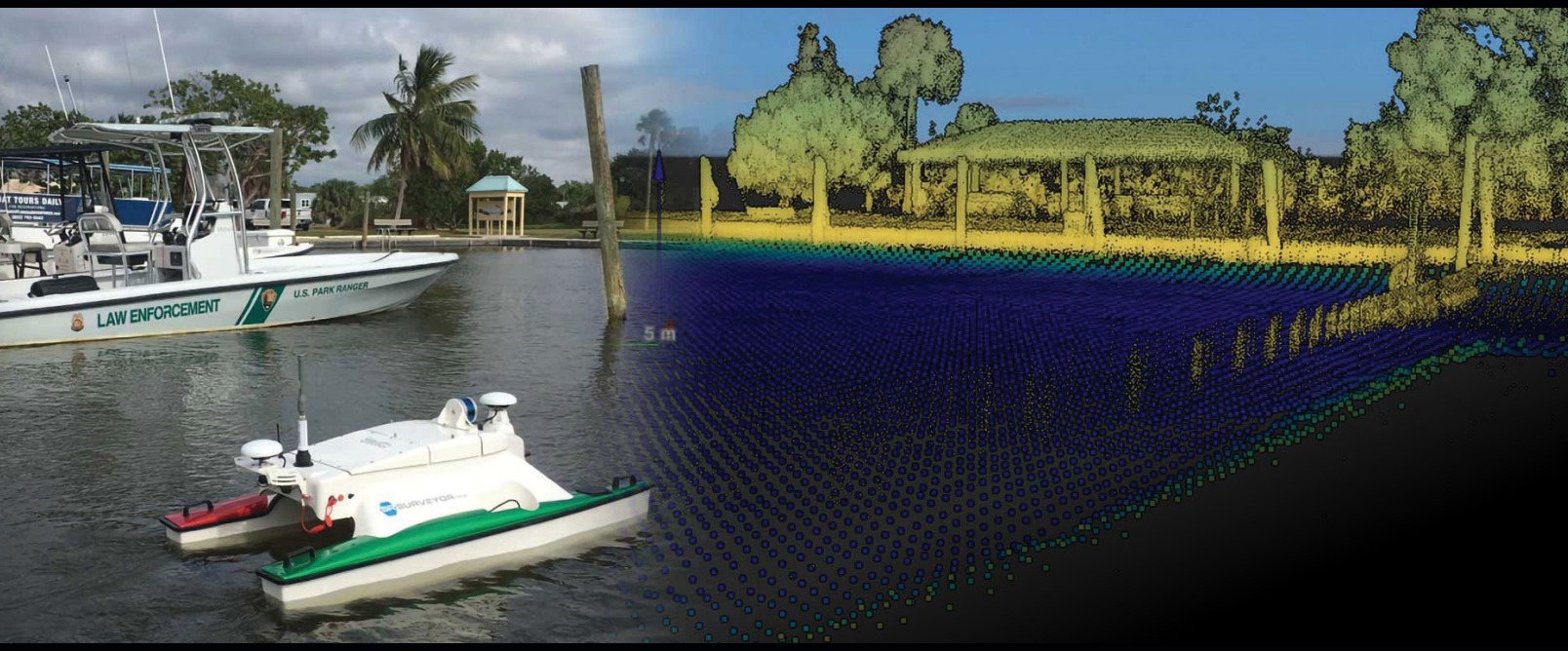
» *IT 6's user interface was designed in close co-operation with EOD technicians and enables multiple unit deployment. (Photo credit: Sonardyne)*

The user interface was designed in close co-operation with EOD technicians and enables operating parameters to be set and multiple IT 6s to be configured prior to deployment. During a live operation, two physical buttons provide an additional layer of security, requiring users to hold one button to arm, then simultaneously press the other to initiate.

The dunker is supplied with 10 meters of cable and provides a secure two-way communications link between the surface and IT 6.

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

Sonardyne



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ROV MAKES 'SPLASH' WITH DEMO ABOARD USS IWO JIMA (LHD 7)

By Hendrick Dickson, Mid-Atlantic Regional Maintenance Center (MARMC)

Mid-Atlantic Regional Maintenance Center (MARMC) hosted a remotely operated vehicle (ROV) tank inspection demonstration aboard USS *Iwo Jima* (LHD 7) in February to assess how the technology could be used to improve maintenance availability efficiency.

A team from Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) led the demonstration, inspecting a 9,000 square-feet ballast tank aboard the amphibious assault ship with a VideoRay Pro 4 ROV. PSNS & IMF have been using the ROV for some nuclear tanks and voids inspections for a couple of years. With that success, the Navy is looking at the possibility of broadening its use at regional maintenance centers and other maintenance facilities.

Nearly 20 leaders in maintenance and innovation from Puget Sound Naval Shipyard, Southeast Regional Maintenance Center, Southwest Regional Maintenance Center, warfare centers, and other ship maintenance facilities watched as the ROV navigated through the tank water recording and capturing images of the tank's structural integrity.

"We were able to get a pretty clear and accurate view of inside of the tank," said Ty Curtin, MARMC Tanks, Voids and Structural Branch Head. "We could see a lot of items in this tank that were documented previously by our assessors. When the ship enters its availability this summer, we can go in and compare what we saw today."

Tank inspections and overhauls are routinely conducted during maintenance availabilities. The process of emptying a tank, drying it out, and conducting a gas-free assessment requires a lot of time, money and man-hours.

"There's an entire process we have to go through before we could get someone into a tank to conduct an inspection that most times takes only a couple of hours to complete," explained Kevin Baum, MARMC Ventilation and Damage Control Branch Head (Code 243). "On the DDGs and CGs, where stability is critical, having the ability to conduct an accurate and descriptive inspection or check on a specific issue without having to go through that preliminary process could be a game changer for us."

» *Roland Campbell, of Puget Sound Naval Shipyard and Intermediate Maintenance Facility, monitors a VideoRay ROV during a ballast tank inspection demonstration aboard USS Iwo Jima (LHD 7). Mid-Atlantic Regional Maintenance Center (MARMC) hosted the ROV demonstration, attended by numerous engineering and innovation experts, to gain insight on how this technology could be impactful to ship maintenance. (Photo credit: U.S. Navy Photo by Hendrick L. Dickson)*

Embracing innovative ways to improve on-time delivery while increasing cost-saving efforts is a major focus in the Navy's ship repair construct, and is vital to sustaining the fleet's mission-readiness.

Kirk Jenne, Chief of Innovation, Surface Ship Maintenance Modernization and Sustainment (SEA 21) and Commander, Navy Regional Maintenance Center (CNRMC) pointed out that what was learned can be used to leverage what is needed for tomorrow. "We learned a lot from all the participants in this collaboration with Puget Sound Naval Shipyard and MARMC. We intend to leverage our new knowledge with investments by DoD and the Office of Naval Research to extend current technologies to a new level of autonomous inspection technologies in these challenging spaces."

Rear Adm. Eric Ver Hage, CNRMC lauded the team's effort saying: "I'm very pleased to see shipyards, warfare centers, and regional maintenance centers coming together like this to solve difficult problems we face over and over. Their use of technology, their collaborative spirit, and their exploration of ideas to reduce the duration, cost, and complexity of tank inspection is tremendous and we need more of it in many areas. This effort is a great demonstration of the old adage, 'we are better together!'"

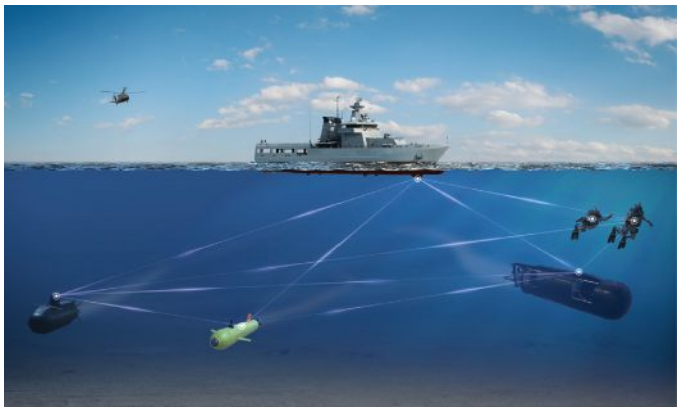
MARMC, a field under Naval Sea Systems Command (NAVSEA), provides surface ship maintenance, management and oversight of private sector maintenance and fleet technical assistance to ships in the Mid-Atlantic region of the United States and provides support to the fifth and sixth Fleet Area of Responsibilities. They are also responsible for the floating dry-dock Dynamic (AFDL-6).

DSIT SOLUTIONS LAUNCHES STATE-OF-THE-ART ACOUSTIC UNDERWATER COMMUNICATION SYSTEM

DSIT Solutions has launched WhitePointer, a state-of-the-art underwater acoustic communication system that enables simultaneous communication between multiple surface and underwater platforms. The system is based on the company's advanced underwater technology that allows networked communication between various users.

The WhitePointer system complies with NATO Standards and enables reliable voice and data communication between surface ships, submarines, and other underwater users including divers and drones such as Swimmer's Delivery Vehicles (SDVs), Diver Propulsion Vehicles (DPVs), Autonomous Underwater Vehicles (AUVs) and Unmanned Underwater Vehicles (UUVs). The system supports underwater acoustic networked communication with multiple users and can be fully integrated with any onboard communication system.

The solution, which implements multiple types of modulations for data transmission, includes a synthesized, high-power transceiver with preset frequencies. This allows the Operator to rapidly switch channels without risking errors.



» *WhitePointer enables reliable voice and data communication between surface ships, submarines, and other underwater assets. (Image credit: DSIT)*

Speaking of the launch of WhitePointer, DSIT's VP Business Development and Marketing,

Mr. Hanan Marom, remarked: "We are proud to launch this innovative acoustic underwater communication system that enables cyber safety and protected underwater networked communication between multiple surface and underwater platforms on the same network, via both voice and data transmissions. The WhitePointer system is an advanced communication suite that supports covert operational missions of multiple maritime vessels as well as tactical missions and search & rescue missions."

BOLLINGER CELEBRATES COMMISSIONING OF 46TH FAST RESPONSE CUTTER USCGC JOHN SCHEUERMAN

Bollinger Shipyards President and CEO Ben Bordelon joined senior U.S. Coast Guard officials at the Port of Tampa on February 23, for the commissioning of one of the newest Sentinel-class Fast Response Cutters (FRC), USCGC *John Scheuerman*. The cutter is the fifth of six FRCs to be home-ported in Manama, Bahrain, which will replace the aging 110' Island Class Patrol Boats, built by Bollinger Shipyards 30 years ago, supporting the Patrol Forces Southwest Asia (PATFORSWA), the U.S. Coast Guard's largest overseas presence outside the United States.

"While every commissioning is special, this particular vessel—especially when and how it was delivered—means a great deal to our team," said Bordelon in his remarks during the ceremony. "As you know, this past August Hurricane Ida made landfall at Port Fourchon, Louisiana with winds just short of a Category 5 hurricane, clocking in at 150 miles per hour…Despite the odds stacked against us, our team persevered and the USCGC *John Scheuerman* was delivered on October 21, a full week ahead of schedule. This vessel and this commissioning represent a major win that our team needed and deserved. It reflects the resilience, commitment and tenacity of the 650 skilled men and women that built it. With the exception of my family, I've never been more proud of anything that I've ever been a part of.

Present at the ceremony was Admiral Karl Schultz, the 26th Commandant of the United States Coast Guard. Admiral Schultz lauded Bordelon and the "Cajun toughness" of Bollinger's employees necessary to complete the Scheuerman build ahead of schedule following Hurricane Ida, saying: "We know what your men and women did and we know how you inspire them to come to work, to have something to rally around, and this product behind us is a testament to the Cajun toughness of Bollinger Shipyards and its employees."

Admiral Schultz continued: "I could not sleep better at night knowing our men and women of the Navy and the Coast Guard in that challenging region of the world are aboard highly-capable, Bollinger-built ships…These ships are truly technologically sophisticated and ready to stand their duties. This is one of those places where we are truly living and embodying the Tri-Service Maritime Strategy where our Navy, our Coasties and our Marines are working side by side to protect our national defense interests."

The U.S. Coast Guard took delivery of the 154-foot USCGC *John Scheuerman* in Key West, Florida in October of last year. The cutter is the 169th vessel Bollinger has delivered to the Coast Guard over a 35-year period and the 46th FRC delivered under the current program. Notably, the USCGC *John Scheuerman* was delivered nearly one week ahead of schedule despite a three-week shutdown due to the significant damage sustained to Bollinger's facilities during Hurricane Ida. The storm made landfall in late August near Port Fourchon, Louisiana as a powerful Category 4 storm. Bollinger's facilities in Port Fourchon, Lockport, Houma and Larose suffered significant damage as a result of Hurricane Ida, which tied with last year's Hurricane Laura and the Last Island Hurricane of 1856 as the strongest on record in Louisiana.

Last year, Bollinger submitted its proposal to the United States Coast Guard to build Stage 2 of the Heritage-class Offshore Patrol Cutter (OPC) program. If chosen, Bollinger would construct and deliver a total of 11 vessels to the U.S. Coast Guard over the next decade, helping to sustain the Bollinger workforce through 2031. The OPCs will provide the majority of offshore presence for the Coast Guard's cutter fleet, bridging the capabilities of the 418-foot national security cutters, which patrol the open ocean, and the Bollinger-built 154-foot FRCs, which serve closer to shore. The OPCs will conduct missions including law enforcement, drug and migrant interdiction, search and rescue, and other homeland security and defense operations.

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

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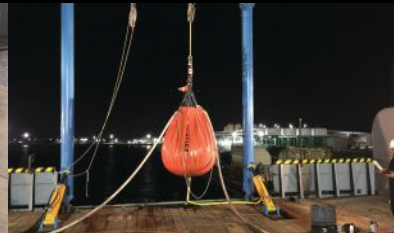

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AUVSI XPONENTIAL
Orlando, FL » April 25-28
https://www.auvsi.org/events/xponential/auvsi-xponential-2022

International Partnering Forum (IPF)
Atlantic City, NJ » April 26-28
https://www.offshorewindus.org/2022ipf/

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

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

US Floating Wind
San Francisco, CA » June 7-8
https://reutersevents.com/events/offshore-wind/content-san-francisco.php

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

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

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

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

EUROPE

Deep Sea Mining Summit
London, UK » April 26-27
https://deepsea-mining-summit.com

World Dredging Congress (WODCON)
Copenhagen, Denmark » May 16-20
https://wodcon2022.org/

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

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

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

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

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

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

OTHER REGIONS

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

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

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

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

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

💻 Digital Issue

FUGRO'S SEAWATCH® WIND LIDAR BUOY ACHIEVES HIGHEST RATING FROM THE CARBON TRUST

Fugro's SEAWATCH® Wind LiDAR Buoy has achieved the highest commercial maturity rating, Stage 3, in accordance with the Carbon Trust Roadmap for the Commercial Acceptance of floating LiDAR technology.

This is the first floating LiDAR system in the world to gain this Stage 3 rating, which certifies the SEAWATCH® as a primary source of wind resource data to support financial investment decisions for offshore wind farms.

Independent third-party evaluation by DNV verified Fugro's SEAWATCH® as meeting the highest standards of data availability for commercial offshore wind campaigns. Data accuracy consistently met industry best-practice criteria in verification trials and, in addition, wind speed measurements in classification trials gave consistent results for sensitivity to environmental variables.

Following the first concept studies in 2009, Fugro performed a series of experiments in 2011 in collaboration with Christian Michelsen Research (CMR) to investigate the effect of motion on a profiling wind LiDAR operating on Fugro's Wavescan buoy.

Promising results led to the production of the first commercial SEAWATCH® Wind LiDAR Buoy in 2013. The Carbon Trust Roadmap was issued that same year and 2 years later the SEAWATCH® was type-validated as Stage 2 (pre-commercial) based on a successful offshore met mast validation trial. Since then, more than 50 SEAWATCH® systems from Europe to North America and East Asia have generated a comprehensive track record of commercial offshore deployments, characterized by reliability and Geo-data accuracy.

Jørn Erik Norangshol, Fugro's Director for Monitoring and Forecasting in Norway said: "In receiving this world-first Stage 3 rating, we acknowledge the support of our offshore wind clients—in particular Ørsted, Eolfi-Shell, Engie and Iberdrola—who kindly granted access to their measurement Geo-data for third-party assessment. Our floating LiDAR systems not only delivered reliable and accurate measurement campaigns to our valued clients but also moved the industry a big step forward on the path towards commercial acceptance of floating LiDAR technology to support investment in offshore wind farms and the wider green energy transition."

» *Fugro's Wind LiDAR Buoy is the first in the world to gain this the Carbon Trust's Stage 3 rating. (Photo credit: Fugro)*

DIVESOURCE ENHANCES OFFERING WITH DRIFT OFFSHORE TIE-UP

Global underwater consultancy DiveSource has announced a collaboration with DRIFT Offshore, the specialist recruitment, training and ROV services company.

The move will see both Aberdeen-headquartered organizations join forces to offer a complete and integrated solution for diving and ROV services worldwide.

The tie-up between DiveSource and DRIFT Offshore is the product of two female business leaders and entrepreneurs, Sarah Hutcheon and Meghan Bowers.

Sarah Hutcheon, Managing Director of DiveSource, said: "For some time, we have been looking for a suitable partner with which to bolster our service offering to better support clients in the offshore wind, energy, and utilities sectors.

"We're delighted to enhance our consultancy, competency and simulator services offering with the ROV knowhow and technical support on offer from DRIFT Offshore.

"This development will further boost the organic expansion of both organisations, while also affording us a presence in the United States to service client requirements in the offshore wind and oil and gas industries."

Meghan Bowers, Director and Co-founder of DRIFT Offshore, added: "We're very excited to be collaborating with DiveSource at an international level.

"Our comprehensive ROV system training and support for the subsea and offshore energy industries will now be available to a wider pool of clients.

"There are synergies in both companies' business models and approach to customer service, allowing this collaboration to open the door to further international expansion beyond their current combined geographic footprint."

Each organization offers a wealth of diving and ROV experience, thanks to the expertise of DiveSource's Commercial Manager Steve Ham and DRIFT Offshore's Co-founder, Kyle Pitman. Having devoted a large portion of their careers to industry technical training, Steve and Kyle plan to combine their capability to focus on developing the next generation of talent.

News of the collaboration follows on from DiveSource's announcement of the successful completion of the Wind Energy Support Toolkit (WEST) scheme, priming the Aberdeenshire-based company to grow its offering in the offshore wind sector.

» *L-R Sarah Hutcheon, Managing Director of DiveSource and Meghan Bowers, Director and Co-founder of DRIFT Offshore*

MACARTNEY MAINTAINS MOMENTUM TOWARDS PROFITABLE GROWTH

» *Claus Omann, MacArtney CEO*

MacArtney, a world leader in underwater technology, looks back on a year in which the company demonstrated its inherent robustness presenting a stable result despite a downturn in sales. A satisfactory outcome, owing to employee contributions. Strong momentum in the second half of the fiscal year forms the foundation for continued optimism.

Summing up the fiscal year 2020/2021, the MacArtney Group presents an annual report showing steady financial prosperity, maintaining its EBIT and EBT at previous levels despite a downturn in sales of 8%. The outlook is generally positive, and MacArtney expects top-line growth in spite of global shortages putting pressure on margins.

Good momentum in the second half of the financial year gives grounds for continued optimism accompanied by record order levels, signifying an exceptional start to the new financial year.

CEO Claus Omann said: "MacArtney enjoyed a successful year with solid results under difficult market conditions, thanks to the magnificent efforts of our employees. They have, parallel to our customers, adapted successfully to new ways of working during the pandemic."

The increased activity level through the year was reflected in investment in working capital, including setting up distribution centers to secure and protect product deliveries as supply chains come under pressure globally.

2021 saw the successful launch and sale of a new version of its multiplexer for data acquisition, the NEXUS 8. The 2020 launch of eLARS—an environmentally friendly, all-electrical Launch & Recovery System—led to an order and the building of one of the largest systems in the company's history.

MacArtney intends to further develop its core business within underwater technology, exploit new fields, particularly renewables, and focus more on its ground-breaking 2025 strategy. Consequently, the company recruited a new board member to promote continued growth in the offshore wind market.

Claus Omann added: "MacArtney has further geographic expansion in its sights, as we believe a global footprint is essential to continued success. Our operation in the Netherlands is building a new office, and we are reaping the rewards from the new locations we opened, including in India."

SEAJACKS OPENS OFFICE IN VIRGINIA BEACH

Seajacks UK Limited, a wholly-owned subsidiary of Eneti Inc., and a leading provider of installation and maintenance vessels to the offshore wind sector, has established an operational base in the City of Virginia Beach, Virginia.

Seajacks is providing Blue Ocean Energy Marine (a Dominion Energy owned company) with a range of support services relating to the construction and operation of the first Jones Act compliant offshore wind turbine installation vessel, Charybdis.

Blair Ainslie, CEO of Seajacks, said: "Virginia is at the heart of the burgeoning US offshore wind energy sector and we are delighted to open our US office in Virginia Beach. This office will soon become the hub for our US activities. Our teams have all been impressed with the local work force, supply chain and facilities available. Virginia is building a new industry in offshore wind and we are delighted to be involved."

Taylor Adams, Deputy City Manager at Virginia Beach, added: "We are excited that Seajacks has chosen office space in Virginia Beach's Town Centre to support their US operations. Their presence helps establish the Hampton Roads region as an emerging hub for the Country's offshore wind industry. Seajacks' performance with offshore installations speaks for itself, and their expertise will be an asset to the Coastal Virginia Offshore Wind Project."

» *Seajacks is a leading provider of installation and maintenance vessels to the offshore wind sector. (Photo credit: Seajacks)*

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