

August 2022

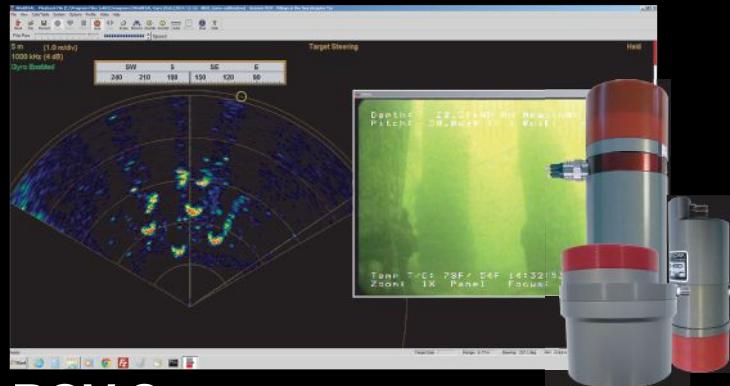
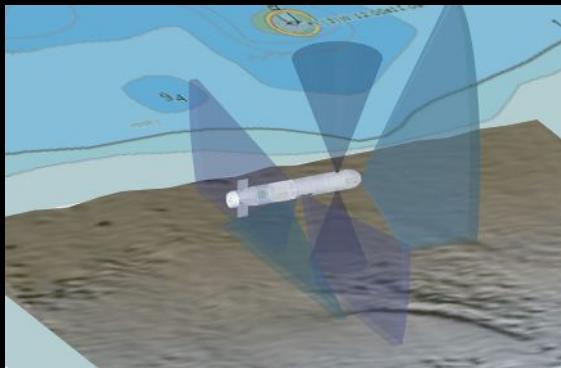
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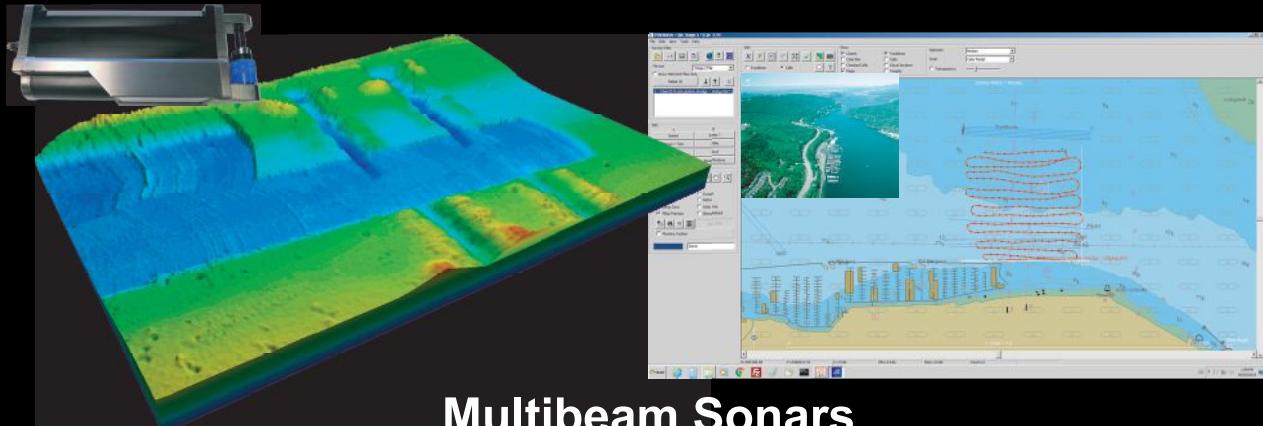


OCEAN NEWS & TECHNOLOGY
SUBMERSIBLES & THE DEEP SEA

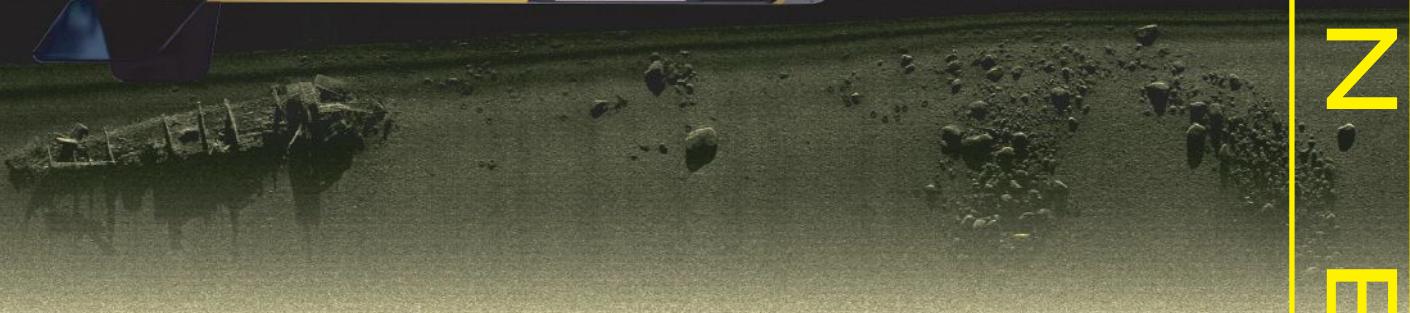
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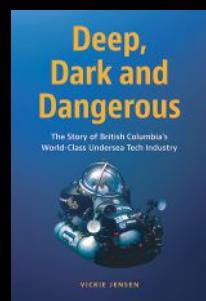
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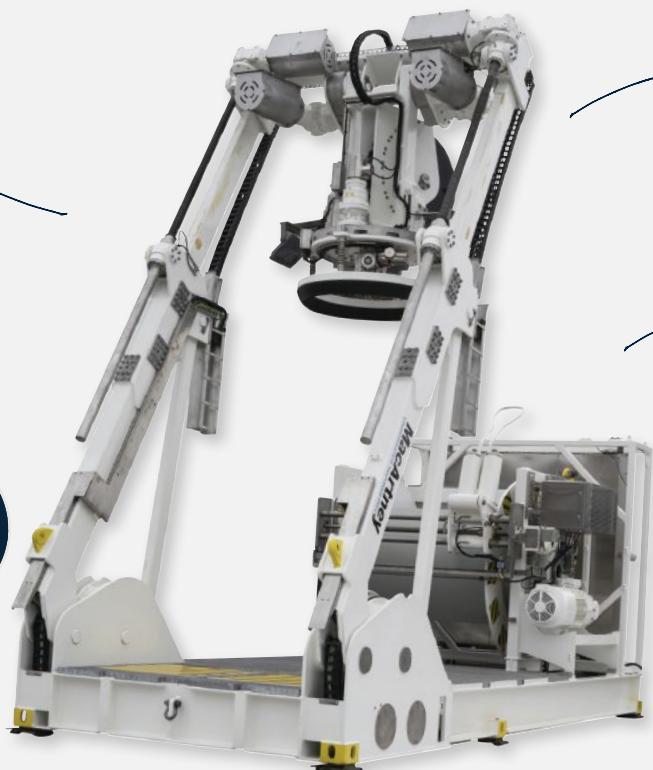
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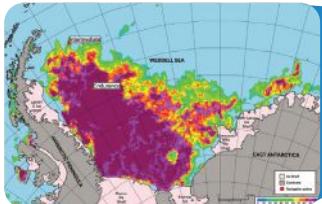
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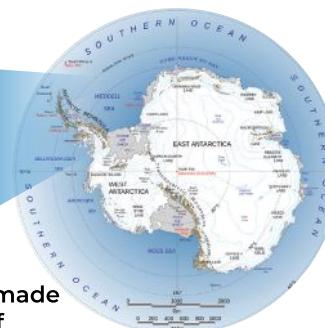


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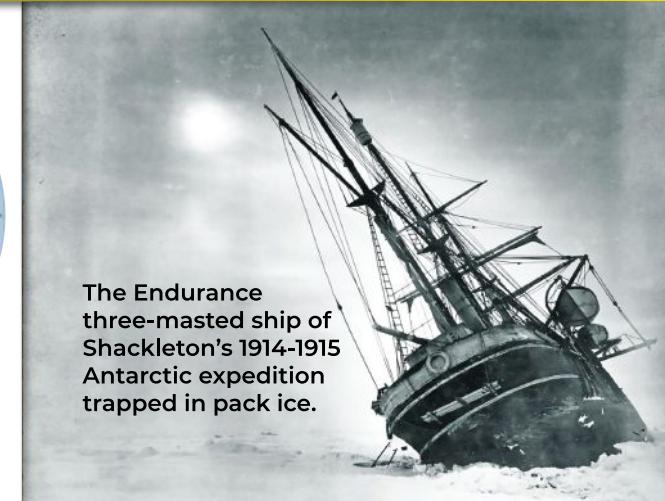


On March 2022, subsea explorers made a profound discovery at a depth of 3,008 m (9,869 ft) below the surface of the Weddell Sea's icy Antarctic waters.

Learn more: Endurance22.org



The Endurance three-masted ship of Shackleton's 1914-1915 Antarctic expedition trapped in pack ice.



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ON THE COVER:

WHOI's Autonomous Underwater Vehicle (AUV) Sentry, which was part of an expedition to the East Pacific Rise in the 9-10°N region in July 2022 to conduct a collaborative, deep-sea study with Lehigh University, Scripps Institution of Oceanography (SIO), and the University of Bergen Norway. (Photo credit: Luis Lamar ©WHOI)

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[WITH THANKS - Ed.]

"We know more about the surface of the moon than we do about the bottom of the ocean," or words to those effect, have long overshadowed some of the pioneering and illuminating endeavors of many a subsea explorer. But no more!

The current rate of deep-sea discovery, amply illustrated by the recent uptick in published evidence depicting everything from detail-rich geophysical seafloor maps to HD images of long-lost shipwrecks, serves as a timely testament to the ocean industry's collaborative investment in the technological capacity of submersibles—crewed and uncrewed—to venture further and deeper offshore.

This month, we are delighted to present some of the true innovators operating in this space: Triton Submarines, SEARCH Inc., SEAmagine, Deepsea Power & Light, U-Boat Worx, and Woods Hole Oceanographic Institute.

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NEVER WAS SO MUCH OWED BY SO MANY TO SO FEW...



By Patrick Lahey,
President, Triton Submarines



For a small percentage of Earth's population, from fishermen to traders, explorers, adventurers, warriors, and ambassadors, to those with inquiring scientific minds, the oceans have always represented the beating heart of our planet.

Today little has changed, but we're privileged to be living in times when those few with a deep dedication and commitment to our collective understanding of the oceans, through exhaustive research, thrilling documentation, scientific analysis, or intrepid exploration, are being supported by those with the resources to create positive and sustainable change. At Triton Submarines, we're proud to count some of these influential and inspiring patrons of the deep among our clients and partners.

DEEPLY PHILANTHROPHIC INITIATIVES

Dedicated to creating a deeply engaged global community of explorers, scientists, and storytellers and educating, inspiring, and protecting the oceans through widespread public engagement with the marine environment, Ray Dalio's OceanX initiative is without question the most experienced, successful, and well-equipped initiative to date.

OceanX's investment in vessels with the sole purpose of achieving the above, the curation of a world-class scientific and operations team, and the provision of the specialty tools and equipment necessary to achieve their missions—including a pair of Triton 3300/3 MKII SE (Special Edition) submersibles—has resulted in numerous blockbuster documentaries, including the BBC's Blue Planet series, David Attenborough's Great Barrier Reef, Search for the Giant Squid, and Deep Sea Shark.

Another ocean philanthropist undertaking a marine research and awareness program is Kjell Inge Røkke, whose REV Ocean foundation features three main elements: the creation of an environmental hub, the World Ocean Headquarters, at Fornebu in Norway; to construct an open-source ocean data platform; and to build an extraordinary 180-meter

research vessel. The latter, Project REV, is not only the next 'world's largest yacht' but also a platform equipped for marine science research, exploration, and documentary production with no expense spared. Triton recently delivered a Triton 7500/3—the world's deepest diving acrylic pressure hulled submersible capable of 3-person dives to 2,300 meters—to the team at REV.

No mention of modern-day ocean exploration would be complete without mention of Victor Vescovo and Caladan Oceanic. Investing in the development of the revolutionary Triton 36000/2 submersible, the first craft ever produced with an unlimited diving depth certification from DNV, Caladan's completion of the *Five Deeps Expedition* (FDE)—a series of successful dives to the deepest points in each of the five oceans—created headlines around the world. While making history, the FDE also provided detailed insights into the marine ecosystem of the Earth's deepest and most remote ocean trenches, while inspiring millions around the world with enthralling images and video footage captured from every dive.

Nekton, based out of Oxford University in the UK, under the steady hand of its industrious CEO Oliver Steeds, is also doing essential work with ocean nations, aiding in research to better understand and protect their waters and share this knowledge with the world. Again, Triton is proud to partner with Nekton as they utilize our submersibles on a wide range of expeditions to advance our knowledge, understanding and awareness of mother ocean.

A LEGACY OF SCIENTIFIC EXPLORATION

Just as the Medici and Vatican were important patrons of humanity's cultural renaissance, so too is the benevolent philanthropy of these important individuals, and a handful of others like them, who will be remembered when stock is taken of our planet's future rejuvenation. To paraphrase the Churchillian sentiment of the title for this article, "in the field of human interest, never has so much been owed by so many to so few."

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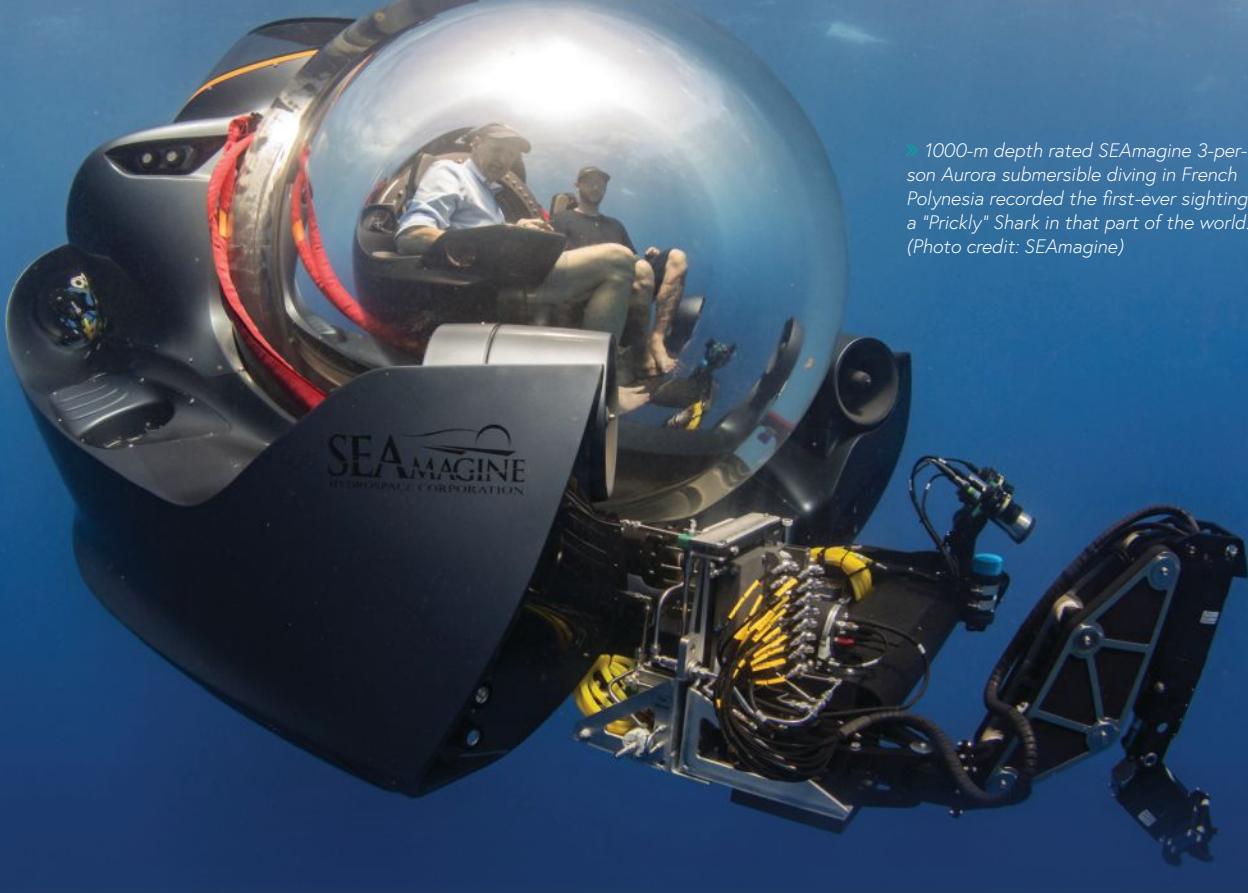
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► 1000-m depth rated SEAmagine 3-person Aurora submersible diving in French Polynesia recorded the first-ever sighting of a "Prickly" Shark in that part of the world.
(Photo credit: SEAmagine)

| FEATURE |

THE KEY BENEFITS OF MANNED UNDERWATER VEHICLES FOR SOLVING SUBSEA CHALLENGES



By Charles Kohnen,
Co-Founder & Chairman, SEAmagine
HydroSpace Corporation



The argument can be made that the only truly "intelligent" autonomous underwater vehicle today is still an HOV (Human Occupied Vehicle), or manned submersible.

As we continue to make technological strides in robotics and autonomous vehicles, there are industries that envisage a future in which crewed vehicles become increasingly redundant. For many industries, including the subsea sector, autonomous vehicle technology has a promising future, but it

would be a mistake to suggest that it is the only path forward in addressing some of the more complex challenges the marine sector will likely face in the years ahead.

The simplicity, practicality, and low operating costs that some of today's new manned submersibles offer the marine sector, even for shallow water, is remarkable. Manned subs are independent from their surface support ships and they incorporate human know-how and real-time decision-making ability to the underwater work site.

These vehicles are competitive in their capital expenditures requirements and offer clear benefits in operating costs, operational efficiencies, the quality of recorded data, the quality of the situational understanding, and on the performance of complex underwater intervention tasks. These points can make the manned submersible the better solution, depending on a project's specific context and prime objectives, no matter whether the goals are scientific, industrial, or defense and security.

ENGINEERED FOR EFFICIENCIES

SEAmagine Hydrospace Corporation is a California manufacturer of manned submersibles since 1995 and it has seen its own sector's technology evolve over the years, many of which the company pioneered. SEAmagine itself has numerous examples of accomplishing difficult subsea objectives with its manned subs using modest infrastructure. The company's subs offer significant benefits to an industry that is constantly seeking new efficiencies and asked to provide more affordable solutions.

For example, SEAmagine delivered one of its manned submersibles to the Argentinian Coast Guard's search and rescue department to help them locate, investigate, and recover victims from drowning accidents in the deep lakes located high in the Andes. The lakes in the Patagonia region are up to 500 m deep and much of the area has limited infrastructure. Mobilizing large surface ships and setting up a work class ROV operation in the lakes is simply not possible. With the SEAmagine subs, that country's coast guard's search and rescue team can now simply launch their SEAmagine sub from its boat trailer and let it float off, and thereby not require any launch and recovery system that are almost non-existent in the area. Then, using a surface tender, the sub is towed to the diving area and the team can readily do its diving mission to a 500 m depth. The rapid deployment ability, and the ease of deep-water access in a one atmosphere vehicle without requiring any large infrastructure topside are key ingredients.

The shear simplicity of the operation with its inexpensive setup, its low running costs, and the efficiency with which the search and rescue officers can rapidly access a deep-water site and gain a full situational understanding of the underwater accident area as they investigate and locate the bodies, represents a powerful, practical, and effective solution. The manned subs have the same impressive subsea tools as work class ROVs and can execute equivalent tasks but without the umbilical and without the dynamic positioned (DP) surface ship requirement. This autonomy from the mother ship reduces the operational infrastructure, and their associated complexities, and costs.

IDENTIFYING SEABED TARGETS

The true difference between an AUV and a manned sub was well illustrated by the late Dr. George Bass, founder of the Institute of Nautical Archaeology (INA), who demonstrated how his SEAmagine sub was instrumental in impressive archaeological survey finds with modest operational budgets and complexity.



» SEAmagine 3-person submersible discovers ancient Roman amphora at a depth of 150 m near the Aeolian Islands in Italy. (Photo credit: SEAmagine)

During his survey for ancient shipwrecks in the Mediterranean, the challenge was not detecting shipwrecks—there are plenty—but rather locating and identifying ancient wrecks worthy of excavation. This process of elimination can be exhaustive and time consuming. Dr. Bass mentioned that, in one month alone, the survey team with the SEAmagine sub discovered 14 wrecks and 10 possible targets; on previous surveys, by comparison, weeks would pass without a single find.

The reason the manned sub proved so successful was the team's ability to make in situ, real-time decisions about the wreck's worthiness of excavation. This efficiency of identifying targets and determining their value is invaluable during underwater archaeology campaigns, search and rescue missions, and other underwater target search efforts.

SEAmagine produced two of its manned submersibles for the U.S. Navy's Naval Sea Systems Command (NAVSEA), delivered to the Azerbaijan Coast Guard to help them perform underwater counter terrorism inspections in



» Two SEAmagine submersibles delivered in 2021 to the U.S. Navy's NAVSEA and operated by the Azerbaijan Coast Guard in the Caspian Sea. (Photo credit: SEAmagine)

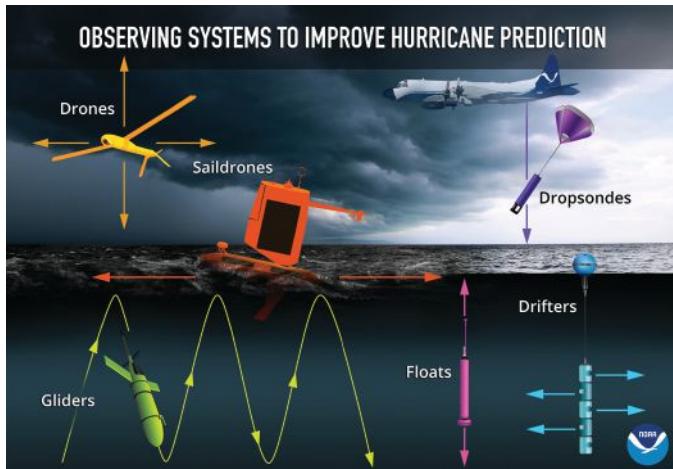
the Caspian Sea. Again, the objectives were to keep operations simple with a manageable level of technology for the dive teams to be capable of handling the vehicles themselves. During the training phase, the subs performed 80 dives in 20 days, mostly in poor water visibility, and they were successful in all the drills that planted fake bombs for the crew to discover. The officers said that they felt safer performing the tasks in poor water visibility aboard their SEAmagine sub instead of wet diving the sites because, from inside the sub, they had access to subsea imaging screens giving them superior appreciation of the underwater structures' layout and gave them awareness of the debris littering a site's area.

The value of having people dive in one atmosphere vehicles and be on site underwater can have valuable benefits in making new discoveries that were unplanned and unexpected. For instance, in 2021, the crew aboard a SEAmagine sub made the first ever sighting of a prickly shark at a depth of 500 m in French Polynesia, and this discovery resulted in the publication of a peer reviewed scientific paper, something that would not have happened if the vehicle was simply preprogrammed and unmanned.

The manned submersible sector has evolved over the years and the technologies they represent today are remarkable, and the crew aboard them have extremely powerful subsea tools at their fingertips. The operational benefits of these vehicles being autonomous from the surface ship are augmented by the operator's powerful ability of real time *in situ* decision making. These are all important points that should not be overlooked by the marine sector, especially when seeking new solutions to new challenges.

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

NOAA AND SAILDRONE LAUNCH SEVEN HURRICANE-TRACKING SURFACE DRONES



» NOAA will use several autonomous instruments to collect ocean and atmospheric data. (Photo credit: NOAA PMEL)

In partnership with NOAA, Saildrone Inc. is deploying seven ocean drones to collect data from hurricanes during the 2022 hurricane season with the goal of improving hurricane forecasting. For the first year, two saildrones will track hurricanes in the Gulf of Mexico.

One of the biggest challenges to hurricane forecasting is predicting rapid intensification, when hurricane wind speeds increase at least 35 mph over a 24-hour period. To fully understand how storms intensify, scientists collect data on the exchange of energy between the ocean and atmosphere in the forms of heat and momentum. However, gathering data in this dangerous environment is best accomplished by uncrewed systems.

"This season, NOAA will work with numerous partners to gather oceanic and atmospheric observations using a suite of platforms to monitor the conditions that play a role in hurricane intensity changes," said John Cortinas, Director of NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML). "Storms that intensify rapidly can cause extensive damage and loss of life and real-time observing systems are crucial to better understanding the atmospheric and oceanic processes that lead to the formation and intensification of these hurricanes."

Saildrones are equipped with a special "hurricane wing," which looks like a hard sail, to withstand the extreme wind conditions encountered in storms as they gather data from the near-surface ocean and atmosphere in real-time. The data are used to improve our understanding and prediction of tropical cyclone intensity changes and advance our knowledge of the ocean-atmosphere interactions that fuel them.

This year, three of the saildrones will work together with underwater gliders to obtain nearly collocated measurements of the upper ocean and air-sea interface. NOAA and partner scientists will deploy underwater gliders equipped with sensors that measure temperature and salinity down to a half mile below the ocean surface. These gliders provide high-volume, high-resolution

data in areas where hurricanes frequently travel. Because of the strong interaction between the ocean and atmosphere during a hurricane's passage, better representation of the ocean in weather models has led to more accurate intensity forecasts.

As opportunities arise, the saildrones will also coordinate with the small uncrewed aircraft system (sUAS), the Altius-600. Altius-600 drones will be deployed into hurricanes for the first time from NOAA's Hurricane Hunter aircraft to sample the atmosphere several hundred feet above the ocean surface.

The goal is to collect the first coordinated air-sea and atmospheric measurements in a hurricane from uncrewed ocean and aerial drones. The coordination of these instruments simultaneously sampling the ocean and atmosphere near each other in real-time will provide high-resolution data from all parts of the hurricane environment to improve forecaster situational awareness leading to improved forecasts.

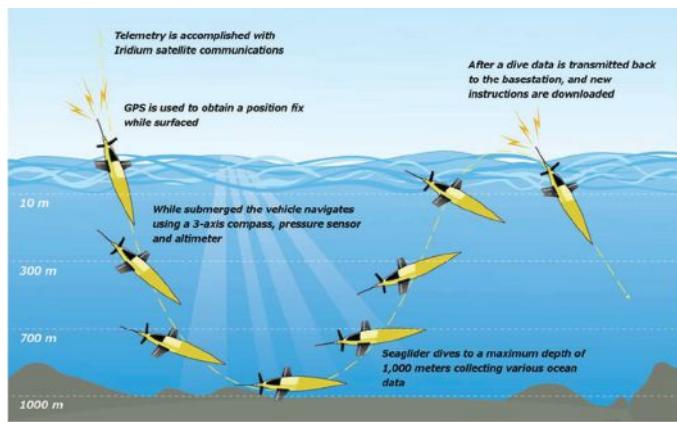
The saildrones provide data directly to NOAA's AOML and Pacific Marine Environmental Laboratory (PMEL), Saildrone's scientific partners in this mission. The data will be ingested in the Advanced Weather Interactive Processing System II, a visualization tool, for use by NOAA's National Hurricane Center forecasters and field offices during the 2022 hurricane season.

Data from saildrones and other uncrewed systems will help forecasters better understand the forces that drive hurricanes to warn communities earlier.

To find out more about NOAA's AOML, visit: www.aoml.noaa.gov.

To find out more about NOAA's PMEL, visit: www.pmel.noaa.gov.

To keep track of 2022 hurricane activity, visit NOAA's National Hurricane Center and Central Pacific Hurricane Center: www.nhc.noaa.gov.



» NOAA will use several autonomous instruments to collect ocean and atmospheric data. (Photo credit: NOAA PMEL)

TYPHOON CHABA VS. FLOATING LIDAR SYSTEM IN SOUTH CHINA SEA

On July 1, 2022 Typhoon Chaba passed through a prospective site for offshore wind farm development in the South China Sea. The site was in the midst of a wind measurement campaign using an industry-standard ZX 300M Lidar integrated into a Blue Aspirations Floating Lidar System (FLS).

Typhoon Chaba originated in the south and headed northwest for several days before finally making landfall in Guangdong province. Chaba brought maximum sustained wind speeds of approximately 140 km/hr, maximum wind gusts of 170 km/hr and maximum wave heights of 10.67 m. Despite these extreme

conditions, the Blue Aspirations FLS and its onboard ZX 300M Lidar continued operating effectively—achieving data availability for all measurement heights at 100%, marking the third occasion in which this FLS has continued to function without issue despite typhoon conditions.

Despite the risks of building and operating wind farms on locations prone to severe weather, many of China's offshore wind farms are developed in precisely these areas. Understanding the effect on turbines of extreme weather events—a long with their frequency and severity—is therefore a key consideration for



» Blue Aspirations BA-FLS-NX5 Floating Lidar System deployment.
(Photo credit: BlueAspirations/ZX Lidars)

Chinese wind farm developers in their analysis of a prospective site: wind loading, for example, can give rise to structural failures of turbines if not properly addressed; high wind speeds, turbulence intensity, and acute directional changes can significantly impact turbine rotor thrust, generated power, torque and rotor speed; and suitable control strategies are required to mitigate potential safety issues.

Recognizing these effects and the importance of providing developers with data that reflects the totality of the conditions at each site, Blue Aspirations and ZX Lidars designed their technologies to

thrive even in the most extreme conditions. Redundancy is at the core of Blue Aspirations' FLS design, seamlessly integrating backups for all main components, fuel cells to supplement power from solar panels and wind turbines, and a dual-Lidar setup in its standard configuration. For added resilience, its hull also incorporates a large counterweight and residual buoyancy that mitigates the risk of capsizing or sinking. It's that commitment to robust design that allows Blue Aspirations' FLSs to remain out on the water collecting data through even the toughest conditions.

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PRESERVING THE PAST: 4K IMAGING SHINES LIGHT ON SUBSEA HISTORICAL ARTIFACTS



By Aaron Steiner,
General Manager, DeepSea



In March 2022, subsea explorers made a profound discovery at a depth of 3,008 m (9,869 ft) below the surface of the Weddell Sea's icy Antarctic waters. The *Endurance22 Expedition*, supported by the Falklands Maritime Heritage Trust, located the wreck of the *Endurance*, a wooden ship that sank off the coast of Antarctica in 1915 after getting trapped in the pack ice. The story of the *Endurance*'s sinking—and the survival of its captain, renowned British explorer Sir Ernest Shackleton, and the entire crew—is a remarkable tale of

perseverance, ingenuity, and camaraderie in the face of dire circumstances.

The discovery of the *Endurance* is an incredible feat. Since its dramatic sinking, numerous attempts have been made to find the lost ship, and all failed. Punishing polar conditions including storms, rough seas, and cold winds at speeds up to 14 knots make working in this region particularly difficult. In fact, Shackleton himself described the area as "the worst portion of the worst sea in the world."

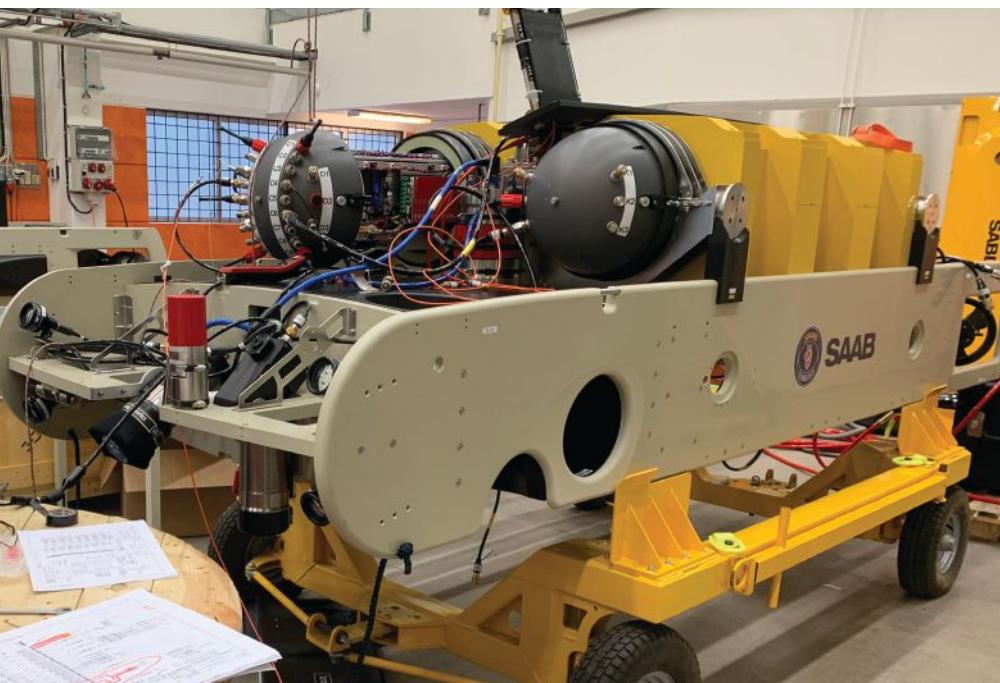
MISSION EQUIPMENT

Key to the mission's success was the experience and leadership of the *Endurance22* team, which included 64 people in addition to 46 crewmembers, as well as the vessel and equipment used. Mission operations were conducted on the S.A. *Agulhas II*, a South African polar research and logistics vessel capable of breaking ice up to 1 m thick when traveling 5 knots.

The expedition deployed SAAB Sabertooth hybrid AUV/ROVs capable of reaching sites up to 100 miles away from their launch point, operating at depths of 4,000 m (13,123 ft) and supported by an infinitesimally thin fiber optic tether tied back to the host ship.

Operating these vehicles in polar conditions presented many unique challenges for the team. According to Nico Vincent, Expedition Sub-Sea Manager, the team had to rethink conventional dive operations and pioneer novel launch and recovery procedures. Among the expedition's major challenges was the ever-present pack ice that surrounded the ship and drug it along as the ice migrated in a complex and difficult to forecast system. Since the S.A. *Agulhas II* could not keep a fixed station, the subsea vehicles

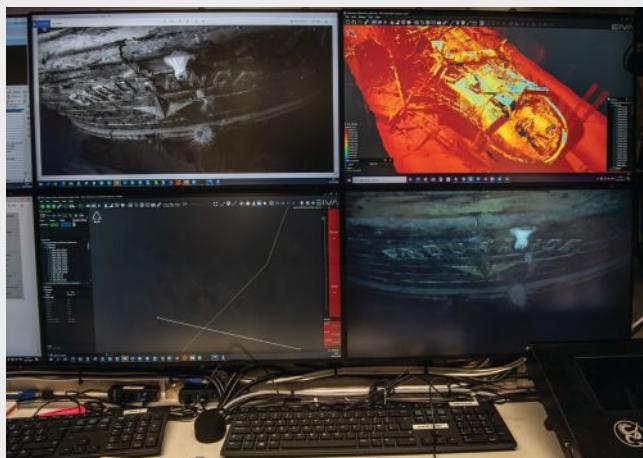
» With the 4k Optim SeaCam mounted, the SAAB Sabertooth vehicle's maneuverability enabled pan/tilt functionality for imaging. (Photo credit: Falklands Maritime Heritage Trust)



had to return to a new recovery zone the size of a tennis court using only acoustic and inertial navigation.

As recently as 2019, in a previous attempt to find the *Endurance*, an expensive AUV was lost under the pack ice after communications failed and updated navigation data could not be sent. A key difference for the Sabertooth vehicles used on *Endurance22* was the fiber optic tether, which enabled constant communication with topside operations.

SUBSEA 4K IMAGING



» Mission operations aboard S.A. Agulhas II, showing footage captured by the Optim SeaCam as well as the ship's photogrammetry data. (Photo credit: Esther Horvath and Falklands Maritime Heritage Trust.)

The SAAB vehicles were outfitted with imaging technology capable of producing high quality data. In addition to a laser scanner capable of creating highly accurate 3D models, the vehicles included DeepSea Optim SeaCam 4K cameras. The Optim SeaCam provided real-time 4K video over the small fiber tether from the hybrid AUV/ROV back to the team on the S.A. Agulhas II. Depth rated to 6,000 (with option to 11,000 m), the Optim SeaCam was chosen for its easy integration, reliability, and ability to provide low-latency, live video during operations in the harsh conditions of the deep Antarctic waters.

The result of the expedition was stunning imagery of what marine archaeologist Mensun Bound described as the "finest wooden shipwreck [he has] ever seen." There are no wood-eating micro-organisms present in the freezing waters where *Endurance* is located, resulting in the ship's remarkably well-preserved condition.

The Optim SeaCam broadcasted live footage to mission operators allowing the team to experience the discovery in real-time. In the cold, clear polar waters, the details in both the shipwreck and the environment around it were stunning.

RESEARCH POTENTIAL FOR 4K IMAGING

Under the Antarctic Treaty, the site of the *Endurance* is considered an historic monument. That means that no part of the ship may be disturbed, ruling out the collection of any samples, even for research purposes. Scientists across disciplines as diverse as archeology, biology, and material sciences will be using the imagery data from *Endurance22* to further our knowledge of the natural world.

The *Endurance22* images captured by the Optim SeaCam demonstrate the potential for future uses of HD and 4K imaging in scientific research and discovery.

The ability to capture high quality imaging data from sensitive environments like this provides scientists with an avenue for non-destructive research, broadening our understanding of these formerly out-of-reach places while ensuring they remain protected.

Already, marine archaeologists and biologists are combing through the video returned from the expedition to learn more about the wreck site, the life that now calls it home, and the unique environment in the cold, dark depths of the Southern Ocean.

Furthermore, studio-grade imaging at 4K provides storytellers with the means to engage and educate the public on discoveries like the wreck of the *Endurance* and their significance. This fall, National Geographic's Explorer series will release a documentary on National Geographic Channels and Disney+ chronicling the *Endurance22* Expedition featuring video and photogrammetric data collected of the wreck.

ABOUT THE OPTIM SEACAM

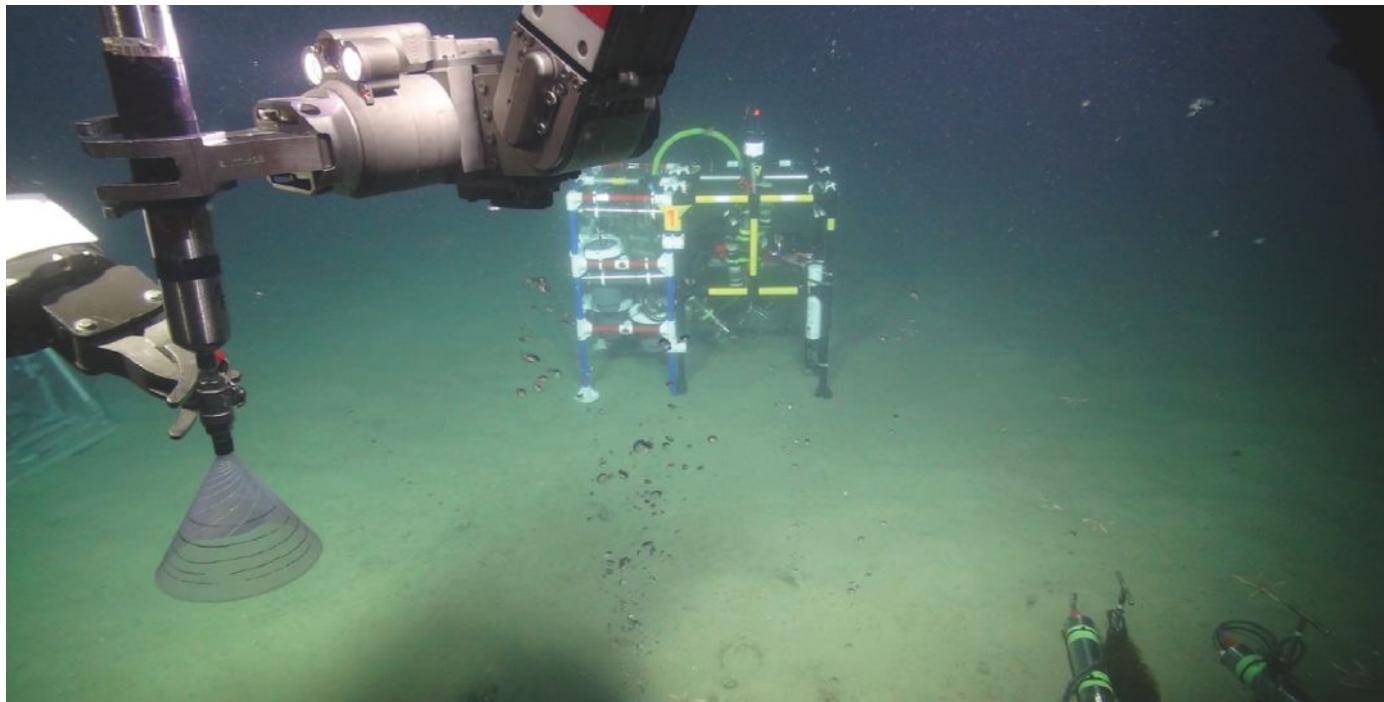
The Optim SeaCam provides a unique tool for scientists, subsea explorers, and film makers combining superb 4K imaging capability with intuitive and familiar controls, flexible integration options, and an unprecedentedly rugged design.

Ideal for real-time viewing in 4K, the Optim SeaCam features an extended zoom range and a 350 mm minimum object distance at full telephoto that makes for stunning close-up images and brings out the smallest details. The design is lab and field proven—having been subjected to more than 10,000 cycles to trench depths during design validation and holding the distinction of being the first 4K camera film the deepest point in the ocean at Challenger Deep in the Marianas Trench.

For more information, visit: www.deepsea.com/optim.



» The stern of the *Endurance*, showing its impressive condition after having sunk over 100 years. (Photo credit: Falklands Maritime Heritage Trust)



» The experiment in the North Sea simulated a release of CO₂ over a period of 12 days at a depth of 120 m and 3 m below the seabed. (Photo credit: NOC)

NEW PAPER SHOWS POTENTIAL FOR SAFE STORAGE OF CO₂ OFFSHORE

A world-first study led by the National Oceanography Centre (NOC) following research off the coast of Scotland suggests that storing carbon dioxide (CO₂) under the sea in a process known as carbon capture and storage (CCS) is both viable and safe. In the unlikely event of unintended CO₂ emissions from a storage reservoir, the work demonstrated that these are detectable and quantifiable through new technologies.

Scientists conducted an experiment in the North Sea 130 km northeast of Aberdeen where they simulated a release of CO₂ over a period of 12 days at a depth of 120 m and 3 m below the seabed, to test whether new technologies were able to detect even small releases of CO₂. The new methodology also allowed the project scientists to measure how much was released and where it was being released from.

CCS is regarded as one of the more effective tools in the fight against climate change. The process involves separating the CO₂ generated during the industrial process such as power plants, hydrogen and ammonia production and steel plants, then transporting the gas through pipes, in tankers via roads or ships and finally injecting the CO₂ directly into rock formations or depleted oil and gas reservoirs deep underground.

The ground-breaking pilot study will help inform the direction of technology development for the long-term monitoring of offshore CO₂ storage reservoirs and is a huge step forward in assuring regulators that this process is safe by being able to monitor any potential leaks as well as assess any potential damage to marine

life. The work is already being used to inform the operators of two proposed storage projects, one in Denmark and another in the UK.

Professor Douglas Connelly, Lead Author and Associate Director, Science and Technology at the National Oceanography Centre, said: "Carbon capture and storage is a key mitigation strategy for keeping the global temperature rise below 1.5 C and offshore storage can provide up to 13% of the global CO₂ reduction target. The artificial CO₂ release in our study enabled us to detect any emissions to the marine environment using acoustic, chemical and physical approaches as well as identifying the location of any leaks—something not previously achieved."

"Showing that carbon capture and storage is safe, as well as being able to monitor any unintended emissions of CO₂, is a crucial step towards much larger implementation of this technology. We have combined existing off-the-shelf technology with the NOC's new sensors, methodological approaches and state-of-the-art modelling work, taking a major step forward in assuring that offshore CO₂ storage is safe. This report will help inform both the public and the regulators that this is a safe process and in doing so, providing regulators and governments the tools they need to effectively regulate the conformity of future storage facilities."

The paper, *Assuring the integrity of offshore carbon dioxide storage*, has been published on ScienceDirect: <https://www.sciencedirect.com/science/article/pii/S1364032122005627>.



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COLUMBIA DEPLOYS NORTEK OCEAN SENSORS FOR IMPROVED HURRICANE PREPAREDNESS

With the 2022 hurricane season upon us, the importance of using science-backed solutions for hurricane preparedness is brought to the foreground. Since Colombia's Caribbean islands were devastated by hurricanes Eta and Iota within a two-week period back in November 2020, government-funded researchers have been using wave and current data measured by Nortek's Ocean sensors to improve hurricane prediction.

With a total of 14 hurricanes, 2020 was the most active Atlantic hurricane season on record. Experience of Eta and Iota prompted the authorities on the Archipelago of San Andrés, Providencia and Santa Catalina to call for help from the Universidad Nacional de Colombia and the environmental institution CORALINA to develop tools to plan and prepare for future events, including computer modeling to better predict hurricane risk.

Dr. Andrés Fernando Osorio Arias, professor at the Universidad Nacional de Colombia and Executive Director of CEMarin (the Center of Excellence in Marine Sciences), explained: "We use these models to create reconstructions of hurricanes that have occurred in the past, and also to predict scenarios that have not yet occurred—synthetic scenarios of hurricanes."

While such models are generally robust, their accuracy is improved by comparison with data measured from the field. This is particularly important as biophysical features such as coral reefs, mangroves and seagrasses can influence sea conditions around islands.

"It's important to collect information from the field and try to reproduce conditions on a laboratory scale because, in the laboratory, you have more control of the different factors. With field and laboratory data, you can develop new equations, new parameters and new physical understanding of physical processes to improve the models."

Current and wave measurement

The scientists gather real-world data on current and wave direction using two Nortek AWAC subsea sensors. These record the motion of the water using calculations based on the Doppler effect, a scientific phenomenon known in the world of physics. The sensors emit sound waves, then measure the echoes that return after bouncing off particles suspended in the water. As waves travel horizontally, these move with the water in a circular, or orbital, motion. This provides insight into how the height and direction of waves varies according to weather conditions.

Cristobal Molina, Nortek's Senior Sales Engineer for Latin America, commented: "The waves on the surface are a combination of many waves, which have different directions, periods and heights. The AWAC acoustic sensor takes

measurements over a long period, allowing us to discriminate between the different waves."

Creating "synthetic" hurricane scenarios

Having validated the model with the real-world data from Eta and Iota, the researchers can now confidently create "synthetic" hurricane scenarios to identify the areas of the islands that are most vulnerable to flooding. As a result, the authorities can take action to protect vulnerable communities, such as planting seagrass in strategic locations.



» The AWAC acoustic sensors are typically placed on fixed frames in an upwards-looking configuration to record the height and direction of waves. (Photo credit: CEMarin)



» Biophysical features such as coral reefs can alter hydrodynamic processes, so collecting data from these features is important for accurate modeling. (Photo credit: CEMarin)



WHOI AND CMA CGM GROUP DEPLOY ACOUSTIC MONITORING BUOY NEAR NORFOLK, VIRGINIA

Woods Hole Oceanographic Institution (WHOI) and The CMA CGM Group, a global player in sea, land, air, and logistics solutions, have deployed an acoustic monitoring buoy 33 miles off the coast of Norfolk, Virginia, with a second buoy for deployment off the coast of Savannah, Georgia to follow.

The buoy deployment aims to aid in the survival of the critically endangered North Atlantic right whale; the species is under serious threats to their survival, and only approximately 336 of these great whales remain.

The WHOI-developed acoustic buoys play an important role in protecting marine animals. Each species of whale creates its own unique calls, and the buoys are equipped with an instrument that transmits information about detected sounds to shore every two hours. This WHOI technology can detect, classify, and report the sounds of marine mammals in near real-time, and the data is analyzed by an acoustician to determine which species are present. Results are displayed publicly on Robots4Whales and shared with mariners. This enables dynamic protections, including NOAA's Slow Zones for Right Whales, which are areas with voluntary vessel-speed restrictions along the eastern seaboard that are established when right whales are detected.

Locations off the coast of Norfolk and Savannah were chosen for the new systems because the ports are among the busiest in the United States, which often puts ships directly in the path of migrating right whales. The new buoys will fill a critical gap as they join a monitoring network of six similar buoys along the East Coast, bringing the total number of buoys to eight.

In addition to the assembly and deployment of the new buoys to alert mariners of the presence of whales near critical U.S. ports, CMA CGM and WHOI will lead the development of an industry consortium focused on reducing risks to right whales from vessels and supporting the continued operation of the WHOI-developed digital acoustic monitoring buoys. This unique collaboration, started in the United States, aims to have a global impact by significantly improving marine mammal protection.

"The deployment of these buoys is an important addition to a network of identical buoys along the East Coast that will let industry, government and the public know when whales are nearby," said Mark Baumgartner, project principal investigator and WHOI marine ecologist. "This network will be especially helpful for reducing risks to the North Atlantic right whale, a critically endangered species that migrates, feeds and gives birth along the East Coast and has only approximately 336 animals left."



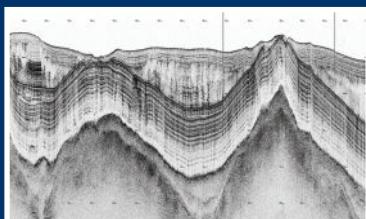
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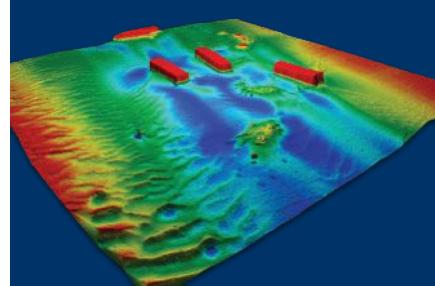
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SUB-AQUATIC ENDEAVORS: A LEGACY OF ENGINEERING EXCELLENCE



By Roy Heijdra,
Marketing Manager, U-Boat Worx



The human urge to venture below the waterline is an ancient and enduring pursuit. Legend has it that Alexander the Great, in or around the year 333 B.C., attempted to explore the Aegean Sea from inside a glass barrel, after which he relayed his observations of whales and other creatures of the deep. As we now know, the average depth of the ocean is over 3,600 meters (2.2 miles), the bottom of the Marianas Trench reaching an inhospitable 11,034 meters (6.9 miles), so there's plenty to fathom. The challenge, as no doubt Alexander the Great would attest, is establishing the means do it safely and efficiently.

Cornelius J. Drebbel, a Dutch inventor and engineer born in 1572, was the first person to patent a design for a subsea craft, in 1598. His submarine was bound by waterproof leather, powered by underwater oars, and a system of tubes to supply oxygen to passengers. This was the pinnacle of 16th century innovation, and something that triggered a legacy of subsea engineering; today, some 400 years later, the Dutch are still the pioneers of submarine and submersible design and manufacturing.

The small city of Breda near the Belgian border is home to U-Boat Worx, an organization that since its inception in 2005 has grown to become the largest exploration submersible builder in the world. The company's current portfolio includes 24 different models

designed for a range of applications, but all were inspired by a common goal of establishing a new gold standard for the development of subs primed for deep-sea discovery.

C-RESEARCHER SERIES

U-Boat Worx launched its C-Researcher series of submersibles to directly address the growing need to equip scientists with a caliber of equipment needed to operate in the remote and harsh conditions found in the seabed—crushing pressures, extremely cold temperatures, and perfect darkness. C-Researcher subs can dive to 3,000 meters, and thanks to their operational efficiency, speed, and the panoramic view they afford passengers, make them perfectly suited to deep-sea research missions and seabed observation.

The C-Researcher submersibles are equipped with a U-Boat Worx pressure-Tolerant Lithium-ion battery system. The battery system, developed in-house by U-Boat Worx, results in a 350% increase of battery capacity when compared to traditional submersibles using lead-acid power sources. The technology has been tested to 4,000 meters and stores a total of 62 kWh in compact battery modules. This abundance of power makes it possible to utilize stronger electrical thrusters, extend mission time, install additional research equipment and lights, and reduce travel time between the surface and the ocean floor by up to 50%.

OPTIONS & PAYLOADS

The C-Researcher subs were also designed and engineered to support significant payloads, whether in terms of outfitting the vehicle with additional tools, sensors, or recording devices, or with regards to its capacity to collect underwater objects. An extensive list of tried-and-tested optional extras is available to expand and enhance operational capabilities of the submersible to navigate, measure, record, collect, capture, and adapt deep-sea research activities. Custom add-ons can also be designed upon request and per client specification. Whatever the customer need, our in-house engineering team is prepared to develop the right tools for the mission at hand.

Bert Houtman, founder and chairman of U-Boat Worx, perhaps puts it best:

"By combining the latest innovations with over 17 years of experience in designing, building and operating the world's largest fleet of submersibles, our C-Researcher series offers deep ocean research communities the safest, best-performing and most luxurious submersibles to explore the underwater world."



» C-Researcher subs can dive to 3,000 meters and offer pilots and passengers a truly immersive experience. (Photo credit: U-Boat Worx)

EXPEDITIONS

Just a few years ago, one of our diver teams came face-to-face with hidden cultural artefacts from the distant past. Unobserved for centuries and concealed 200 meters below the surface were three shipwrecks containing hundreds of amphorae. From aboard one of our subs we witnessed a truly historical sight and were able to piece together a story of these three vessels and their ill-fated cargoes of olive oil, wine and garum. It was a breathtaking moment when the first amphora appeared out of the shimmering darkness and into the light beams of the submersible.

The Roman era wrecks date back to over 2,000 years ago but were only ever identified following extensive side-scan sonar surveys conducted by the AURORA Trust in 2009 and 2010. Our dives were intended to further advance the world's understanding of our collective marine cultural heritage. This is what motivated us to investigate these deep shipwrecks in more detail, using state-of-the-art submersibles. A joint expedition between U-Boat Worx, AURORA Trust Foundation, and the Superintendent of the Seas of Sicily allowed us to navigate these wrecks in the safety and comfort of a submarine.

"Thanks to the U-Boat Worx submersible and its skilled pilot, we were able to shed light on new seabed secrets that were previously inaccessible," stated Ian Koblick, co-founder of the AURORA Trust Foundation. "Despite the demanding dive schedule, weather, and uncharted depths, we successfully achieved our objective of mapping each shipwreck and the surrounding areas."

The submarine used during this operation was equipped with specialized cameras to enable the capture of both video and digital images of each wreck site, culminating in hundreds of high-resolution images as the submersible hovered with precision over the sunken vessels. After each dive the digital images were processed onsite using special software to produce detailed 2D and 3D photo mosaics, which were then passed on to the Italian authorities that accompanied the expedition.

The expedition crew were subject to the profoundly unique experience of coming face-to-face with these remains, cultural hallmarks that will continue to unlock the key to our collective maritime heritage.

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



» All builds offer a range of custom outfitting, inside and out, to ensure that each sub is equipped with mission-critical tools and sensors. (Photo credit: U-Boat Worx)



» U-Boat Worx submersibles can be fitted with specialized underwater cameras and lighting to facilitate the capture of both video and digital images. (Photo credit: U-Boat Worx)

UK MET OFFICE SELECTS SONARDYNE ACOUSTIC RELEASES FOR MOORING WEATHER BUOYS

Acoustic release transponders from ocean science technology company Sonardyne have been chosen by the UK's Met Office to secure its network of moored buoy Marine Automatic Weather Stations (MAWS) in the North Sea and Atlantic Ocean.

Under a call-off agreement, Sonardyne's RT 6s and deck topside command units will be used to support deployment and retrieval of the MAWS buoys from their locations as far north as the Faroe-Shetland Channel and down to the southwestern approaches and the English Channel in the south.

The Met Office's MAWS buoys are a key part of its Marine Observing Network, which gathers essential observations, including wind speed, air and water temperature, and wave height and period.

They contribute to an international network of World Meteorological Organization (WMO) and the International Maritime Organization (IMO) coordinated marine observations, which provide critical data for weather forecasting, atmospheric modelling and work on climate science, by the Met Office and other organizations.

Because many of the buoys are moored in more harsh North Atlantic waters, they have to be designed to withstand extreme conditions, including significant wave heights recorded at above 18 m. They also have to be serviced every two years, so the Met Office needs a safe and reliable mechanism to allow for easy release from and then redeployment to their seabed moorings.

Sonardyne's RT 6 family of release transponders, operate using a secure acoustic signal from the sea surface, to activate a release mechanism connected to a seabed anchor. Moored instrument strings and oceanographic buoys can then be retrieved onboard a vessel for servicing or redeployment.

To support the MAWS deployments, each buoy will be fitted with two releases installed in a load amplification frame, providing a working load limit (WLL) of 15 tonnes. This configuration provides both equipment redundancy and the WLL needed to withstand



» Weather buoy E1 off south-west England. (Photo credit: Plymouth Marine Laboratory)

harsh ocean conditions. Operators will command and control their RT 6s using Sonardyne's newly developed Deck Topside. Rugged and portable, Deck Topside features a high brightness screen, inbuilt GPS receiver for recording deployment locations and a battery life of eight hours. A cabled, over-the-side dunker provides the secure acoustic communication link between the surface and RT 6s.

The Met Office expects the first deployment using their new Sonardyne equipment to be on the 'K7' buoy, which will be reinstalled about 150 km west of the Shetland Islands in 700 m water depth by the Northern Lighthouse Board's lighthouse tender NLV Pharos.

Mark Hemmell, Marine Engineering Manager at the Met Office said: "Met Office buoy moorings are designed to withstand the worst that the Atlantic can throw at them for deployments of four to six years. They take advantage of the properties of synthetic materials to do this, and it is our intention to remove all these materials from the ocean at the end of a deployment. Tandem release assemblies will ensure that this can be done reliable and safely, reducing our impact on the marine environment."

"Deployed far from shore in deep water, at significant operational cost, and exposed to some of the severest weather that the North Atlantic can generate, it's vital that the Met Office's buoys are moored securely for years at a time. Consequently, the selection of our RT 6 acoustic releases is a significant vote of confidence in our technology," added Geraint West, Head of Science at Sonardyne.

CODA OCTOPUS INTRODUCES NEW REPORTING AND QC TOOL

The new tool integrates with Survey Engine but also with the Automatic Boulder Detection and Reporting Module—a ML based AI solution—also available for Survey Engine.

The QC Tool allows the user to quickly and easily validate all the contacts/targets in the database in the form of a simple grid or data list display. Auto-generated thumbnail images are displayed for ease

and speed of interpretation with all QC results posted to the Survey Engine project database.

The tool also complements the Survey Engine Automatic Object Detection Package.

With the growth in the offshore renewables sector, where boulder detection and contact/target measurement

reporting are critical functions for the planning and design of offshore wind farms, the requirements to handle significantly more data in the form of very large data projects (≥ 10 GB) is now prevalent.

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

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ADVANCED
NAVIGATION



» MBARI's new 31,900-square-foot facility will provide scientists and engineers the space they need to complete critical assembly, integration, and testing of new equipment. (Image credit: MBARI)

MBARI'S NEW ROBOTIC TECHNOLOGY LAB

MBARI is expanding their capacity with a new robotic technology lab: the Instrumentation Integration and Testing Facility. This two-story, 31,900-square-foot facility will provide scientists and engineers the space they need to complete critical assembly, integration, and testing of new equipment before it is deployed into the harsh conditions of the ocean.

"A healthy ocean is our first line of defense against climate change. As the planet continues to warm, we need to stay one step ahead with new discoveries and innovations to understand and better manage the ocean," said MBARI President and CEO Chris Scholin. "Our new Instrumentation Integration and Testing Facility will be an unprecedented proving ground for our scientists and engineers to test ideas and ensure our technology is field-ready, while increasing the speed with which we can scale our designs and move from research to operations."

The state-of-the-art facility will also provide space for a weather deck to test the satellite communication capabilities of various instruments (e.g., long-range autonomous underwater vehicles (LRAUVs), floats, gliders) and a meeting space we can convert into classrooms to accommodate training programs or conference rooms for hosting seminars. Additionally, the Central and Northern California Ocean Observing System (CenCOOS)—a regional network of organizations based along the coast that collects, integrates, and shares a wide array of ocean information for the public's benefit—will be headquartered there.

The Instrumentation Integration and Testing Facility joins the new Expedition Staging Building as MBARI's first new buildings in more than 20 years. The Instrumentation Integration and Testing Facility will allow to test new technology innovations, while the Expedition Staging Building will help the team prepare marine equipment for

deployment in remote field expeditions beyond Monterey Bay, including Mexico and the Arctic. Together, these facilities mark an exciting new chapter that will expand MBARI's research capacity.

Accelerating ocean discovery and conservation

Other key features of the new facility that will enable MBARI to accelerate its ocean discovery and conservation efforts include:

- A high bay with an overhead crane for assembling newly developed instruments and sensors before moving them onto research vessels for deployment and testing at sea;
- Freezers to preserve samples of marine organisms and deep-sea sediments;
- A variety of research laboratories, including a lab for housing robots like the LRAUVs, which are used to collect ocean health data, an analytical room for processing environmental DNA (eDNA) samples collected using MBARI's Environmental Sample Processor (3G ESP), and a clean room for assembling and testing precise electronic instruments (e.g., Global Ocean Biogeochemistry Array (GO-BGC) floats that measure oxygen, chlorophyll, and pH);
- An operations center for coordinating field programs; and
- A multimedia center to support in-house training programs, workshops, and seminars.

MBARI is constructing the new building on the same footprint as an existing building that has reached the end of its life span. The construction is set to start in the fall of 2022 and is estimated to take approximately 20 months.

CELLULA ROBOTICS TO DEVELOP AN IMOTUS-S AUV FOR SIGNATURE MEASUREMENTS OF MARINE VESSELS

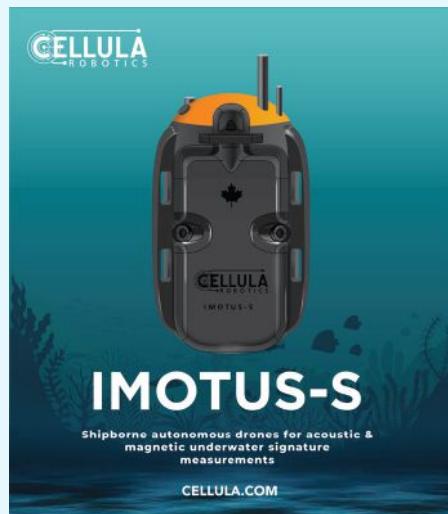
Cellula Robotics Ltd. recently announced a contract through Innovative Solutions Canada's Testing Stream for the build and test of a hovering Autonomous Underwater Vehicle (AUV) for use in underwater measurements of a ship's acoustic and magnetic signature.

The innovation, known as Imotus-S, builds on Cellula's existing commercial Imotus AUV and is configured with an Ocean Sonics hydrophone and an Ocean Floor Geophysics self-compensating magnetometer. Imotus-S will test the ability to be deployed from a marine vessel to provide magnetic and acoustic signature measurements in open water. This potential

capability would enable deployed vessels to easily monitor their signature in a timely manner without having to leave station.

"We are thrilled to be working with the Department of National Defence on testing our solution that will complement and extend current vessel signature management capabilities," said Jacqueline Nichols, Business Development. "With only two fixed ranges in Canada, Cellula hopes to reduce operational constraints where ships must travel to a range for measurement."

The test program for the Imotus-S system will allow for data obtained to be compared



to traditional range measurements and pave the path to a shipborne, containerized solution in the form of a fleet currently under development at Cellula.

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COMMODITY MARKETS CONFOUNDED BY GEOPOLITICS AND INCIDENTS



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

CRUDE OIL:

We have talked about the structural tightness in the global crude oil market that became more evident following the Russian invasion of Ukraine in late February. The tightness developed from the speed of the global economic recovery following the COVID-19 shutdowns in 2020. Fear of the unknown from Russia's invasion helped drive the WTI price to \$124 and Brent to \$133 per barrel. With Russia unable to roll over Ukraine, the global oil market began assessing reduced risk of supply disruptions, so prices eased.

Demand for most commodities—fuel and food in particular—is inelastic, meaning their demand is largely insensitive to changing prices. People need to drive; homes must be heated in the winter and cooled in the summer if people are to live comfortably; and food is necessary because people like to eat three meals a day. When prices for these commodities rise, people respond by limiting their use or substitute alternatives, but they do not stop doing these activities entirely. It would destroy lifestyles, something people will fight.



» U.S. recession would hurt demand and bring volatile prices during the remainder of 2022.

For crude oil, the petroleum industry's challenge was dealing with a demand recovery faster than anticipated while the industry still struggled to manage the fallout from an extended period of low oil prices. It upended business operations leading to large job losses, compromised supply chains, and limited investment in new productive capacity. Such forces can be tolerated for short times, but not for five to seven years. Over such a long period, productive capacity is sapped, which must be replaced before supply can grow. In the U.S., domestic oil output was at 9.5 million barrels per day in December 2014 when the OPEC oil price war commenced. Two years later, U.S. production had fallen by 700,000 b/d. Better prices and the shale oil revolution's success lifted output to 12.9 mmb/d in December 2019, but it fell by almost 2 mmb/d during the pandemic year of 2020. The most recent weekly government estimate shows domestic production of slightly over 12 mmb/d. The production surge came in response to the high oil prices we have lived with during the first half of 2022.

Oil prices have declined steadily since early June, falling 26 percent to \$88 per barrel in early August. Helping drive the price down was a strong U.S. dollar, but that trend is beginning to reverse. Since the June price peak and despite periodic rallies, oil prices have consistently been below their 20-day moving average. Futures prices suggest that by August 2023, oil prices will be in the low \$80s, or about where they were in January 2022. The current price decline comes with China's economy still locked down and 1 mmb/d of oil released from our Strategic Petroleum Reserve adding to supply. Those conditions will change in the fall, and we still have the December 5 wildcard of Europe's total ban of Russian oil purchases to consider. There is serious debate ongoing over whether the U.S. is in a recession, along with the rest of the world. If so, or a recession materializes later, oil demand will be hurt. With structural oil industry problems continuing, be prepared for volatile oil prices in response to events during the rest of 2022.

NATURAL GAS:

Natural gas prices have exploded to levels not seen since the 2000s. They are driven by a trifecta of forces: global demand for liquefied natural gas supplies, especially by Europe which is struggling to reduce its dependence on Russian gas supplies, is high; searing heat waves sweeping across the U.S. are boosting air conditioning demand; and gas production growth has been limited. These forces are shaping gas



» The U.S. LNG industry has been operating at maximum capacity in response to European demand.

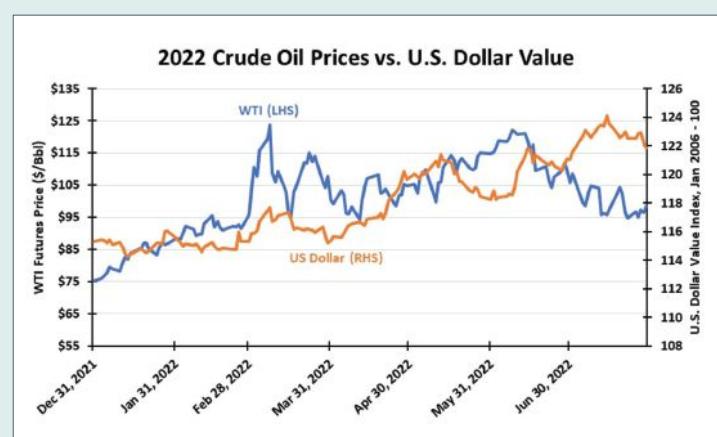
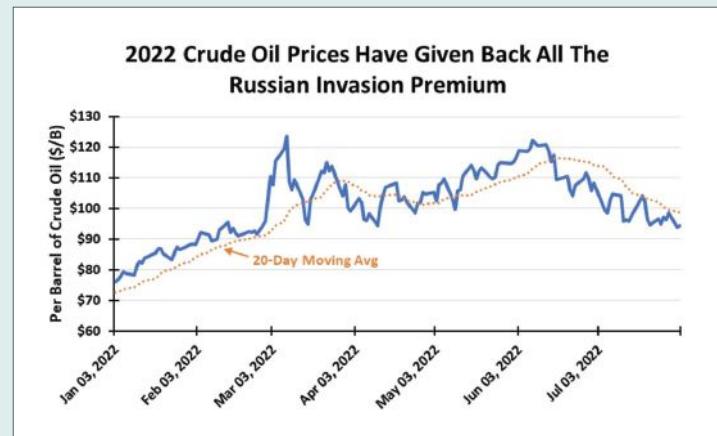
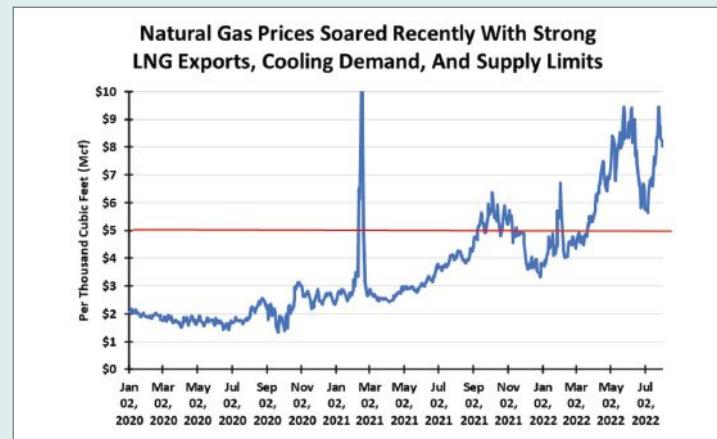
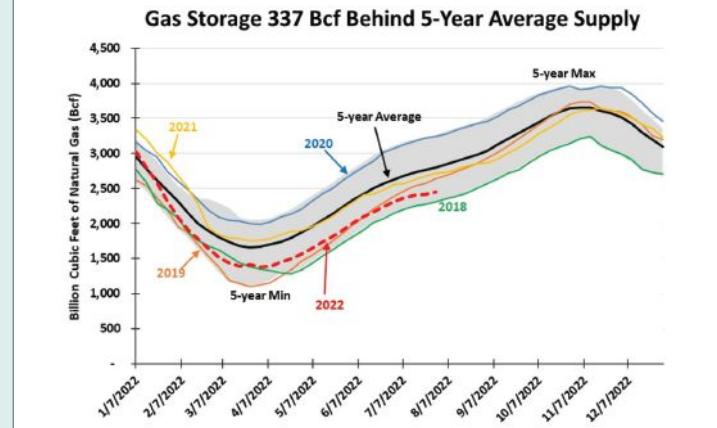
prices and given the demand for gas by economies around the world to meet power needs, the pressure is upwards. The U.S. LNG industry has been operating at maximum output in response to the extraordinarily high prices being paid for cargos in Europe that have exceeded what Asian buyers are willing to pay. That will not change anytime soon.

The accompanying chart of natural gas prices shows they peaked in late May, only to collapse shortly thereafter. That price drop resulted from a fire at Freeport LNG's terminal on June 8 that forced it to shut down. The terminal represents 20 percent of U.S. LNG export volumes. With Freeport's output lost until October at the earliest, gas traders expected the terminal's supply would rebuild storage at a faster rate than predicted, therefore high prices were unnecessary to secure storage volumes. Summer gas prices reflect levels traders believe are necessary to induce producers to store gas for winter use.

Gas prices quickly rebounded following the shock of losing the Freeport terminal's export volumes because the first heat wave in the western portion of the country emerged. Heat waves continued coming boosting gas demand for air conditioning. Temperatures remain elevated (it is summer) so gas consumption remains strong.

Regulators have indicated they will allow Freeport LNG to restart partial shipments in October, but that must still be considered tentative given the various safety tests yet to be completed. If the October date holds, the global gas market will breathe a sigh of relief, as the additional supply will be available by early winter.

High natural gas prices have enticed producers to add more drilling rigs, so we can expect increased supplies for the rest of the year. They will be needed because current gas storage volumes are lagging by 10 percent behind last year's storage and 12 percent behind the 5-year average storage volume. Given the world's need for more gas supply, global markets will have an outsized impact on U.S. gas markets and prices. Global and winter storage demands overwhelm any recessionary impact on gas consumption. Gas prices will remain elevated until the storage situation improves.





» Key wells to watch 2022. (Image credit: Wildcat, Westwood Analysis)

HIGH IMPACT EXPLORATION ON THE REBOUND

By Jamie Collard, Senior Analyst – Global Exploration and Appraisal, Westwood Global Energy Group

38 high impact (targeting a >100mmboe prospect or any frontier play test) exploration wells were drilled in the first half of 2022, similar to the same period in 2021 when 39 wells completed. The 38 wells resulted in 13 potentially commercial discoveries at a 34% commercial success rate, delivering ~6bnboe of discovered resource.

Eight of the wells tested frontier plays, with significant basin-opening discoveries at Venus and Graff in the Orange Basin offshore Namibia. Venus is the largest discovery in 2022 so far, with multi-bnboe potential in a Lower Cretaceous Aptian-Albian basin floor fan. There were, however, key frontier failures at Mlima in the Lamu Basin offshore Kenya and at Ulcinj offshore Montenegro.

18 wells tested emerging plays in 1H 2022 resulting in nine commercial discoveries and a 50% commercial success rate. Eight wells were completed in the Upper Cretaceous play offshore Suriname-Guyana delivering six successes. The other emerging play discoveries were in the Levantine (Athena), Perth (S Erregulla) and Orange (La Rona) basins. Key emerging play failures include

Cutthroat in the Sergipe-Alagoas Basin, which tried to extend the Barra Upper Cretaceous play, as well as Apus in the Roebuck Basin offshore Australia, which was unsuccessful in extending the Dorado play.

High impact exploration in maturing/mature plays disappointed, with only one potentially commercial discovery from 12 wells drilled, at Huron in the US Gulf of Mexico. There were multiple failures attempting to extend the pre-salt play in Brazil, as well as further disappointments in the SWAP license in the shallow waters of Azerbaijan.

High impact exploration shows signs of recovery

High impact drilling activity will pick up in the second half of the year, with between 80 and 90 high impact wells expected to have been drilled by the end of 2022, the highest number since 2019 when 98 high impact wells completed.

South America will continue to be an exploration hot spot with more wells planned for the Suriname-Guyana basin and offshore Brazil. Africa will see a return to

high impact exploration in 2022, with key wells planned in South Africa, Mozambique and Zimbabwe following the successes in Namibia earlier in the year. Whilst activity levels in Asia-Pacific and NW Europe are relatively stable, 2022 sees a return to high impact exploration in the deepwater of the Eastern Mediterranean after 2021 when no wells were drilled.

Westwood has highlighted 13 wells planned for the remainder of 2022 as 'key wells to watch.' These include a number of frontier play tests, for example Raia offshore Mozambique, and Pensacola, offshore UK; extensions of proven plays, including Zanderij offshore Suriname and Hoodoo, US Gulf of Mexico; and large prospects in proven plays, such as Wei, offshore Guyana.

High impact drilling performance for 1H 2022 as well as the key wells to watch for 2H 2022 are reviewed in detail by Westwood in a recently published report which provides descriptions of the plays and prospects along with the key risks and implications of success.

For more information, visit:
www.westwoodenergy.com

FUGRO'S GEO-DATA SUPPORTS DEVELOPMENT OF DENMARK'S LARGEST OFFSHORE WIND FARM

The collected Geo-data will be used to inform the design, fabrication and installation of the main wind farm components including turbine foundation, inter-array and export cables. With a planned capacity of 1,000 MW, Thor will be Denmark's largest offshore wind farm to date, producing enough green electricity to supply the equivalent of more than one million Danish households.

Fugro will be mobilizing multiple vessels from its industry-leading fleet, including Fugro Scout which has already begun investigations at the wind turbine locations, approximately 22 kilometers from Thorsminde. Vessels will be equipped with Fugro's SEACALF® Mk V DeepDrive® system for seabed cone penetration tests (CPTs) and Fugro's innovative Blue Snake™ geotechnical system which integrates CPT and sampling technology to enable safe, efficient and high-quality data acquisition along the wind farm

cable routes. The Geo-data will be used to understand soil behavior under the various turbine loading areas, as well as inform the design, installation and protection of the inter-array cables and the main export cable that connects the offshore substation with the onshore grid.

All work will be managed through Fugro's cloud-based Geo-data engagement platform. With the ability to provide near real-time deliverables to RWE and the project team, the platform increases collaboration, facilitates faster decision-making and accelerates timelines on critical milestones.

Günther Fenle, Project Director Thor Offshore Wind Farm, RWE Renewables, said: "We are looking forward to using the data collected by Fugro to start the design works for the main components of our Thor Offshore Wind Farm. With Thor, we have two projects off



» Fugro has begun geotechnical site investigations at RWE's Thor offshore wind farm development. (Photo credit: Fugro)

the Danish coast and this means that RWE is making a major contribution to Denmark's energy transition. Denmark has very favorable wind conditions and has ambitions to deploy even more offshore projects off the Danish coast—and as RWE we want to be part of this development."

Dennis Koenen, Fugro's Global Director Geo-data Acquisition Marine Site Characterization, added: "We're proud to be delivering state-of-the-art solutions that support the responsible design and installation of offshore assets. With a range of specialized vessels and equipment, we are committed to supporting Denmark's energy transition and we're proud to work with RWE as they prepare for future developmental phases of this project."

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BOMBORA GEARS UP TO DEPLOY THE WORLD'S MOST POWERFUL WAVE ENERGY CONVERTER

Bombora Wave Power (Bombora) is entering the final test and assembly phase of the ground-breaking 1.5 MW Pembrokeshire Demonstration Project, as it prepares to validate the world's most powerful Wave Energy Converter.

Rigorous testing of the key sub-systems is currently underway as the ocean energy specialist prepares to deliver the £20 million project, financially supported by the European Regional Development Fund (ERDF) via the Welsh Government.

The cell modules, a key element of the firm's iconic 'membrane-based' WEC system, mWave™, are now being operated through their final round of design limit testing, before being fitted into the steel foundation structure in Pembroke Dock.

Bombora's COO, Dave Rigg said the pioneering project has rapidly gathered momentum in 2022 and the team will soon be ready to fully energise the 1.5 MW mWave in the ocean waves off the Pembrokeshire coastline: "The project has been progressing at pace, with our specialist mWave cell membranes currently undergoing final tests, with extreme inflation and deflation cycles. This is the culmination of the full-system testing process involving detailed instrumentation, operation of the valve systems and powering of the PTO (Power Take Off) module.

"We have applied acute attention to detail, pushing our technology way beyond the expected operational limits to ensure high performance levels, robustness and durability. In the coming months we will complete the final assembly process on the quayside in Pembroke Dock before loadout to the operational site at East Pickard Bay, where the mWave technology will be validated in the open ocean, advancing it to TRL (Technology Readiness Level) 7/8."

Bombora's novel mWave solution involves a series of air-inflated concave cells covered with rubber membranes and mounted into a steel foundation structure secured beneath the ocean's surface. As waves pass overhead, air is squeezed out of each cell module in sequence, passing through one-way valves and into a duct system fitted with an axial turbine before being recirculated to refill each of the cell modules once the wave has passed. The unidirectional axial flow turbine is directly connected to a variable-speed generator to produce electricity.

The 900 tonne 1.5 MW mWave is 75 meters long, 15 meters wide and 6 meters high. mWave cell modules can be configured to suit either fixed-bed nearshore foundation systems or floating offshore ocean environments.



» MWave's air-inflated concave cells are covered with rubber membranes. (Photo credit: Bombora)

DEMOSATH FLOATING UNIT LAUNCHED

Saitec Offshore Technologies and RWE achieved another milestone in the DemoSATH project with the successful completion of the launching operation of the floating unit. The project moves forward at a fast pace for its installation later this summer. During the next months the submarine dynamic cable will be deployed at the installation site and the floater will be towed out to be connected to it, as well as to the mooring lines that were previously installed in late April.

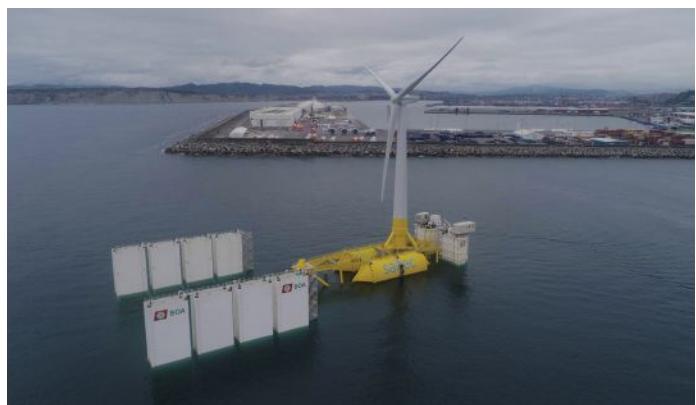
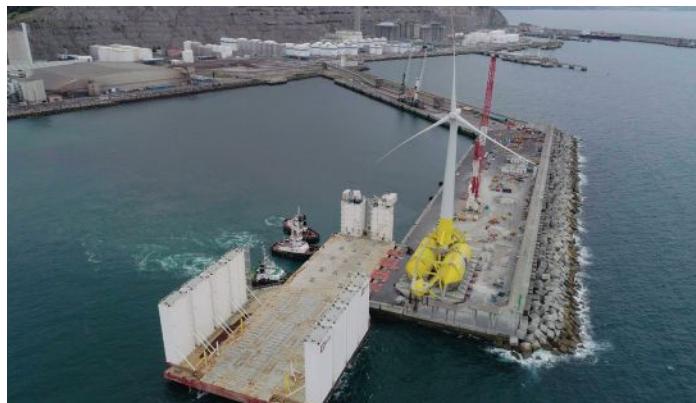
The load out and launching operations were performed at Punta Sollana quay, in the Port of Bilbao (Spain), where the prestressed concrete platform was previously constructed and assembled and equipped with a 2 MW turbine.

Firstly, the DemoSATH unit was loaded onto the semisubmersible barge's deck by means of Self-Propelled Modular Transporters. The barge was then ballasted down lower into the water until the DemoSATH unit became buoyant, after which it was towed off.

Araceli Martínez, Chief of Engineering at Saitec Offshore Technologies, said: "This is a great step forward for the DemoSATH project. The load-out and float-off operations were an important milestone to fulfill as they were the first of their kind executed for the SATH floating offshore wind turbine. The operations were thoroughly planned between all the parties involved and the final performance was excellent. Once afloat, it took less than 45 minutes to safely berth the DemoSATH wind turbine at quay. After the successful completion of the launching in the Port of Bilbao, we are proud to announce that the demonstrator is ready to become the first floating wind turbine to be commissioned to the mainland Spanish Grid during the next months."

Saitec Offshore Technologies and RWE Renewables entered into the partnership to develop DemoSATH project in 2020. The 2 MW unit using SATH Technology will be installed in a test field (BIMEP) which is two miles off the Basque coast, where the sea is 85 meters deep.

The SATH design allows the pre-fabrication of concrete components and uses a single-point-of-mooring system that allows the structure to yaw around its mooring and passively align itself to the wave and current direction. The aim of this demonstrator project is to test the technology for its industrialization for offshore wind farms in deep waters.



» DemoSATH float-off operation. (Photo credit: Saitec/RWE)



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SHIPWRECKS IN THE DEEP: DISCOVERY, ARCHAEOLOGY, AND TECHNOLOGY IN THE 21ST CENTURY



By James P. Delgado PhD,
Senior Vice President, SEARCH Inc.



The seabed, along with the many lake and river beds of the world are the resting place for as many as two million shipwrecks. Most of these date to the last two centuries, a time of industrial growth, and the creation of large fleets that created a global economy. Many were lost in battle, while many met their fate battling the elements, but all reveal hallmarks of our past.

By the end of the twentieth century, and now as we near the close of the first quarter of the twenty-first, technology has literally and virtually opened the door to more thorough and concentrated ocean exploration and discovery. It has also done the same for naval archaeology.

Discovery is not necessarily archaeology, nor is archaeology always about the act of finding something once lost. Archaeologists are usually not the ones making oceanic discoveries. However, the two are not mutually exclusive either; archaeology can only happen after something is discovered. Nor should discovery always immediately lead to archaeology if archaeology is defined as excavation—that is, digging it up. Here's where the latest ocean technologies are making discovery and archaeology natural partners as we increasingly explore the world's greatest subsea museums.

HEADLINE DISCOVERIES IN 2022

Ocean science and technology headlines in the first half of 2022 have been dominated by a long list of discoveries, of new insights based on exploration, and of shipwreck archaeology: Archaeologists recovered a massive marble head of Hercules from an ancient Roman wreck; Israeli archaeologists revealed the results of their excavation of a 1,400-year-old early Islamic period wreck off their coast at Ma'agan Michael; The results of years of study determined that a wreck off the British coast proved to be a famous wreck, that of HMS Gloucester, in which the former King James II nearly died in 1654; Excavation inside the wreck of *Clotilda*, the last ship known to have brought captives from Africa to enslave them, in 1860, revealed new physical evidence from its voyage; Archaeologists excavated a 4th century BC Greek wreck in the Nile Delta; Spanish archaeologists excavated a 1,700-year-old Roman wreck just off the beach in six feet of water, once buried by sand, off Mallorca, Spain; Researchers also identified a wreck off Greece as the 1891 wreck of an Italian steamship, *Taormina*, after an extensive survey by a remote operated vehicle.

Discoveries also included a 1,500-year old Byzantine wreck found off Greece's Fourni archipelago, a 13th century wreck off Britain's Dorset coast; Ernest Shackleton's fabled *Endurance*; a deep water site in the



» *Clotilda* as depicted by sonar. (Image credit: SEARCH, Inc./Alabama Historical Commission)



» The engine room of the steamer *Ituna*, wrecked off the Pacific Coast documented on a NOAA/Ocean Exploration Trust cruise in 2016. (Photo credit: Ocean Exploration Trust/NOAA)



» An octant and jug from a wreck off Blake Ridge in the Atlantic. (Photo credit: NOAA/Office of Ocean Exploration)



» Ernest Shackleton's fabled *Endurance*, found in March 2022. (Photo credit: SEARCH, Inc.)

Gulf of Mexico that is possibly the 1836 wreck of the whaling brig *Industry*; two World War II destroyer wrecks at extreme depths of the Pacific, USS *Johnston*, just over three and half miles down and USS *Samuel B. Roberts*, four miles deep, the world's oldest shipwrecks discovered to date; and the schooner barge *Atlanta*, lost in 1891, in 650 feet of water in Lake Superior.

And archaeologists are currently working with first responders rescued timbers from a 1693 wreck, the Spanish galleon, *Santo Christo de Burgos*, from sea caves and tide pools on the Oregon coast from a fabled wreck that served as the inspiration for Steven Spielberg's movie *The Goonies*. SEARCH Inc. has taken the lead on or had involvement in four of these projects—*Clotilda*, *Santo Christo de Burgos*, the possible *Industry*, and *Endurance*—and have watched the others with approbation and respect.

TECHNOLOGY SPURS COLLABORATION

From that more recent perspective, as well as over four decades of work in the field, from wrecks in shallows to the deep, and as a participant in many expeditions, what is clear is that, just as the James Webb Space Telescope, civilian spacecraft, and the on the ground exploration of Mars has shown in space, inner space is also being opened by human interest, ingenuity, and technology at an unprecedented scale.

Part of this is from the international collaborative effort to map the global sea floor with great accuracy. Another key aspect is the growth of private and philanthropic investment and result-driven project focus.

The ongoing role of governments—as represented in the United States by organizations such as NOAA's Office of Ocean Exploration, the U.S. Navy, the Bureau of Ocean Energy Management, the National Park Service, and the U.S. Army Corps of Engineers—works alongside the work of state and local governments and cultural resource management and survey firms in advance of development in marine environments.

What this means is that more evidence of the past will be found, and the potential is there, with comprehensive seafloor mapping, perhaps many of the sea's mysteries will be solved. Solving a mystery, especially the fate of specific ships, is a publicly fascinating goal, and one well suited to media and documentary films. As an archaeologist who works in both of these arenas, I argue that there is more to discovery than this. What comes from discovery is more than headlines. There is closure for families, reminders of service and sacrifice, and in that, occasionally rewriting history. But what archaeology brings is also its ability to add to history—the human

story. The physical remains speak powerfully to and about what we build, what we do—as opposed to what we say we do—and how we live and die.

Moving forward, what many hope to see is a focus on ongoing integration with not only seabed mapping, but other aspects of ocean science. Multiple platforms, multiple areas of inquiry, and interdisciplinary cooperation during and after missions are all key. Discovery paired with science, data collection, and ongoing analysis and publication of the results is much more than simply being cost-effective. Using discovery to engage the public, and to educate, is also paramount. Open, freely shared exploration and discovery, by agencies like NOAA, helps maintain public trust when what is being done is accessible, unfiltered, and unhindered by a payroll.

As the world is in a period of dramatic climate change, and the oceans face new stresses and peril, exploration and science, as well as evidence from the past, are as critical as our quest into space. As all mariners know, if as explorers, discoverers, and ocean scientists, we are through our work serving as beacons as we open the depths to human inquiry and understanding. Let us all be beacons, cooperative and collaborative. Lighthouses don't compete; they work together toward common goals.

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



» Plans are for Holland Hydrogen I will to be operational in 2025.
(Image credit: Kraaijvanger)

SHELL TO BUILD EUROPE'S LARGEST RENEWABLE HYDROGEN PLANT

Shell Nederland B.V. and Shell Overseas Investments B.V., subsidiaries of Shell plc, have taken the final investment decision to build Holland Hydrogen I, which will be Europe's largest renewable hydrogen plant once operational in 2025.

The 200 MW electrolyzer will be constructed on the Tweede Maasvlakte in the port of Rotterdam and will produce up to 60,000 kilograms of renewable hydrogen per day.

The renewable power for the electrolyzer will come from the offshore wind farm Hollandse Kust (noord), which is partly owned by Shell.

The renewable hydrogen produced will supply the Shell Energy and Chemicals Park Rotterdam, by way of the HyTransPort pipeline, where it will replace some of the grey hydrogen usage in the refinery. This will partially decarbonize the facility's production of energy products like petrol and diesel and jet fuel. As heavy-duty trucks are coming to market and refueling networks grow, renewable hydrogen supply can also be directed toward these to help in decarbonizing commercial road transport.

"Holland Hydrogen I demonstrates how new energy solutions can work together to meet society's need for cleaner energy. It is also another example of Shell's own efforts and commitment to become a net-zero emissions business by 2050," said Anna Mascolo, Executive Vice President, Emerging Energy Solutions at Shell. "Renewable hydrogen will play a pivotal role in the energy system of the future and this project is an important step in helping hydrogen fulfil that potential."

Shell's ambition is to help build a global hydrogen economy by developing opportunities in the production, storage, transport, and delivery of hydrogen to end customers. Holland Hydrogen I's approval marks an important milestone on that journey not only for the Netherlands, as a leader.

EXXONMOBIL MAKES TWO NEW DISCOVERIES OFFSHORE GUYANA

ExxonMobil has made two new discoveries offshore Guyana to the southeast of the Liza and Payara developments in the Stabroek block. The discoveries at Seabob and Kiru-Kiru are the sixth and seventh in Guyana this year, with the total number of discoveries in Guyana at more than 25.

The Seabob-1 well encountered approximately 131 feet (40 meters) of high-quality hydrocarbon-bearing sandstone and was drilled in 4,660 feet (1,421 meters) of water by the *Stena Carron* drill ship. The Kiru-Kiru-1 well encountered approximately 98 feet (30 meters) of high-quality hydrocarbon-bearing sandstone and was drilled by the *Stena DrillMAX* in 5,760 feet (1,756 meters) of water. Drilling operations at Kiru-Kiru are ongoing.

"ExxonMobil and its partners continue to accelerate exploration, development and production activities for the benefit of all stakeholders, including the people of Guyana," said Liam Mallon, president of ExxonMobil Upstream Company. "The resources we are investing in and discovering offshore Guyana will provide safe, secure energy for global markets for decades to come."

The company's 2022 investment plans include further exploration drilling and resource development in Guyana, where it is already increasing production at an accelerated, industry-leading pace. Two floating production storage and offloading (FPSO) vessels operating offshore Guyana—*Liza Destiny* and *Liza Unity*—have exceeded their initial combined production target of 340,000 barrels of oil per day.

A third project, Payara, is expected to produce 220,000 barrels per day. Construction on its production vessel, the *Prosperity FPSO*, is approximately five months ahead of schedule with start-up likely before year-end 2023. The fourth project, Yellowtail, is expected to produce 250,000 barrels per day when the ONE GUYANA FPSO comes online in 2025.

Guyana's Stabroek block is 6.6 million acres (26,800 square kilometers). ExxonMobil affiliate Esso Exploration and Production Guyana Ltd. is the operator and holds 45% interest in the block. Hess Guyana Exploration Ltd. holds 30% interest, and CNOOC Petroleum Guyana Ltd. holds 25% interest.



» Drill ship *Stena Carron*. (Photo credit: Stena Drilling)

ECO WAVE POWER COMMENCES REAL CONDITIONS TEST JAFFA PORT

Eco Wave Power Global AB recently announced that it has officially commenced test runs of its newly installed wave energy pilot project at the Port of Jaffa in Tel Aviv, Israel.

The real-conditions testing was initiated in July 2022 with the purpose of examining the operation of the mechanical and hydraulic subsystems of the project. During the testing, the Eco Wave Power floaters were lowered to the water and tested for the very first time, resulting in a green light for the next phases of the project, which will include grid connection and testing of the overall system, to be followed by full operation.

Once testing and final works are completed including the grid-connection, an official launch of its power station will follow.

"Lowering the floaters into the water for the very first time was an exciting moment for our team. It is incredible to witness a technology that starts from sketches and calculations to an actual soon-to-be grid connected wave energy project. We are now working hard to ensure that the EWP-EDF One pilot project will be functioning and operating at optimum levels," said Inna Braverman, Founder and CEO of Eco Wave Power.

"We are pleased with the results of our very first real-conditions test run," said David Leb, Founder and Board Member of Eco Wave Power. "We are looking forward to the completion of the grid connection works by the Israeli Electric Company ("IEC"), which will enable us to start providing clean, renewable electricity to Israel's national grid through the power of the waves."

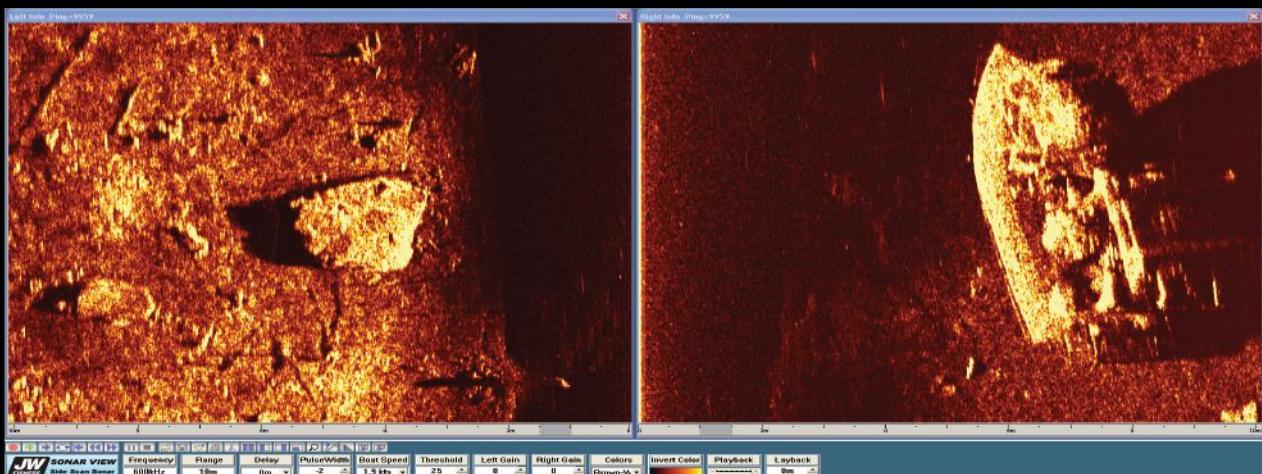
On August 1st, 2022, Eco Wave Power's engineering team met with representatives from the Israeli Electric Company (IEC) to coordinate the next steps for the actual grid connection works.

Once connected to the grid, the EWP-EDF One wave energy pilot project will be the first time in the history of Israel that electricity produced by the power of the waves will be officially transmitted to Israel's national electric grid.



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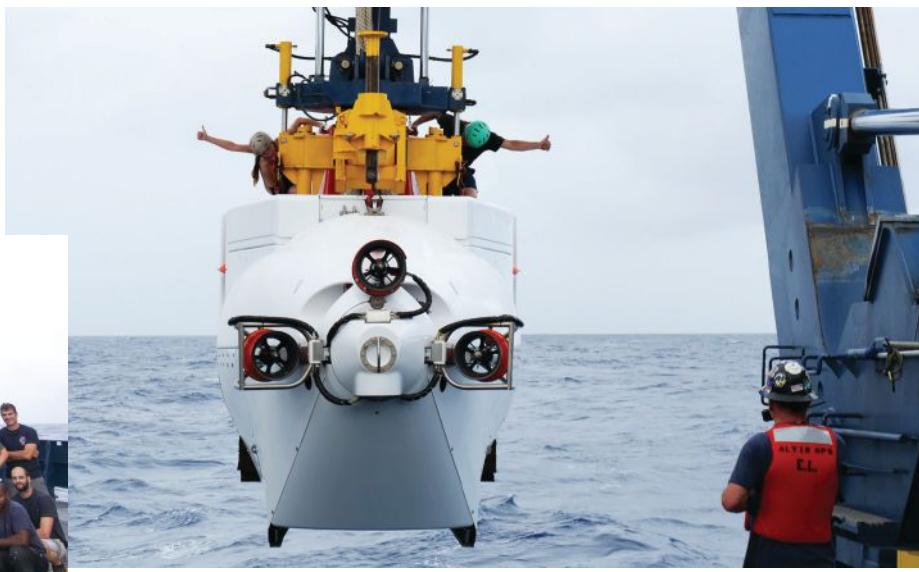
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CHECK THE TECH



» The Alvin team on the deck of the R/V Atlantis after Alvin's historic dive on July 21, 2022. (Photo credit: Ken Kostel/WHOI)



» Alvin preparing to make the deepest dive ever in its 58-year history, north of San Juan, Puerto Rico. (Photo credit: Ken Kostel/WHOI)

UNDERWATER VEHICLES GRANT SCIENTISTS AN ACCESS-ALL-AREAS PASS TO DEEP-SEA DISCOVERY

The ocean is crucial to life on Earth, yet it remains remarkably unexplored. To better understand the ocean, scientists often find they need to get themselves or their instruments into very specific places.

Thanks to a spectrum of available tools, ranging from human-occupied submersibles to autonomous and towed robots, technology that is owned, operated or developed at the Woods Hole Oceanographic Institution is revolutionizing the way in which scientists can access and connect with what lies below. And sometimes, different vehicles work together to accomplish big goals.

THE DEEPEST DIVE EVER

On July 21, 2022, human-occupied vehicle (HOV) *Alvin* made history when it successfully reached a depth of 6,453 meters (nearly 4 miles) in the Puerto Rico Trench. This is the deepest dive ever in the history of the storied submersible.

The added range puts roughly 99% of the seafloor within reach of the world's longest-operating, most active, and, by many measures, most successful human-occupied submersible program in the world.

"Investments in unique tools like *Alvin* accelerate scientific discovery at the frontier of knowledge," said WHOI President and Director Peter de Menocal. "*Alvin*'s new ability to dive deeper than ever before will help us learn even more about the planet and bring us greater appreciation for what the ocean does for all of us every day."

The sub has completed 5,086 successful dives and, at the time of writing, is preparing for an entirely new set of missions. *Alvin* is one of the most recognized and the most widely used deep submergence vessels in the world and is famed for its iconic expeditions including exploration of the wreck of the RMS *Titanic* and studies of hydrothermal vents in the Pacific and Atlantic.

A BRAND-NEW FIELD

Also in the past month, a joint effort using WHOI-developed technology led to the discovery of a new high-temperature, off-axis hydrothermal vent field on the Pacific seafloor and highlighted the growing use of autonomous underwater vehicles (AUVs) in expeditions that include *Alvin* or remotely operated vehicles (ROVs) such as *Jason*. Surveys collected by AUV *Sentry* at a well-studied portion of the East Pacific Rise between 9° and 10°N resulted in maps that revealed the location of the vent field where no one had looked before. The study was done in collaboration with Lehigh University, Scripps Institution of Oceanography (SIO), and the University of Bergen Norway.

The size and location of the site underscores the likelihood that there are more hydrothermal vents in the deep-sea than previously thought. It also emphasizes the need for more high-resolution mapping to locate them, as well as the importance of using AUVs with other platforms to improve the efficiency of human-aided exploration.

The study team named the vent field "YBW-Sentry" after three WHOI pioneers of AUV technology—Dana Yoerger, Al Bradley, and Barry Walden. The name also acknowledges *Sentry*'s role in the discovery and its place as part of a long legacy of AUV innovation at WHOI.

Alvin, *Sentry*, and the remotely operated vehicle *Jason* are part of the NSF-funded National Deep Submergence Facility. For more information, visit www.ndsf.whoi.edu.



» AUV *Sentry* aided in the discovery and mapping of a new off-axis hydrothermal vent on the East Pacific Rise. (Photo credit: Luis Lamar/WHOI)

DECOM ENGINEERING INKS TWO CONTRACTS IN NORTH SEA AND WEST AFRICA

Decom Engineering (Decom) has secured two contracts worth more than £300,000 in the North Sea and offshore west Africa, strengthening their reputation as a leading provider of decommissioning services.

The company had designed and developed a range of cold cutting saws which are deployed on a variety of energy sector decommissioning projects which require pipelines and associated infrastructure to be safely removed.

The UK Continental Shelf contract is a conductor recovery and removal project deployed topside on a vessel and Decom's C1 Chopsaw is expected to complete eight cuts on behalf of a global offshore contractor. Separately, Norwegian-headquartered subsea and offshore wind farm contractor Havfram have commissioned Decom to carry out cutting operations on a ROVCON connector in water depths of up to 800 m off the coast of west Africa.

Both projects were secured following a series of technical trials at JFD Global's testing tank and the National Hyperbaric Centre in Aberdeen, and they follow the successful completion of two phases of another international workscope offshore in the Gulf of Thailand in which Decom's chop saws performed hundreds of cuts on piping of up to 16" diameter.

Decom Engineering Managing Director, Sean Conway, said: "The successful completion of a strategic project offshore Thailand and our imminent mobilization on workscopes in the North Sea and Africa, demonstrates that our technology is gaining traction with energy companies and contractors who have technically challenging requirements on a range of international decommissioning projects.

"Recent technical trials in Aberdeen have proven our cutting technologies can operate safely in deeper waters and that they are preferable to rival solutions where accessibility to subsea infrastructure is an issue."

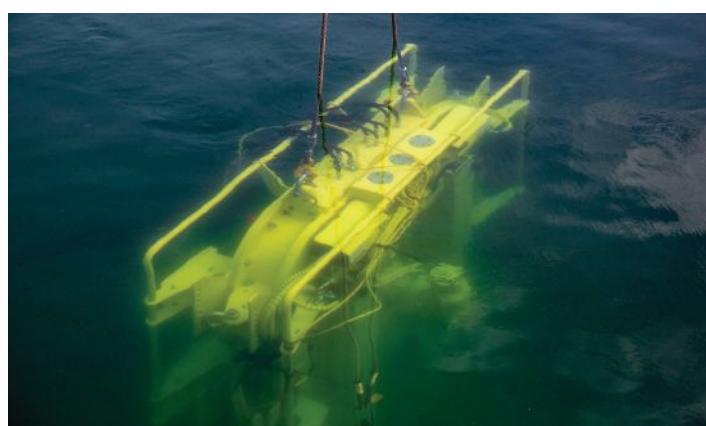
Decom are confident that on completion of the UKCS project they will be in prime position to secure a more significant workscope from the same client on a second North Sea platform.

Nick McNally, Decom Engineering Commercial Director, added: "Both of these contracts are firsts—the first conductor removal and the first ROVCON connector project we have undertaken, which underlines the versatility and flexibility of our technologies.

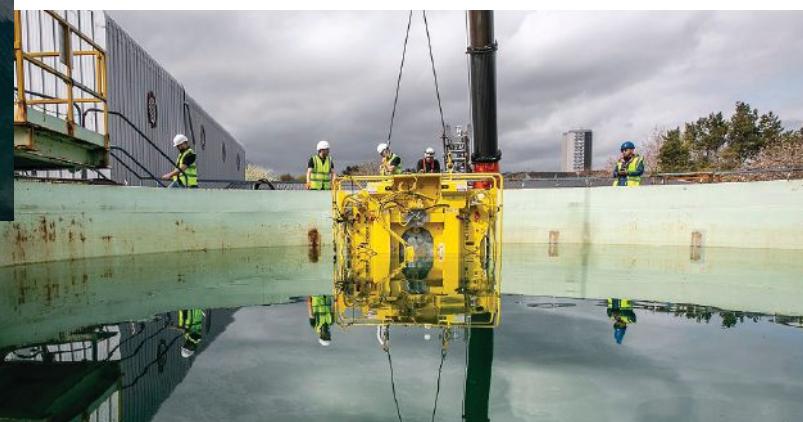
"The technical trials in Aberdeen gave reassurance and confidence to the end-clients, and proved our saws are capable of operating in water depths of 800 meters or more, opening up new opportunities for engagement on more challenging decommissioning projects."

Steven Gibson, Senior Engineer with Havfram during testing, said: "The potential of Decom's saw to cut the heavy grade material we are going to be cutting through on the west African seabed, the speed of the cut, and the ability to position it in a very restricted space, were the driving factors in awarding this workscope."

Northern Ireland-based Decom opened up a new base near Aberdeen at the start of 2022 to be located closer to potential North Sea clients and the policy appears to be paying off following this most recent contract award.



» Decom Engineering's C1-24 chopsaw being tested on a ROVCON connector at the National Hyperbaric Centre, Aberdeen. (Photo credits: Decom)



IMCA ISSUES BURIAL AT DEPTH MEASUREMENT GUIDANCE

The International Marine Contractors Association's (IMCA's) latest guidance 'Guidelines for the Measurement of Depth of Burial' (IMCA S 029) aimed at both the offshore renewables and offshore oil and gas industries, looks at the different methods of measuring the depth of burial of subsea cables and pipelines together with factors influencing the depth of burial.

It also includes measuring the thickness of an embankment of crushed rock on top of a pipeline or cable; and provides guidance on measurement of depth of lowering—including explanation of the difference between lowering and burial or cover.

Subsea pipelines and cables are commonly buried in the seabed or covered with crushed rock to give them protection from anchoring and bottom trawling.

They can also be buried/covered to maintain an operating temperature and, in the case of pipelines, to be restrained from upheaval buckling. Some pipelines and cables are left exposed on the seabed to permit thermal expansion or left in an open trench designed to protect the line from passage of an anchor or trawl. 'Depth of Burial' or 'Depth of Cover' becomes a contractual requirement and therefore needs to be measured with equipment and procedures that produce results of known accuracy. IMCA S 029 gives clarity to this important topic.

The document includes sections on the methods for defining depth of burial or cover; selection of survey sensors; tone injection for active cable trackers; accuracy of DOB measurements; depth of burial measurement in different types of survey; reporting depth of burial; possible disputes in depth of burial measurement; developments in pipe and cable tracking as well as a useful introduction providing both an overview of methods of burying pipelines or cables and of equipment for measuring burial; clarification of terminology; a glossary; references and further ready and appendices focusing on Teledyne TSS 440 and PanGeo Sub-Bottom imager.

Further information on IMCA and its work on behalf of the global offshore marine construction industry is available from www.imca-int.com.



» Blue Prism™ will be available in 2023. (Image credit: Fugro)

FUGRO TO DEVELOP NEXT GENERATION USV

Fugro has signed a contract with Kooiman Engineering and Van Oossanen Naval Architects for the naval design of Blue Prism™, Fugro's next generation of uncrewed surface vessels (USVs).

Specifically engineered for operations in both coastal and offshore environments, the Blue Prism™ will combine an ultra-low carbon footprint with high quality data collection, weather resilience and endurance characteristics.

Available to clients in 2023, Fugro's Blue Prism™ will acquire bathymetry and sub-bottom data of the highest accuracy using hull mounted sensors, whilst also having the ability to tow multiple geophysical sensors. Capable of beyond line of sight operations, it will be the first low carbon autonomous vessel to combine these advanced vessel characteristics and sensors. Together with Fugro's smart data management software, the speed and endurance of the Blue Prism will reduce risk and accelerate project delivery in offshore wind, hydrographic charting and coastal resilience.

Perry van Oossanen, Managing Director and Naval Architect at Van Oossanen Naval Architects, said: "We

are thrilled to be part of this exciting project in which the best technics in Dutch ship building are combined in this new uncrewed ultra-efficient vessel. To re-think the design and layout of a vessel without a crew is a dream come true for a naval architect."

Maarten Kooiman, Director of Kooiman Engineering, added: "The collaboration between Kooiman and Van Oossanen has already led to innovative solutions, and we are pleased to be able to help Fugro take the next step in uncrewed vessels."

Frank Koopman, Fugro's Global Director Marine Site Characterisation, also stated: "Autonomous vessels play an important role in the future of the maritime survey sector by improving safety, reducing carbon emissions, and delivering high quality data more efficiently. We chose to work with Kooiman Engineering and Van Oossanen Naval Architects because of their extensive track record in innovative ship design and hydrodynamics and we look forward to working with them on this exiting project as we are determined to grow our fleet of USVs for safer, more sustainable marine operations."

OCEANTOOLS LAUNCHES NEW C-LEVEL SUBSEA DIGITAL DISPLAY

OceanTools has launched a new C-Level Subsea Digital Display, adding to their extensive industry leading range of high specification subsea technology.

The C-Level is an ROV or diver deployed digital level that can be used to measure and display the inclination angle of underwater structures or mooring lines. An integrated inclination measurement and display unit, it combines the functionality of an OceanDISP subsea display and OceanTILT precision attitude sensor. The measured angle is shown in real time on a high visibility LED matrix display.

Building on the success of the DISTIL display and tilt sensor, it has a 300 m depth rated acetal housing with anodized aluminium front plate and acrylic window. The unit has an integral 3.6Ah rechargeable battery pack, which is ample to power it for a full working day.

Custom handle options are available to aide deployment by ROV or diver. Mounting block guides can be fitted to the base to allow it to sit on a mooring chain or wire and measure the angle of the mooring, with a magnet base option also available.

Brian Hector, Technical Sales Manager at OceanTools, said: "We are delighted with the design of our C-Level as it utilises tried and tested technologies already used in other products. We have developed the product in response to customer requirements in a wide range of subsea engineering applications and we are confident that these can be fulfilled by the C-Level."

The C-Level can be deployed in any subsea engineering project requiring a high level of accuracy including construction, maintenance and decommissioning.



» The C-Level Subsea Digital Display is depth rated to 300 m. (Photo credit: OceanTools)

How Shipshape is Your Hull?
Take Control of Your Environment

A large yellow semi-autonomous ROV, labeled 'SEA ROBOTICS AN ADVANCED OCEAN SYSTEMS COMPANY', is shown from a side-on perspective. It has a complex internal structure visible through a clear plastic cover on its side. The hull is yellow with black accents and features the 'SEA ROBOTICS' logo. The ROV is positioned against a dark background.

Keep your vessel at sea, not the shipyard.

The gains associated with proactive hull grooming are immediate, both in terms of a vessel's efficiency and environmental footprint. The SR-HullBUG is a field-tested semi-autonomous ROV that uses light brushes to eliminate the early signs of biofouling and prolong periods between costly drydocking. The system's sophisticated capture and filter system enables operators to safely remove effluents and invasive species in portside waters.

Cleaner seas need cleaner hulls.

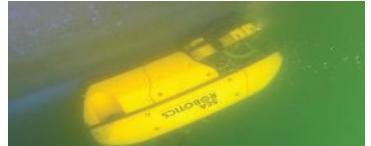
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AN ADVANCED OCEAN SYSTEMS COMPANY

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ROVs for Hull & Tank Cleaning

Engineering & Design

Manufacturing & Fabrication



Bio-inspired
ROV Technology



Dockside or Barge Deployment
and Biofouling Filtration



Hull Grooming for
Optimized Vessel Performance

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GEOQUIP MARINE ADDS SPECIALIST DEEP-PUSH CPT VESSEL TO FLEET

Global offshore geotechnical data acquisition, analysis and reporting specialist Geoquip Marine has confirmed the further expansion of its fleet of vessels with the addition of a further integrated geotechnical survey vessel (GSV), the *Geoquip Elena*.

Geoquip Elena is setup as a specialist deep push Cone Penetration Testing (CPT) vessel and has been acquired to add vital capacity to the demand from offshore windfarm developers, especially in Europe and North America.

The vessel is a 4,000-ton IGSV 91 m in length and 19 m in breadth. It was built at Vard Brattvaag, Norway in 2002.



» *Geoquip Elena* is a specialist deep push CPT vessel. (Photo credit: Geoquip)

It is currently being fitted with one of Geoquip Marine's 200kN seabed CPT units, which can operate a range of seabed penetration test equipment.

Once operational on the seabed, the CPT unit relays data to an operator on board in real-time where it is then processed. The 200kN system provides a continuous profile of tip resistance, sleeve friction and pore water pressure, which can be used for the derivation of shear strength in cohesive soils and the relative density of non-cohesive soils.

The rig can reliably push to depths in excess of 40 m and is therefore ideally suited for gathering data for the construction of foundations for offshore windfarms.

Geoquip Elena joins five other DP2 and four-point moored vessels in the company's fleet, which provide a highly versatile range of offshore geotechnical investigation services in all parts of the world.

"We are delighted to announce the addition of *Geoquip Elena* to our fleet, providing greatly needed additional capacity for deep bed CPT services in our busiest locations," said Geoquip CEO Stewart Higginson. "The company has experienced tremendous growth in the last few years and the demand for offshore wind power continues to gather greater momentum. The extra capacity it provides will significantly reduce waiting times for developers in these areas."

GEOXYZ INTRODUCES GREEN SURVEY VESSEL, GEO OCEAN VI

With a focus on delivering the next generation Geo-data acquisition solutions, GEOxyz Group further invests in its offshore survey fleet. With the acquisition of the hybrid propulsion vessel *Geo Ocean VI*, GEOxyz further specializes in providing greener, sustainable and smarter solutions for hydrographic, geophysical & geotechnical surveys.

Being equipped with a fully integrated launch and recovery system, the vessel is also ready to act as mother vessel for our hydrographic survey ASVs. Creating a flexible all-round platform, both cost and operationally efficient, which can easily meet today and tomorrow's offshore survey requirements.

Patrick Reyntjens, Founder & CEO of GEOxyz, said: "GEOxyz is committed to take up its responsibility in ensuring

a sustainable development of the blue economy. This addition to the fleet illustrates that mission, enabling us to provide a greener and smarter service to our clients. Adding an additional vessel to our fleet also allows us to continue to grow as offshore Geo-data specialist while securing availability of vessels meeting our highest technical and safety standards."

Geo Ocean VI, built in 2014, was originally designed as Seismic support vessel and can be run under four propulsion modes, including full electrical mode during survey operations.

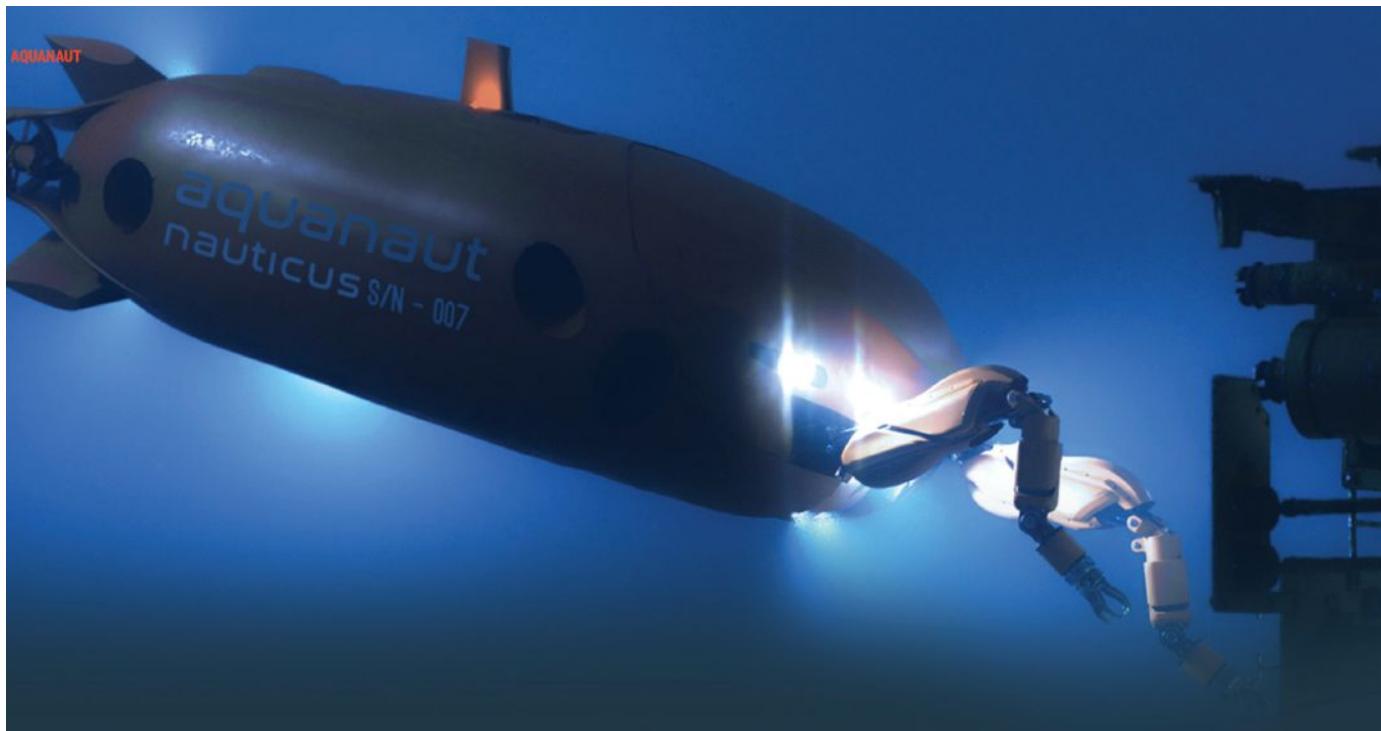
With an overall length of 53.8 m and a deck area of approx. 230 m² - 5t/m², the vessel has a large deck area and crane coverage turning it into a flexible platform capable of performing a multitude of survey operations.

Furthermore, the vessel is equipped with a fully integrated launch and recovery system of 10t lifting capacity @ 30m/min enabling it to launch and recover our Autonomous Surface Vehicles. In addition to that a large 5T A-frame will be installed at the aft.

This makes the *Geo Ocean VI* a green and versatile multi-disciplined Offshore Survey Vessel, fitted for Geophysical as well as Geotechnical survey work. She will be permanently equipped with specifically selected survey equipment and ready to serve the offshore industry.



» *Geo Ocean VI*. (Photo credit: GEOxyz)



» Aquanaut is deployed from Nauticus' small surface vessel, Hydronaut, to carry out a range of subsea tasks. (Image credit: Nauticus Robotics)

NAUTICUS ROBOTICS AND SHELL TO COLLABORATE ON AUTONOMOUS OPERATIONS

Nauticus Robotics, Inc., a Houston-area developer of subsea and surface robotic services using autonomy software, recently announced an agreement with Shell to advance to the qualification phase for a more efficient means of acquiring subsea integrity data utilizing Nauticus' Aquanaut and Hydronaut robotic platforms.

This collaboration will enable Shell to add an advanced tool to its subsea asset integrity management lineup with the potential to improve subsea operations. Shell and Nauticus will collaborate with the industry's leading inspection tooling service providers, leveraging their expertise and technology to fully integrate into Nauticus' robotic service solution.

An initial feasibility study for the phase-gated project was recently completed, and the team now moves onto the operational qualification phase, which focuses on remote operations of the robotic duo using supervised autonomy and tool control using Nauticus' acoustic communication networking technology. The collaboration is targeting the preliminary work required for an offshore pilot project.

"Working with a leading company such as Shell marks an exciting milestone for Nauticus, and this collaboration further validates the superior capabilities and extensive use cases of our robots across the energy sector," said Todd Newell, SVP of Business Development

at Nauticus. "Implementing our supervised autonomous method, one that has proven more robust and dynamic than most of its kind, is expected to provide our partner and future customers more than 50 percent cost savings compared to today's methods of operation."

This collaboration will utilize a fully electric subsea robot, Aquanaut, which is deployed from Nauticus' small surface vessel, Hydronaut, which is used for the transport, recharge, and communication for Aquanaut, among other tasks. Together, this robotic pair will function as a unified solution to bring a new means of conducting subsea work to the offshore services industry. Their inherent autonomous architectures will

allow a transition to far more autonomous operations over conventional solutions.

"An exciting aspect of this project is the opportunity to combine the strengths of advanced inspection tooling with the advanced marine robotic capabilities developed by Nauticus Robotics," said Ross Doak, Deepwater Robotics Engineer of Shell's robotics team. "This project aims to fundamentally improve how we collect subsea facility data, through the combination of 'AUV native' tooling design, supervised autonomy, and recent improvements in remote communications."

REVOLUTIONARY UNCREWED SOLUTIONS FOR THE OFFSHORE ENERGY SECTOR

Argeo has launched an uncrewed, remotely supervised survey and inspection vehicle, named Argeo Argus. The USV (Uncrewed Surface Vehicle) will carry out advanced mapping and inspection services using robotics and autonomous ocean space technology for offshore and energy projects in water depths from up to 200 meters.

"Investments in the offshore energy sector are growing at a massive rate. The Argeo Argus is a major breakthrough in commercial uncrewed solutions for the offshore energy sector," said Argeo CEO Trond Crantz.

"We believe Argeo Argus is the perfect match for developers in this market segment. The demand for mapping and inspection services is increasing and we expect that offshore wind will be an important business segment for years to come."

Key Benefits:

- Full position control enabling worldwide safe and remote supervised operations 24/7
- High-resolution data quality for detailed seabed mapping and shallow water geology from integrated geophysical & hydrographical sensors
- Fast and effective with up to 30 operating days and hybrid propulsion system, enabling cost effective shore-to-shore operations
- Tailor made to comply with governmental rules and regulations
- Operational and sensor configuration flexibility with configurable back-deck with two moon pools
- Can potentially be toolled with Argeo's novel Electromagnetic technology for UXO investigations and a new Ultra High Resolution (UHR) seismic system
- Data acquired by Argus will be integrated into Argeo's Digital Ocean Space platform

Reduced Carbon Footprint

The vessel was built at Maritime Robotics in Trondheim, Norway, in close collaboration with Argeo. The carbon footprint of the vessel was a critical design consideration.

"We managed a 95% reduction in the emission compared to a traditional manned vessel. Our goal is 100%, which we hope to reach soon," added Crantz.



» Argeo Argus was manufactured by Maritime Robotics. (Photo credit: Argeo)



» Rotating Buoyancy Modules are used to mitigate buckling in seabed pipelines. (Image credit: CRP Subsea)

CRP SUBSEA TO PROVIDE INNOVATIVE BUOYANCY SOLUTIONS IN THE GULF OF MEXICO

CRP Subsea has recently been awarded a major deep-water contract to provide two of their market-leading buoyancy solutions in the Gulf of Mexico.

CRP Subsea's unique Rotating Buoyancy Modules will be used to mitigate flowline buckling combined with their innovative Integral Buoyancy Modules, helping to generate a system riser configuration.

Steve Bray, Commercial Team Manager at CRP Subsea, stated: "This award continues to strengthen our collaboration with a market-leading installation contractor and build on our unrivalled track-record for both buoyancy solutions. We are extremely proud to have been chosen to supply two of our innovative solutions for this project and look forward to collaborating further in the future."

Engineering works are due to commence at CRP Subsea's World Class buoyancy production facility in the North West of England later this year, with completion and deployment in mid-2023.

Rotating Buoyancy Modules are used to mitigate buckling in seabed pipelines, they roll on the seabed reducing lateral friction and berm creation, allowing repeatable and predictable pipeline behaviour. Integral Buoyancy Modules clamp directly to subsea pipelines providing buoyancy at specific locations, they combine the functions of the traditional clamp and buoyancy elements into one unit, so there is no need for a separate internal clamp assembly.

LOGAN INDUSTRIES COMPLETES COILED TUBING REELER PROJECT FOR ONESUBSEA



» Logan's CT reelers provide full torque control for tubing without the need for a standard injector head. (Photo credit: Logan)

Logan Industries International Corporation (Logan) has successfully delivered a unique, space saving coiled tubing (CT) reeler suite for OneSubsea, designed to maximize profitability.

More than simply storage reelers, Logan's CT reelers are coiled tubing winches, where the reelers provide full torque control for the tubing without the need for a standard injector head. This reduces space required compared to standard tubing reeler/injection head combination and allows for a larger fluid storage footprint on deck. When the equipment required to handle CT has a small footprint, more deck space can be dedicated to hauling fluid, which increases profitability for the operator.

Whereas Logan has built several sets of these machines in the past with fixed drums, this is the first unit Logan has delivered with a removable drum, which means the unit footprint can remain static on the vessel while the drums can be taken to a shore base for unspooling and respooling.

They are transported in a purpose-built DNV lift rated drum basket, fully secured and protected. The swap out drum also makes the machine faster to build, reducing typical assembly time for the drum and drive train from two weeks to two days.

At 15,000 psi working pressure, 10,000 feet of 2 in. CT was provided on the drum, with live swivel and isolation valves

on the unit. The suite of equipment provided for this work includes a spare drum, adapter to allow it to fit into most tubing service spoolers at the tubing manufacturer's facilities, transport basket and lifting set along with the reeler, HPU, control stand and interconnect lines. Logan also provided a purpose-built overboarding platform with a translating / clamshell to accommodate OneSubsea's unique end connection philosophy.

Logan's technical director Dean Carey said: "We placed a work deck, dimple connector, test tool, controls and safeguards on this overboarding platform to give the crew plenty of access to the volume of space under the overboarding point. The overboarding platform also provided a reeler deck loading spreader effect on the vessel's deck. We believe this is truly the next evolution in coiled tubing deployment offshore, and provides significantly more convenience for our customers. This is one of the most comprehensive reeler equipment suites Logan has had the pleasure to provide, and we expect it to remain in service for quite some time."

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NEC TO BUILD NEW TRANS-PACIFIC SUBSEA FIBER OPTIC CABLE

NEC Corporation has been contracted by Seren Juno Network Co., Ltd., a company established by NTT Ltd Japan Corporation, PC Landing Corp. Mitsui & Co., Ltd. and JA Mitsui Leasing, Ltd. to build a trans-Pacific subsea fiber-optic cable, "JUNO Cable System," connecting California in the US with Chiba prefecture and Mie prefecture in Japan. This cable will provide the largest data capacity between the US and Japan, spanning a total distance of approximately 10,000 km, and is expected to be completed by the end of 2024.

Until recently, subsea cable was composed of 16 fiber pairs at most, but today, by using NEC's newly developed energy efficient repeaters, and the leading-edge SDM (Space Division Multiplexing) technology, this system will be able to adapt as

many as 20 fiber pairs for the first time in a trans-Pacific subsea fiber-optic cable. The cable is expected to provide a maximum capacity of 350Tbps, the largest among any existing cable system between the US and Japan.

Japan plays an important role as a data hub in the Asia-Pacific region. This cable will promote the development of digital economies by supporting the strong demand for communications, including the spread of 5G throughout Asia and North America. In addition, by providing communication routes from two separate locations in Japan to the US, the system will be highly resilient to natural disasters in the coastal areas of Japan. Moreover, the WSS (Wavelength Selective Switch) function will enable the system to remotely alter the bandwidth of each route,

enabling it to respond flexibly to customer business needs and changes in communications traffic demand.

NEC has been a leading supplier of submarine cable systems for more than 50 years, and has built more than 300,000 km of cable, spanning the earth nearly 8 times. NEC is well-established as a reliable partner in the submarine cable field as a system integrator that provides all aspects of

submarine cable operations, including the manufacture and installation of optical submarine cables and repeaters, provision of ocean surveys and route designs, training and delivery testing. NEC's subsidiary OCC Corporation manufactures subsea optical cables capable of withstanding water pressures at ocean depths beyond 8,000 meters.



» New cable between US and Japan will be completed in 2024.
(Image credit: NEC)

PRYSMIAN UNVEILS PLANS FOR US OFFSHORE WIND CABLE PLANT

Prysmian Group announces it has received the first layer of approval of the construction permits for the development of its new submarine cable plant in Brayton Point, Massachusetts, and confirms construction planned to start in summer 2023 and to last two years.

With a \$200 million investment plus the purchase of the land, the Group plans to

redevelop the site of a decommissioned coal-fired power plant into a strategic knowledge and production hub located at the heart of the sharply growing US offshore wind industry. The new plant will be dedicated to the production of high-tech submarine inter-array and export cables up to 275 kV AC and 525 kV DC to connect offshore wind farms to mainland power grids. The factory is designed to start delivering 270 Km AC 275 kV of

finished 3-cores cables a year. It is designed for a possible future upgrade, should the market allow. The Brayton Point cable hub will also have an R&D center with a high-voltage test lab, which will be the first of its kind in the United States.

Prysmian Group can already count on a strong presence in the US with 28 production plants, 8 distribution centers and 6 R&D centers employing nearly 6,000 people. Prysmian's US track record includes milestones submarine cable interconnection projects like Neptune, TransBay and Hudson Transmission, as well as the recently awarded SOO Green HVDC link.

In addition to the Vineyard Wind 1 offshore wind farm cabling project already underway, Prysmian's order book includes the €900 million Commonwealth Wind and Park City projects awarded by Vineyard Wind and the €630 million project to link the 2.6 GW Coastal Virginia Offshore Wind (CVOW) wind farm to the mainland grid. Another project under execution is the Empire Wind inter-array cable.



» The Massachusetts plant will produce high-tech submarine inter-array and export cables.
(Image credit: Prysmian)

PLDT FIRES UP US-TRANS-PACIFIC JUPITER CABLE SYSTEM

PLDT Inc. has officially fired up the US-Transpacific Jupiter Cable system, the Philippines' fastest, direct data cable link to the US and Japan.

This latest cable system will immensely boost the country's international data capacity and advance the digital infrastructure needed to further spur the country's economic growth.

Held at the Marriott Hotel in Pasay City, PLDT celebrated the activation of the country's link to the newest international submarine cable with some of the top enterprises from the country's major industries, key officials from the government, and diplomatic partners. "The PLDT Group takes pride in leading our nation's digital advancement, made possible through dynamic synergies with government and private sector partners," PLDT and Smart President and CEO Alfredo S. Panlilio said as he acknowledged event guests.

Among those present were PLDT Chairman Manuel V. Pangilinan, Department of Information and Communications Technology (DICT) Secretary Atty. Ivan John E. Uy, Department of Trade and Industry (DTI) Secretary Alfredo E. Pascual, Japan Ambassador Koshikawa Kazuhiko, US Ambassador MaryKay Loss Carlson, and NTT SVP and Head of Global Business Hideaki Ozaki. Major partners of corporate business unit PLDT Enterprise, its ICT arm ePLDT, and international business unit PLDT Global Corporation were also in attendance.

The 14,000-kilometer Jupiter Cable system is the newest international gateway connecting the Philippines directly from PLDT's cable landing station in Daet, Camarines Norte to Japan and the US West Coast. PLDT's investment in Jupiter responds to the rapidly growing requirements for digital services and next-generation technologies; and supports data-driven industries, particularly those with global operations and high-bandwidth demands such as BPOs, multinationals, and global hyperscalers.

"Our investment in Jupiter will exponentially boost the Philippines' international capacity, ramp up the global trade of digital services, and propel the nation's digital economy, while increasing internet speed and reliability for Filipinos," Panlilio explained.

Already ahead in terms of international capacities among Philippine telcos, Jupiter will triple PLDT's international capacity to about 60 Terabit/s, further cementing its lead in the industry and reinforcing its commitment to driving the country's digital capabilities forward. "PLDT is committed to powering the digital future of the Philippines, and all our efforts align with the larger Mission across our Group: To empower Filipinos everywhere through digital innovations that unlock and share their infinite potential," Panlilio added.

Submarine fiber optic cables are among the most critical components of the internet's infrastructure, serving as the backbone connecting countries, carrying communications, and



» PLDT's launch event in Pasay City welcomed leaders from major industries, key officials from the government, and diplomatic partners. (Photo credit: PLDT)

enabling digital services across the globe. Strengthening undersea cable links, especially those landing in the US and Japan, is crucial as the bulk of internet content and services being accessed by Filipinos—which are mostly offered by global hyperscalers—are from servers in the US, while a material portion of demand for content is served via Japan.

Together with a sound investment environment, robust ICT capabilities, and available local data center infrastructure, the capacity offered by Jupiter is expected to help promote the Philippines to global hyperscalers and position the country as the new digital hub in the Asia-Pacific.

"This milestone immensely strengthens our thrust in helping us position the Philippines as the next hyperscaler hub of Asia-Pacific and enriching the country's Hyperscale Ecosystem," said PLDT and Smart FVP and Head of Enterprise Business Group Jojo G. Gendrano.

"It will also enable us to increase international capacity into our data centers—now a major component of the country's digital ecosystem—and enhance the attractiveness of the country as an investment destination. Our network of VITRO data centers, with our newest to be built in Sta. Rosa, readies the country to service and drive this rising industry," he added.

Currently, PLDT has extensive participation in 16 international submarine cable networks and is set to expand further with the completion of two more major international cable systems, namely Asia Direct Cable (ADC) and the APRICOT cable system, set to be completed in the next two years. It also operates the most expansive fiber optic network among local ISPs at 803,000 kilometers linking all islands in the archipelago with fiber connectivity and powering local economies and communities in the cities and regions.

E-MARINE PJSC COMMISSIONS MAKAILAY ACROSS THEIR INSTALLATION AND REPAIR FLEET

In the last year, Makai Ocean Engineering, Inc. has started commissioning the submarine cable industry's number one cable installation software, MakaiLay, on E-marine PJSC's cable installation and repair vessels. MakaiLay was recently added to the Cable Ship *Maram* and Cable Ship *Umm Al Anber*, and is currently being added to the Cable Ship *Niwa*, with other ships to follow.

"It is a great honor and achievement to get a vote of confidence from an experienced operator like E-marine. With their team coming onboard, MakaiLay is now being used by over 90% of the global fiber-optic cable laying fleet," said Dr. Venkata Jasti, Director of Engineering Software at Makai.

In addition to adding MakaiLay, E-marine PJSC will also be using MakaiPlan Pro for pre-installation planning in their offices. The E-marine team has completed trainings on both software products and plan to conduct more trainings as Makai's software becomes fully adopted and integrated into their workflow.

"We're looking forward to leveraging the advanced modelling and real-time control functionality of MakaiLay to tackle deep-water cable lays and repairs," said Mr. Omar Jassim Bin Kalban, CEO of E-marine PJSC, a leader in submarine cable deployment, maintenance, and repair.

E-marine PJSC plans to use these software products on all future cable installation and repair projects. MakaiLay will allow for more precise control throughout the cable installation, with specific improvements in the deep-water areas.



» Cable Ship *Maram*. (Photo credit: E-marine PJSC)

MakaiLay is an advanced subsea cable installation software that enables users to lay submarine cables with the highest level of accuracy, speed, safety, and reliability possible today, dramatically reducing the risk of cable failures. The software has been rigorously tested and validated and is now used by over 90% of the global fleet of cable ships on countless commercial lays and military installations to successfully install well over 600,000 km of cable worldwide.

MakaiPlan Pro enables powerful and precise 3D dynamic simulations of submarine cable installations. Cable operators can quickly simulate an entire cable lay in advance and in the office at up to 50 times faster than real-time. An entire trans-oceanic lay simulation can be completed in one day. MakaiPlan Pro is an extension of the successful cable route planning software, MakaiPlan and also includes all the planning features of MakaiPlan.

EQUIANO LANDING EXTENDS WIOCC'S OFFERINGS IN SOUTH AFRICA

The arrival in South Africa of Google's state-of-the-art, 144 Tbps, 12 fiber pair Equiano cable will have a direct impact on connectivity throughout the Southern Africa region, resulting in faster internet speeds, reduced internet prices and improved user experience.

WIOCC's commitment to delivering a market-leading portfolio of wholesale services, based on strategic investment in subsea and terrestrial digital infrastructure, has been further demonstrated with the arrival in South Africa, on 8 August 2022, of Google's Equiano cable.

WIOCC is a key partner in Equiano, landing the cable in Lagos, Nigeria, and owning a full fiber pair on the system. Partnering in bringing Equiano to Africa is further reinforcing WIOCC's ability to support its clients in extending their reach and capability across Southern Africa.

WIOCC Group CEO Chris Wood commented: "Having invested multiple billions of Rand to

enhance our 16 Tbps-ready, Optical Transport Network-enabled national hyperscale network infrastructure, we are extremely well positioned to provide businesses with access to fully upgradeable, quickly and easily scalable capacity throughout South Africa and into neighboring countries, over one of the most future-proof networks in the country."

As a fiber pair owner, WIOCC's Equiano capacity is upgradable fully under its own control. WIOCC owns and manages its own Submarine Line Terminating Equipment (SLTE), choosing to light and upgrade its capacity exactly as it wishes to meet the needs and demands of its clients.

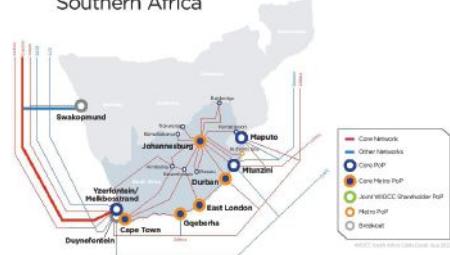
WIOCC's Chris Wood added: "Our investment in Equiano continues our long-standing policy of making strategic investments in subsea cables. We own almost a third of the >10Tbps EASSy system, which extends from South Africa along Africa's eastern coastline

to Djibouti and Port Sudan; we deliver more capacity than any other carrier on the WACS system, which links South Africa to western Europe and lands in many countries along the west coast of Africa; and we are a member of the 2Africa cable, which will bring another high-capacity connectivity option to Africa during 2023/24."

WIOCC

Africa's Digital Backbone

Southern Africa



ITALIAN NAVY & SPARKLE SIGNED MOU FOR CABLE PROTECTION

The Italian Navy and the Italian telecommunications company Sparkle signed a Memorandum of Understanding (MoU) on July 11 to improve the protection of subsea communication infrastructures.

The signatories were the Chief of the Italian Navy, Admiral Enrico Credendino, and Sparkle's CEO Elisabetta Romano at the presence of Sparkle's Chairman Alessandro Pansa.

The MoU formalizes the willingness to cooperate in a strategic sector for the country's socio-economic development and envisages, in particular, the setting up of shared operating procedures and the possibility of undertaking joint reconnaissance and monitoring activities of Sparkle's proprietary submarine cables and neighboring areas. The Italian Navy will also provide cartographic support for the seabed of interest as well as assistance in emergency operational situations.

The agreement will also allow the development of study and research activities deemed to be of common interest between the parties for the pursuit of their respective tasks.

"The Italian Navy is one of the main pillars of national maritime cluster and works daily to defend and support it. We have professional competences and skills to perform submarine operations and today, also thanks to Sparkle, an important process begins that gives the right attention to the underwater dimension of Italy, a maritime country with 8,000 km of coastline, at the center of the Mediterranean Sea," said Admiral Enrico Credendino after the signature of the agreement.

Stressing the importance of this joint protocol, CEO Elisabetta Romano said: "We are proud and honored of this prestigious collaboration with the Italian Navy, which confirms the strategic role of digital infrastructures for the Country's development while recognizing Sparkle's significant contribution."

More than 97% of the bulk of data that makes up the Internet stream, on which our society relies, is transmitted through a dense network of undersea cables. Such critical infrastructures largely rely on the only protection provided by the depth of the sea in which they lie, protection that is now evanescent thanks to technological advances that make the ocean depths increasingly accessible, and at decreasing cost.

To Sparkle, which is among the world's leading players in the strategic submarine cable industry, belong an articulated set of networks and systems that constitute a critical infrastructure to the Country's smooth socio-economic development.



» The signatories were the Chief of the Italian Navy, Admiral Enrico Credendino, and Sparkle's CEO Elisabetta Romano

At the same time, the Navy is the only institutional entity capable of ensuring the monitoring and protection of the underwater dimension where vital interests for the country insist, such as those residing in the so-called communication backbones.

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IXBLUE AND ECA GROUP DEMONSTRATE SUCCESSFUL SUBSEA ASSET TRACKING TO POLISH NAVAL ACADEMY

iXblue and ECA Group recently demonstrated successful subsea asset tracking in shallow waters using iXblue Gaps M7 USBL (Ultra Short BaseLine) positioning system and ECA Group new R7 ROV (Remotely Operated Vehicle).

Hosted by their local partner THESTA, a Polish company providing maritime navigation services and communication systems for the defense sector, the demonstration was organized for the Polish Naval Academy and NAVSUP 2022 attendees with the aim of showing that accurate positioning of underwater targets is possible in a potentially hostile and fast-approaching environment, in coastal regions characterized by shallow waters and often limited access.

As part of the mission scenario, ECA Group's R7 ROV investigated objects and structures submerged in the shallow waters of the Baltic Sea in Gdynia harbor. iXblue Gaps M7 USBL acoustic positioning system was deployed to geolocate the R7 ROV and correct its trajectory in real time. A fixed transponder was also placed several hundreds of meters away from the vessel, at only 5 meters deep. The trials were carried out in water depths of 7 to



» The R7 ROV and Gaps M7 ready for deployment (top) and in action (bottom). (Photo credit: iXblue/ECA)

10 meters, surrounded by many docks and vessels causing significant acoustic echoes.

Despite challenging acoustic conditions, the positioning of the ROV and the transponder was stable and accurate. Extremely efficient in shallow waters, Gaps M7 ensured excellent horizontal tracking capabilities with omnidirectional coverage and 200° acoustic aperture. With no calibration required, it was easy to deploy and ready to use, saving precious operational time on the field.

The ROV inspection was successful despite the low visibility. Such environments make the use of traditional cameras impossible, but the HD acoustic inspection camera performed remarkably, providing high-resolution data with superior localization accuracy. The R7 combines the compactness and maneuverability of mini-ROVs with the performance and power of professional observation-class ROVs. It embeds a wide range of fast-equipped payloads and operates well under harsh sea conditions, making it the perfect ally of Navies for quick and efficient subsea interventions.

GENERAL DYNAMICS MISSION SYSTEMS AWARDED \$272.9 MILLION US NAVY CONTRACT

General Dynamics Mission Systems, a business unit of General Dynamics, has been awarded a U.S. Navy contract to support development, production and installation of fire control systems for the Columbia- and Dreadnought-classes of ballistic missile submarines.

The contract as awarded has a value of \$272.9 million over the next six years. This contract is the second for General Dynamics Mission Systems and

is comprised of development, production and installation support for U.S. and U.K. submarine strategic weapons systems and subsystems. It will also support strategic weapons systems upgrades on currently fielded U.S. and U.K. strategic ballistic missile submarines. Work will primarily be performed in Pittsfield, Massachusetts, and is expected to be complete by July 2028.

General Dynamics Mission Systems' Maritime and Strategic

Systems line of business will deliver the fire control system for the U.S. Navy's second and third Columbia-class submarine and the third U.K. Dreadnought class submarine as well as installation support and pre-deployment planning for both U.S. and U.K. sites. This contract also includes Columbia and Dreadnought design completion scope and continuation of design activities for the first planned refresh of the Columbia and Dreadnought fire control system.

"The U.S. Columbia and U.K. Dreadnought class submarines are of strategic importance to our nation and our allies. General Dynamics has been supporting previous submarine programs for more than 65 years and we are extending our support through the development, production and installation of mission critical systems for this new fleet of submarines," said Carlo Zaffanella, vice president and general manager at General Dynamics Mission Systems.



» Nauticus Robotics' Hydronaut vessels will be equipped with the Smartgyro SG80 unit. (Photo credit: Diverse Marine)

GOLDEN ARROW MARINE SUPPLIES SMARTGYRO STABILIZATION FOR DIVERSE MARINE'S HYDRONAUT VESSELS

Golden Arrow Marine is supplying advanced Smartgyro SG80 gyroscopic stabilization units to Cowes boatbuilder Diverse Marine for installation on its new 18-meter Hydronaut vessels for Houston-based Nauticus Robotics.

The modular Smartgyro stabilizers were selected due to the ease of installation and onboard maintenance and will be fitted on the first Hydronauts of a 20-strong robotic navy fleet to maximize comfort and roll reduction during manned and unmanned operations.

The Smartgyro SG80 gyros feature a cutting-edge design, creating the industry's first gyro units that can be serviced, maintained and assembled directly inside the boat. Suitable for both new builds and refit installations, all SG series models offer superior stabilization due to breakthrough technology within the control electronics, braking system, liquid cooling system and vacuum enclosure.

Smartgyro's UK Master Dealer Golden Arrow Marine has partnered with Nauticus Robotics, a developer of offshore subsea and surface robots and autonomy software, to construct the initial production run of the Hydronaut for its Nauticus Fleet. Production and delivery of

the first two vessels is scheduled for Q1 2023, with the remainder being fulfilled by the end of 2024.

An autonomous UAV deployment daughter craft, Hydronaut's primary objective is to support the launch, recovery and real-time operations of Aquanaut, its undersea robotic counterpart. Hydronaut ferries Aquanaut to and from the worksite and supports battery recharges as well as the communications link from the local remote operations center for supervised autonomous operations. Nauticus' Houston-based global remote operations center provides additional technical and operational support.

Initially manned, so built to class with flag and MLC compliance, the vessel is fitted with gyro-stabilization and ride control to maximize the operational envelope of the craft. Comprehensive navigation and communications manage the transfer of control and information for both Hydronaut and Aquanaut.

Simon Leppard, Business Development Manager, Golden Arrow Marine said: "We are delighted to work with Diverse Marine on such an exciting project. Effective stabilization

is essential for the Hydronaut vessels for comfort and roll reduction. As well as advanced technology, superior performance and efficiency, the Smartgyro solution offers significant additional benefits because of the ease of installation and onboard maintenance, so there is no need to remove the gyro and downtime is reduced."



» The Smartgyro SG80 gyro stabilizer. (Photo credit: Smartgyro)

GREENSEA SYSTEMS AWARDED CONTRACT FROM U.S. NAVY'S OFFICE OF NAVAL RESEARCH

Greensea Systems Inc. has been awarded a contract for a 2-year Phase II Option Period by the U.S. Navy's Office of Naval Research to continue the technology development for an Autonomous Hull Cleaning Vehicle. This is a continuation of the work that Greensea has been conducting through a Small Business Technology Transfer (STTR) program since 2018.

"The objective of this STTR is to develop a highly autonomous robotic system for proactively cleaning ship hulls, that can be operated easily and cost effectively with minimal supervision. The Navy is interested in this technology as a means to keep ships clear of biofouling in an environmentally sustainable way, ensuring fleet readiness and ultimately reducing hull related maintenance costs," said Karl Lander, Armach Robotics' Director of Regulatory Compliance and Outreach.

"The focus of the earlier Phase I and II efforts were to design, characterize, develop and test a navigation system

that can provide the required accurate on-hull navigation. The focus of the newly awarded option period is to continue to refine the navigation and autonomy technology, demonstrate the capabilities through proactive cleaning of a vessel of significance to the U.S. Navy, and deliver a complete data package for the cleaning system."

A final requirement of any STTR program is to demonstrate the commercial viability of the technology, in addition to demonstrating its value to the U.S. Navy. To achieve this, Greensea has developed a novel, hull-relative positioning system for use in a hull crawling robot designed and built by Armach Robotics. Using a combination of inertial and feature based sonar navigation, the Armach hull cleaning robot will be capable of determining and continually updating its position on the ship's hull with extreme accuracy, allowing Greensea's autonomy capabilities to free the operator from driving the robot.



» The hull crawling robots uses a combination of inertial and feature based sonar navigation to groom a ship's hull with extreme accuracy. (Photo credit: Greensea)

To achieve the goals of Phase II, Greensea has partnered with Maryland's Maritime Environmental Resource Center (MERC) and Armach Robotics. MERC brings significant expertise in biofouling control methods and will provide critical support in assessing the efficiency and efficacy of the robots' navigation, autonomy and cleaning technologies.

STEADICOPTER WINS TENDER WITH BLACK EAGLE ELECTRIC SYSTEMS FOR ISRAELI NAVY

Steadicopter, a leader in the Rotary Unmanned Aerial Systems (RUAS) industry, has announced another win in a significant tender, this time for the Israeli Navy, for its Black Eagle Electric systems. The Black Eagle Electric family is the first family of unmanned helicopters that are powered by an electric motor, are capable of carrying several payloads and sensors, and can be adapted to diverse applications, including complex maritime missions.

The Black Eagle 50 Electric helicopter has a maximum take-off weight of 50 kg, a useful load weight of 30 kg—including payload



» The Black Eagle 50 Electric helicopter. (Photo credit: Steadicopter)

and batteries, and a flight time of two hours. These capabilities enable high performance as well as maximum operational flexibility for military applications such as intelligence, coastal security, search & rescue, and advanced maritime missions.

The electrically-powered engine significantly reduces the weight of the platform, thereby enabling the installation of additional payloads that are required for a variety of missions. Weighing just 20 kg as a platform, the helicopter can carry additional batteries for longer flights, heavier mission payloads, and more. As such, the system enables the widest variety of missions, including covert operations.

The dual-electric propulsion helicopter is economical, simple to operate, easy to maintain, and needs no fuel storage, making it environmentally friendly and safe. It is based on the proven capabilities of the gasoline-powered Black Eagle, including vertical take-off and land, long hover durations, and advanced mission sensors for any mission scenario, whether day or night. In addition, like other Steadicopter platforms, it is adapted to high-altitude flights.

HII MARKS MILESTONE IN VIRGINIA-CLASS SUBMARINE MASSACHUSETTS (SSN 798) CONSTRUCTION

All-domain defense and technologies partner HII (NYSE: HII) shared that its Newport News Shipbuilding division has achieved a significant milestone in construction of *Virginia*-class submarine *Massachusetts* (SSN 798).

Shipbuilders working on *Massachusetts* recently reached pressure hull complete, meaning that all of the hull sections were joined to form a single, watertight unit. This is the last major construction milestone before the submarine is launched.

"Our highly skilled shipbuilders are driven to serve the nation by delivering great submarines that help ensure America's undersea superiority," said Jason Ward, Newport News Shipbuilding vice president of *Virginia*-class submarine construction. "Reaching this point in construction demonstrates our commitment to getting *Massachusetts* ready as soon as possible to become part of the U.S. Navy fleet."

Newport News Shipbuilding is one of only two shipyards capable of designing and building nuclear-powered submarines. The advanced

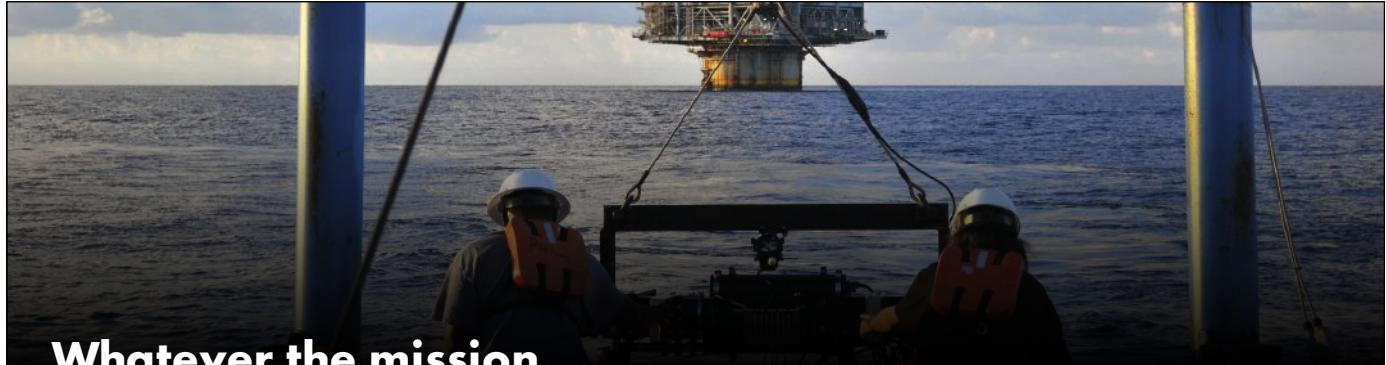


» *Massachusetts'* pressure hull is now one watertight unit.
(Photo credit: HII)

capabilities of *Virginia*-class submarines increase firepower, maneuverability and stealth.

This milestone on *Massachusetts* comes following the delivery of USS *Montana* (SSN 794) and launch of *New Jersey* (SSN 796) at Newport News Shipbuilding earlier in 2022, as the shipyard continues to invest in its workforce and facilities to make steady progress on delivering these important assets to the Navy.

Massachusetts is the 25th *Virginia*-class fast attack submarine.



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AMERICAS

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

Wind Power Finance & Investment Summit
New York, NY » October 4-5
<https://www.windfinanceusa.com/>

IWCS Cable & Connectivity Forum
Providence, RI » October 10-13
<https://iwcs.org/>

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

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

Offshore Wind Executive Summit
Galveston, TX » November 8
<https://www.offshorewindsummit.com/>

Floating Wind USA
San Francisco, CA » November 8-9
<https://events.reutersevents.com/renewable-energy/floating-wind-usa>

TMA BlueTech Week
San Diego, CA » November 14-18
<https://www.tmablueotech.org/bluetech-week>

SPE Brazil Subsea Symposium
Rio De Janeiro, Brazil » November 29-30
<https://subsea-symposium.spebrasil.org/>

EUROPE

Floating Offshore Wind
Aberdeen, UK » October 12-13
<https://events.renewableuk.com/fow22-overview>

RenewableUK Cables
Aberdeen, UK » October 12-13
<https://events.renewableuk.com/cables22-overview>

ICOE - OEE
Basque Country, Spain
» October 18-20
<https://icoeoe2022donostia.org>

Deep Sea Minerals
Bergen, Norway » October 26-27
<https://events.geonova.no/event/deepseaminerals/>

Offshore & Floating Wind Europe
London, UK » November 2-3
events.reutersevents.com/renewable-energy/offshore-floating-wind-europe

Int'l Wind Congress
Berlin, Germany » November 7-8
<https://windcongress.com/>

Offshore Energy
Amsterdam, The Netherlands
» November 29-30
<https://www.offshore-energy.biz/offshore-energy-2022/>

Wind Power Finance & Investment Summit EU
London, UK » December 6-7
<https://windfinancesummit.com/>

OTHER REGIONS

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

Asia-Pacific Decommissioning & Abandonment
Kuala Lumpur, Malaysia » October 4-5
<https://offsnet.com/da-apac>

Mediterranean Offshore Conference
Alexandria, Egypt » October 18-20
www.moc-egypt.com

ADIPEC
Abu Dhabi
» October 31 - November 3
<https://www.adipec.com/>

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

Asia-Pacific Deep Sea Mining Summit
Singapore » December 12-13
<https://www.asia.deepsea-mining-summit.com/>

IEEE Underwater Technology
Tokyo, Japan » March 6-9, 2023
https://conferences.ieee.org/conferences_events/conferences/conferencedetails/49729

SubOptic
Bangkok, Thailand » March 13-16, 2023
<https://www.terrapinn.com/exhibition/suboptic/>

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	CONTENT FOCUS & PRODUCT/SERVICE
JANUARY Editorial: Dec. 17 Ad: Jan. 13	» Uncrewed Surface Vehicles Floating Wind Solutions / March 1-3 Oceanology International / March 15-17	Content Focus: Remote Marine Operations, Force Multiplication, Ocean Research, Search & Rescue, Tooling Product/Service: A/USV manufacturers, multibeam echosounders, side scan sonars, control systems, thrusters, positioning systems, thermal cameras, communication systems
FEBRUARY Editorial: Jan. 24 Ad: Feb. 10	» Naval Defense & Security UDT / June 7-9	Content Focus: Intelligence, Surveillance & Reconnaissance (ISR), Mine Countermeasures (MCM), Harbor Security, Anti-Submarine Warfare (ASW) Product/Service: AUVs, USVs, marine robotics, search and rescue technologies, underwater tracking & communications
MARCH Editorial: Feb. 21 Ad: Mar. 10	» 21st Century Marine Survey AUVSI XPONENTIAL / April 25-28 IPF / April 26-28 OMAE / June 5-10 ☐ H2O Conference / June 14-16	Content Focus: Hydrographic Survey, Sensor Innovation, Research Vessels Product/Service: Sensor manufacturers, UAVs, multibeam echosounders, sonars, software & analytics, deck handling equipment, survey companies, research vessels
APRIL Editorial: Mar. 21 Ad: Apr. 07	» Green Energy US Offshore Wind / July 18-19 OTC / May 2-5	Content Focus: Renewable Offshore Energy (Wind, Solar, Tidal & Wave), Green Hydrogen, Power Storage Supply Chain Product/Service: Offshore wind supply chain, alternative offshore energy technologies, subsea batteries, hydrogen powered vessels
MAY Editorial: Apr. 18 Ad: May 05	» Subsea IMR Technology Canadian Hydrographic Conference / June 6-9 Seanergy / June 15-17	Content Focus: Shore-based Command Systems, Subsea Residency, Digital Twins Product/Service: AUVs, ROVs, robotic tooling, buoyancy materials, cameras & lighting, pressure sensors, propellers, tethers, simulation software
JUNE Editorial: June 06 Ad: June 23	» Oceanography Dredging Summit & Expo / July 25-28 Offshore Northern Seas / August 29-September 1	Content Focus: Data Collection, Transmission & Communication, Data Analytics & Software Platforms Product/Service: Buoys, drifters, acoustic modems, releases & transponders, magnetometers, subsea cables, connectors, weather stations
JULY Spotlights: June 14 Ad: July 11	» Uncrewed Vehicles Buyers' Guide ☐	Content Focus: Special Edition
AUGUST Editorial: July 25 Ad: Aug. 11	» Submersibles & The Deep Sea OCEANS / October 17-21	Content Focus: Deep-sea Exploration, Seafloor Archaeology, Deep-sea Science, Ocean Mining Product/Service: Crewed submersibles, support vessels, mining machines, geo-technical technologies
SEPTEMBER Editorial: Aug. 22 Ad: Sep. 08	» Artificial Intelligence & Remote Marine Operations Offshore Energy / November 29-30 ACP WINDPOWER / October 18-19 ICOE/OEE / October 18-20	Content Focus: Swarm Technology, Control Systems, Automation, Ocean Health, Maritime Efficiency Product/Service: Uncrewed vehicles, simulation & modelling platforms, cloud-based data analytics
OCTOBER Editorial: Sep. 19 Ad: Oct. 06	» Offshore Energy Offshore & Floating Wind Europe / November 2-3 Int'l Wind Congress / November 7-8 ☐ Floating Wind USA / November 8-9 ☐ TMA BlueTech Week / November 14-18	Content Focus: Sector Diversification, Seabed IMR, Sensor Innovation, HSSE, Decommissioning, Oil Spill Response, Renewables Product/Service: Marine survey, oil spill response, renewable energy technologies, geotechnical services
NOVEMBER Editorial: Oct. 17 Ad: Nov. 03	» Underwater Imaging	Content Focus: Bathymetric Mapping, IMR, Habitat Characterization, Acoustic Sensing Product/Service: Observation ROVs, AUVs, cameras, lights, diving innovation, tracking & positioning systems, optical and acoustic sensors
DECEMBER Editorial: Nov. 14 Ad: Nov. 18	» The Future of Ocean Technology Oceanology Int'l Americas / Feb 14-16 Floating Wind Solutions / Jan 30 - Feb 1	Content Focus: Special Edition

MOTIVE OFFSHORE ACCELERATES RENEWABLE GROWTH WITH MULTIMILLION INVESTMENT

Motive Offshore Group has secured a significant multimillion pound investment from H2 Equity Partners (H2). The deal will support the international growth plans and ambitions of Motive, generating 75% of revenue from renewables by 2025.

The announcement follows a successful period of growth where the company has more than doubled its business within a three-year period, including already reaching close to 60% of sales in the renewable market, which is significantly ahead of its original five-year strategy plan. Within this timeframe, Motive has also made substantial acquisitions, growing its team to two hundred people and increasing turnover by more than £10 million between 2020-2021. H2's international operating experience, collaborative approach and strong track record in supporting ambitious, founder-owned businesses, will

enable Motive to accomplish its next stage of sustainable and rapid growth, where it will continue to accelerate its energy transition.

With a key plan to continue with international growth and diversification, Motive will implement its strategy of applying offshore resources, cross-sector collaboration and innovation to the energy sector, with ambitions to extend its renewables market share. The company will continue to target new strategic locations, with global expansion in its workforce and projects, in response to market demand. Following previous success, Motive will continue to increase its inspection service offering and diverse rental fleet, whilst also advancing its equipment through digitalization upgrades.

Dave Acton, CEO of Motive Offshore, said: "We've grown our business extensively over the last three years and this



» Motive CEO Dave Acton

trajectory is only accelerating, so collaborating with the right partner to meet this incline is paramount to our success. We're delighted to add further investment to both our people and products with the support of H2 Equity Partners, continuing to provide opportunities for our dedicated teams and innovative solutions

for our customers. Part of this will include increasing our renewable portfolio with multi-sector solutions and Taiwan renewable hub. Today we currently support over 23 global wind projects and excitingly, that number is increasing rapidly."

BLUEPRINT LAB CHANGES NAME TO REACH ROBOTICS



Blueprint Lab Pty Ltd will have changed its corporate name to Reach Robotics Pty Ltd. The name change has been spurred by a recognized need to communicate the company's offering more adequately to clients, stakeholders, and the market in general.

"The name Reach Robotics provides greater clarity to the market about the company's core technologies and better captures our

team's vision," said Anders Ridley-Smith, Commercial Director. "We have secured commercial trademark rights to the 'Reach Robotics' name and are excited to operate on this basis in our key markets."

The change is in name only and there is no change to the underlying team or the company's vision and mission. "We have grown a lot in the five years since the company was founded and, whilst we have a subsea pedigree, we are moving rapidly into harsh environments in all domains. Now is the right time to align our name with the full scope of what we do," said Paul Phillips, Managing Director. "We have the same vision—to extend human reach into harsh environments—but an expanded strategy, including intervention solutions

designed for land and space domains and increasing global market penetration."

Blueprint Lab was established in late 2016 with the aim of revolutionizing robotics for harsh environments, removing people from harm and increasing the productivity of remote systems. Since then, the company has grown considerably to 40+ staff, a global sales and support footprint, and a strong research and development capability.

Blueprint Lab has its headquarters and manufacturing facility in Sydney, Australia. The company creates advanced robotic arm solutions for harsh environments which enable complex inspection and intervention in maritime infrastructure management, military and police operations, marine science, autonomous robotics research applications, and more.

AQUEOS CORPORATION ACQUIRED BY MICHELS HOLDINGS, INC.

Aqueos Corporation (Aqueos), an international subsea and transitional energy service provider, has been acquired by Michels Holdings, Inc. The Michels family of companies is a US-based diversified global leader in energy and infrastructure construction. Aqueos will continue to operate as a separate and independent company. Ted Roche, the current Aqueos CEO & President, and all Officers of the company will remain in their roles.

The move strengthens Aqueos' presence in the offshore energy, civil and renewable sectors. In addition, it provides the company with the necessary scale and balance sheet to accelerate its growth plan to become one of the leading offshore and marine construction companies. Our goal is to become a "one-stop-shop" to many of our clients, where there is a combination of offshore and onshore scope. Together, Michels and Aqueos form an extraordinary team of professionals with a broad range of specialty equipment that can self-perform complex engineered solutions for various offshore and inland marine-related projects.

"With a goal to create a strategic partnership focused on excellence, service, and professionalism, it quickly became clear that Michels shares the same vision we have, from the strength of management to the diversity of service offerings, and from the family-oriented environment to the focus on customer service, our cultures are very much aligned," said Ted Roche, Aqueos President & CEO.

"Michels' scale, scope, and significant service offerings give Aqueos the tools we need to accelerate our growth strategy and expand into new markets. Most importantly, our stakeholders will benefit from this transaction, including shareholders, employees, suppliers, and especially, our customers. Aqueos looks forward to the opportunity to continue to bring exceptional service, on a larger scale, as part of the Michels family of companies."

The Michels Family of Companies, founded in 1959, has over 8,000 staff worldwide, operating almost 17,000 heavy equipment assets. The family-owned and operated organization has an extensive history of providing construction infrastructure services. It has a solid on-shore marine construction capability and sees Aqueos as the ideal support partner to help deliver a wider array of marine-related construction services to its customers.

Speaking on behalf of the Michels Family of Companies, Pat Michels said: "We see Aqueos as a solid fit for our Group. There are several synergies already. Plus, Aqueos brings the expertise we can leverage as we continue to expand our service offering further offshore to meet the demands of our existing and new clients."

The logo for ICOE (International Conference on Ocean Energy) features a stylized blue wave icon to the left of the acronym "ICOE" in a bold, blue, sans-serif font. Below the acronym, the full name "INTERNATIONAL CONFERENCE ON OCEAN ENERGY" is written in a smaller, all-caps, sans-serif font.
The logo for Ocean Energy Europe features the words "OCEAN ENERGY EUROPE" in a bold, blue, sans-serif font. To the right of the text is a circular emblem containing a stylized blue wave and a green sun-like symbol.
The logo for Energiaren Euskal Erakundea (Ente Vasco de la Energía) is a green square. It contains the text "Platinum Sponsor" at the top, "40" in large green digits in the center, and "1982 - 2022" below it. To the right of the "40" is the text "ENERGIAREN EUSKAL ERAKUNDEA" and "ENTE VASCO DE LA ENERGÍA" in smaller green text, accompanied by a green stylized 'E' logo.
The text "Donostia / San Sebastián 2022" is displayed in a large, light blue, sans-serif font. The background of the entire advertisement features a photograph of a surfer riding a large, greenish-blue wave in the ocean, with a city skyline and a prominent green hill in the background.
The text "CONFERENCE & EXHIBITION" is in a blue, sans-serif font at the bottom left.
The text "BASQUE COUNTRY, SPAIN 18 - 20 OCTOBER" is in a blue, sans-serif font at the bottom left.
A white button with the text "REGISTER NOW" in a bold, black, sans-serif font, enclosed in a rounded rectangle.
A standard black and white QR code located in the bottom right corner of the advertisement.



» Left to right: Angus MacDonald (Operations Manager), Jonny Moroney (Operations Director), Paul Slorach (Business Development Director)

VERLUME SCALES UP MANUFACTURING CAPACITY WITH NEW OPERATIONS FACILITY

Verlume, a specialist in intelligent energy management and energy storage, has moved to a larger operations facility as it prepares to fulfill ambitious growth plans.

Located in the former Weatherford building within the Raiths Industrial Estate in Dyce, Aberdeen, the 20,000 square foot facility boasts a generous workshop floor, craneage, office space and laboratory areas.

The Dyce facility, which is six times the size of Verlume's previous operational base, will accommodate manufacturing operations for the company's range of intelligent energy management and storage technologies, including project assemblies for the award-winning flagship Halo modular battery energy storage system. On-site laboratories will be used for industry-leading product and software development.

Verlume's main office will remain at Davidson House in Aberdeen Innovation Park.

Jonny Moroney, operations director at Verlume said: "We are very excited to be scaling up our operations with this new facility move. Having been in our Bridge of Don workshop since 2017, this new operational base in Dyce will allow us to deliver on the increasing demand for our range of products. I am looking forward to building up the facility, as well as the team which will support it."

Paul Slorach, business development director at Verlume added: "As the energy market continues to look for technology solutions to reduce carbon footprint and decarbonize operations, we are experiencing significant interest in our solutions. Our new facility will be crucial to delivering these solutions at scale."

ONE YEAR AT SEA: ADVANCING OCEAN DATA COLLECTION IN THE ATLANTIC

Saildrone (SD)1079 has just completed a first-of-its-kind mission to remote areas of the equatorial Tropical Atlantic. Sailing 11,910 nautical miles (13,796 miles or 22,057 km) and spending 370 days at sea, SD 1079 mission was to collect CO₂ data to improve global carbon projections and help enable sustainable ocean resource management.

SD 1079's voyage set a new Saildrone record for autonomous, uncrewed endurance, beating our previous record holder, SD 1020, by 31 nm. SD 1020 circumnavigated Antarctica in 2019, covering 11,879 Nautical miles during that voyage.

"This has been a phenomenal mission," said Richard Jenkins, Saildrone founder and CEO. "Not just by the range and endurance of SD 1079, but by the ability to take these crucial measurements in very remote parts of our oceans. Areas that are very hard to reach with traditional technologies like research ships."



» SD 1079 pictured behind SD 1078.
(Photo credit: Saildrone)

DEEPSSEA TECHNOLOGIES ACQUIRES AF GLOBAL UK TO EXPAND GLOBAL SYNERGIES

Deepsea Technologies, Inc. (DTI) recently announced the 100% acquisition of AF Global UK Ltd. (AFGUK), the subsea division of AFG Holdings Corporation. The company will now operate under the name Deepsea Technologies UK Ltd. Combining AGUK's full product range with DTI's products, and leveraging their strong position in the Eastern Hemisphere, marks significant growth for Deepsea Technologies Inc.

AF Global UK specializes in subsea connection systems and has delivered over 1,700 systems, serving all key subsea regions globally.

DTI will integrate their existing technologies and well-established products to create a solutions based subsea hardware organization expanding its global presence.

Adding UK operations to their existing structure in the US, Brazil, and India enables DTI to expand their global business whilst continuing to provide support to its customers locally.

BRITISH STANDARDS INSTITUTE (BSI) AWARDS BLUEFIELD GEOSERVICES ISO CERTIFICATION



In May 2022, Bluefield Geoservices (Bluefield), an international marine geotechnical services provider, was awarded International Organization for Standardization (ISO) certifications by the British Standards Institute (BSI), including ISO 45001:2018 (health and safety management) and ISO 9001:2015 (quality management). By demonstrating its implementation of the stringent criteria incorporated within these standards, Bluefield proves its

commitment to the Company's workforce and clients, ensuring best in class service delivery globally.

Jim Edmunds, Managing Director stated: "By achieving ISO 9001:2015 and ISO 45001:2018 certifications, Bluefield has demonstrated that it will work tirelessly to achieve the health, safety, and quality standards that its clients, workforce, and stakeholders deserve. With these certifications, our technology, people,

and process have been vetted against the industry's most stringent standards."

The world's most recognized organization for standardization, ISO ensures that businesses conform to industry standards and best in class business management practices to enable consistent provision of products and services that meet customer applicable statutory and regulatory requirements. Obtained through extensive and annual independent BSI specified assessments, world class ISO certification demonstrates that a company applies the very best practices when performing its duties to its customers and employees.



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👤 Dan Cote, Sales Manager

DeepWater Buoyancy Inc. is the world's largest producer of subsea buoyancy products for the oceanographic community and has a vast product line of buoyancy solutions for offshore oil & gas, energy and technology companies. This product portfolio has been built over the course of 40 years serving these industries. Though products are offered for shallow water applications, the company specializes in deepwater, providing solutions to depths of 6000 meters and beyond.



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Imagenex Technology Corp. is an innovative company that was founded in 1988 by pioneers in the development of high resolution sonar. With thousands of systems in use on imaging and profiling projects all over the world, Imagenex has developed a reputation for products that break new ground for depth capability, size, cost, imaging quality and functionality. Each system in this growing product line integrates the latest in sub-miniature electronics into industry proven, robust underwater housings for a total package that is small, rugged, and will provide years of maintenance-free use. Products include multibeam, mechanical scanning, and sidescan sonars.



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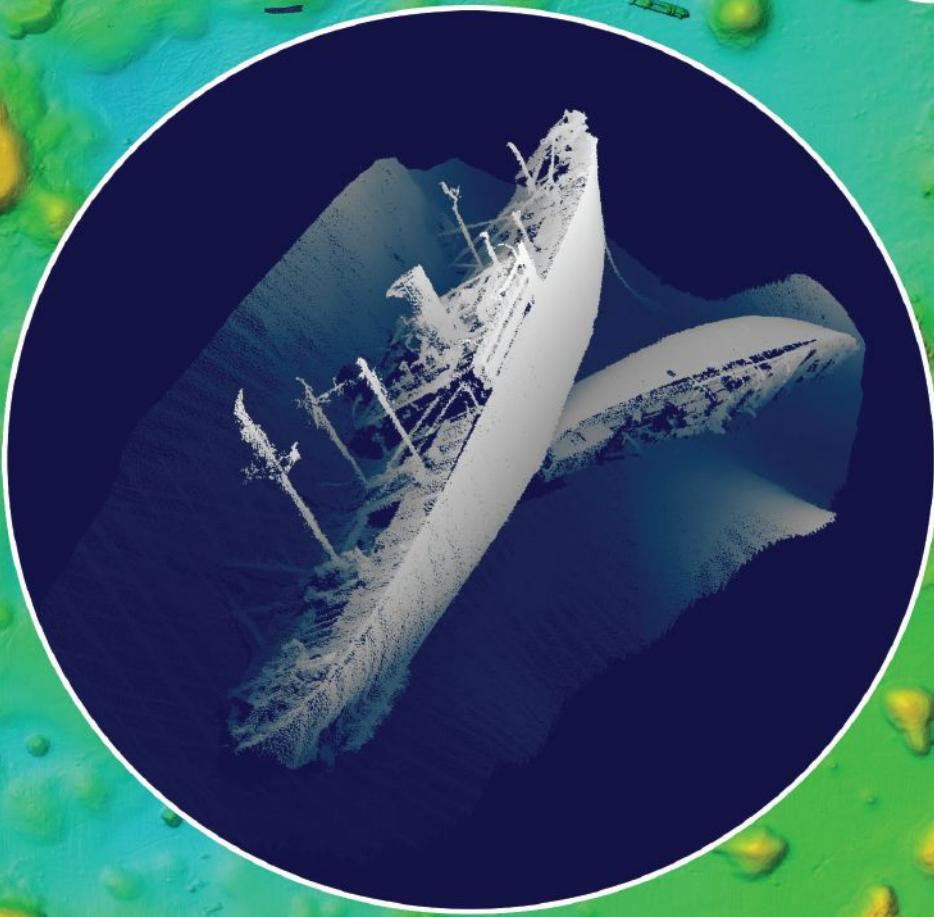
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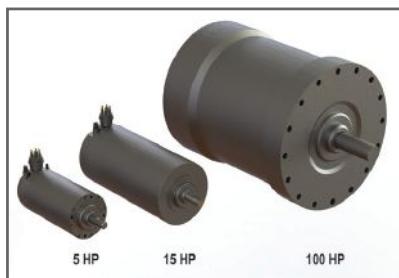
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