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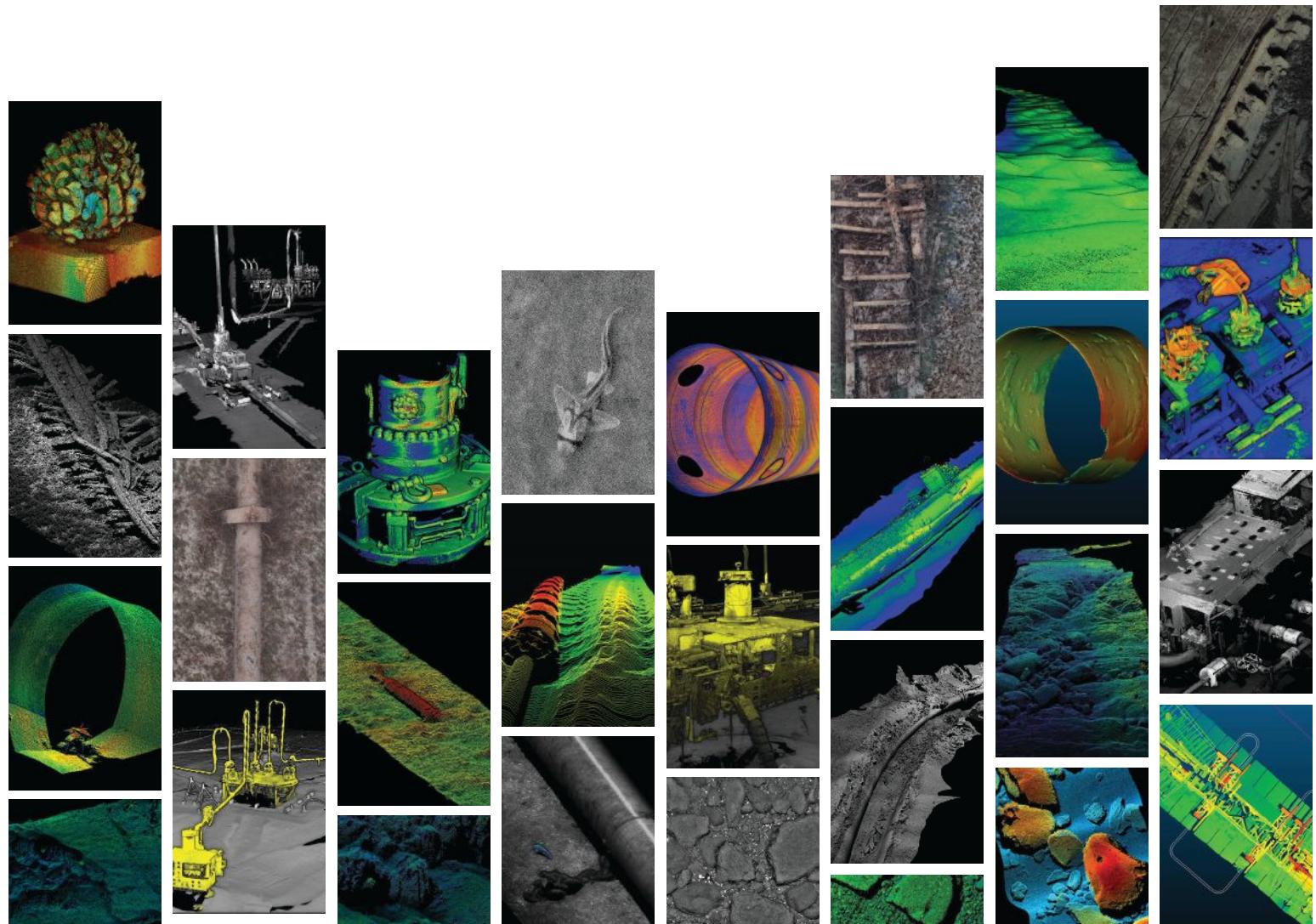
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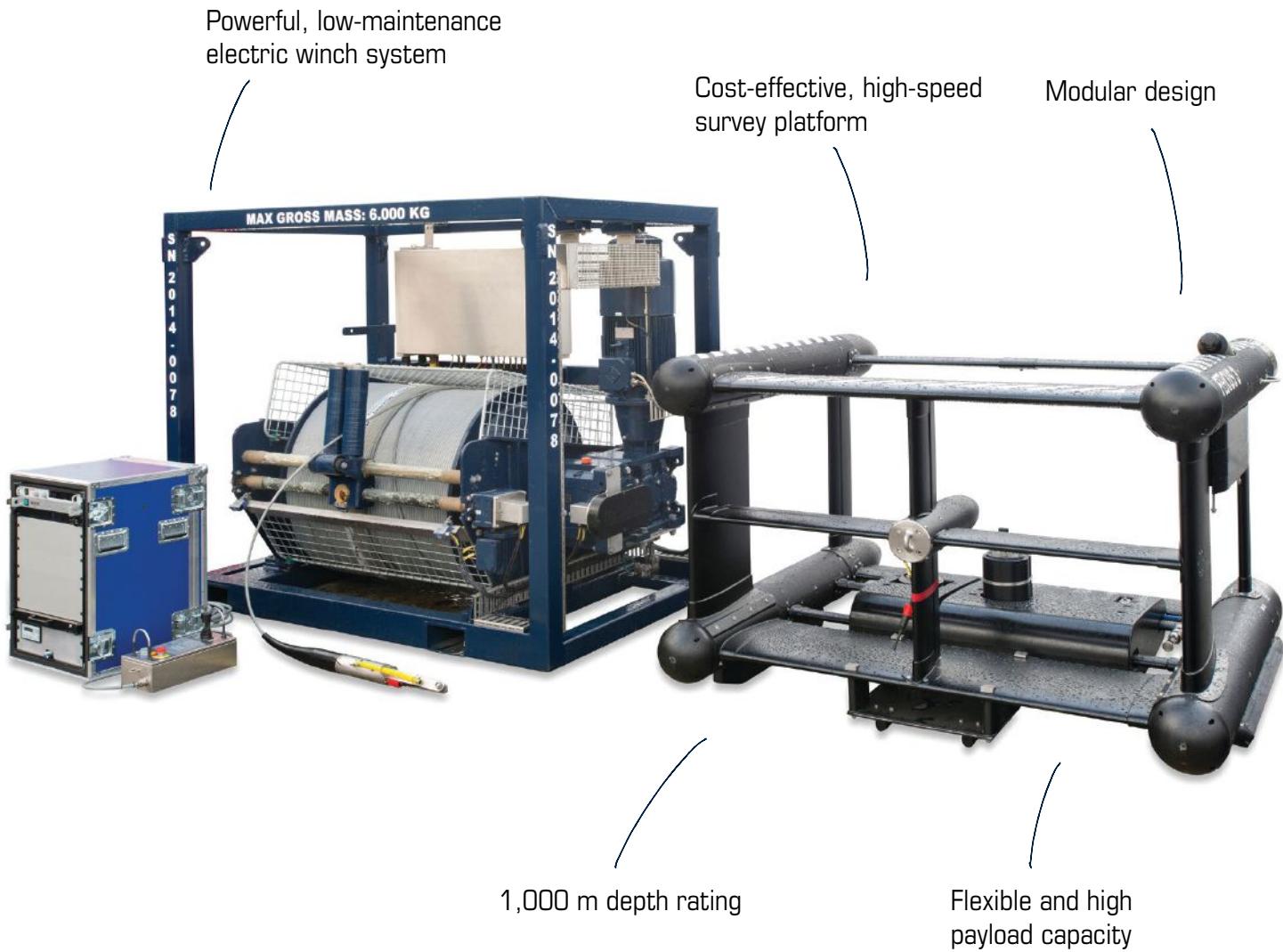
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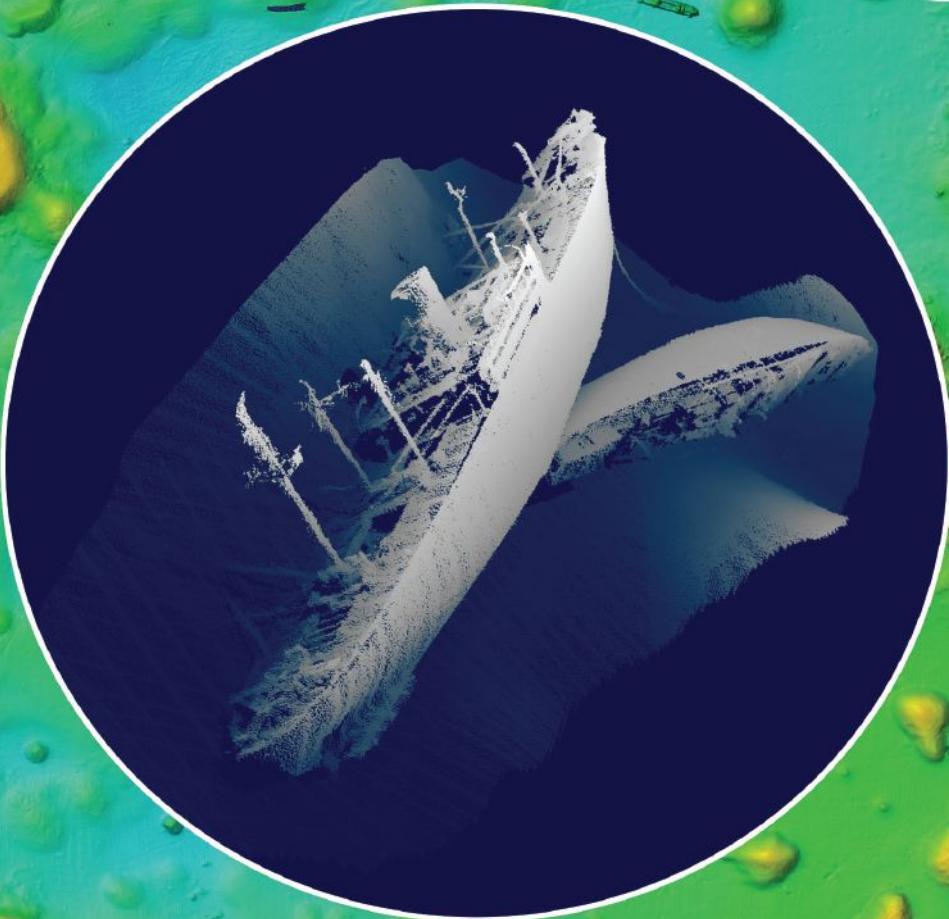
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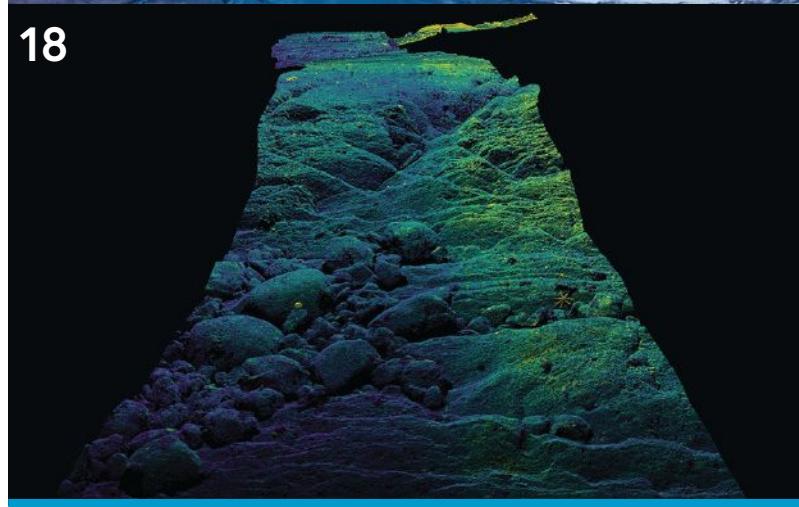
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ON THE COVER:
The limited edition Project Neptune submersible, a collaboration between Aston Martin and Triton Submarines, can transport three people to depths of 1,650 m in unprecedented subsea luxury. (Image credit: Triton Submarines)

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[WITH THANKS - Ed.]

August's ON&T explores the full spectrum of Deep-Sea Exploration, from the mesopelagic mystery of the Ocean Twilight Zone to the deepest, darkest chasms of the Mariana Trench.

Our journey of discovery is only made possible thanks to the extraordinary technologies—crewed and uncrewed—featured in these pages, so our thanks go to Triton Submarines, Voyis Imaging, RTsys, Cathx Ocean, NOAA, and WHOI for their expert editorial contributions.

Special thanks also to DeepSea Power & Light, sponsors of the latest episode of SeaState—in this month's podcast we talk "NASA and Ocean Exploration" with American physician and former NASA astronaut Scott Parazynski.
editor@oceannews.com

Ed Freeman

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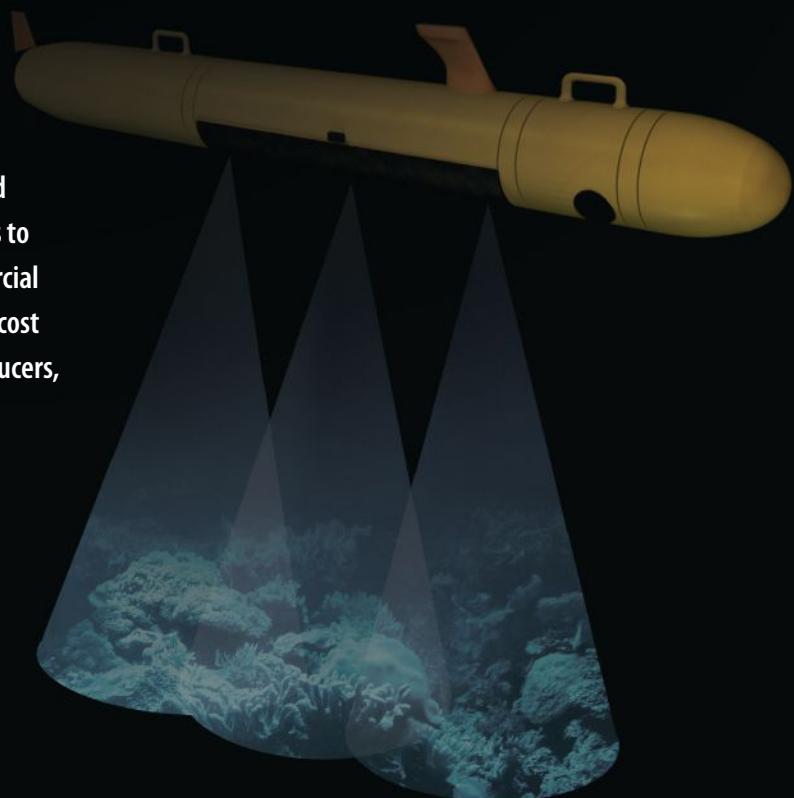
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PATRICK C. LAGRANGE, CEO**ADVERTISING SALES**

LISA CHILIK

Tel: 574-261-4215

lchilik@tscpublishing.com

MIMI KING

Tel: +44 (0) 777 6017 564

mkking@tscpublishing.com

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A VIEW FROM THE FRONTIER OF DEEP-SEA EXPLORATION

BY GENENE FISHER

Acting Director, NOAA Ocean Exploration

Technology is a cornerstone of deep-sea exploration. Whether exploring from shore, at sea, or undersea, we rely on ever advancing technologies to enable access to the deep ocean and map, measure, image, sample, communicate, navigate, analyze, and educate.

The ocean provides numerous essential services to humankind. Yet, there's much about our ocean, particularly the deep ocean (>200 meters), that we don't know.

Our Past and Present

As the only U.S. federal program dedicated to exploring the deep ocean, NOAA Ocean Exploration plays an important role in filling deep-sea knowledge gaps, but we aren't alone. With partners from multiple sectors, domestic and foreign, we collect and deliver deep-sea data necessary for effective management, conservation, and use of ocean resources.

In 2021, NOAA Ocean Exploration is celebrating 20 years of exploring the deep sea. By using existing technologies in innovative ways and integrating new technologies into operations such as those on NOAA Ship *Okeanos Explorer*, we've changed how we explore and made significant contributions to ocean exploration.

With partners, we pioneered telepresence-enabled ocean exploration and advanced remotely operated vehicle operations using one of the few systems in the world that provides access to the deep sea. Together, these technologies enable shore-based scientists, students, and anyone with an internet connection to experience the excitement of discovery in real time.

Through dedicated technology demonstrations, cooperative institutes, a grant competition, the National Oceanographic Partnership Program, the Small Business Innovation Research program, and other partnerships with government agencies, academia, philanthropic organizations, and the private sector, NOAA and NOAA Ocean Exploration have supported development of ocean exploration technologies that also benefit the broader ocean science community.

This year, we field tested a full-ocean depth autonomous underwater vehicle through NOAA's Ocean Exploration Cooperative Institute, piloted cloud-based projects for processing multi-beam sonar data and video, and supported artificial intelligence solutions for video annotation and analysis. Also, *Okeanos Explorer* became the first ship in the world with a complete, integrated Kongsberg EM 304 MKII high-resolution deepwater multibeam echosounder system, enabling even greater mapping data quality and coverage.

The Future

Ocean exploration has come a long way in the last two decades, and technological innovation continues at a rapid pace. There's no lack of challenges, no shortage of drivers. Technology is central to the National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone; Seabed 2030; and NOAA strategies for uncrewed systems, artificial intelligence, cloud computing, and data.

Ambitious goals have been set. To meet them and expand the scope, pace, efficiency, and affordability of ocean exploration, partnerships across sectors and geopolitical boundaries and greater leveraging of resources and expertise will be essential.

Key areas of opportunity include autonomous platforms; innovative sensing, sampling, and telepresence technologies; cloud-based and artificial intelligence data solutions; and education and training for the next generation of ocean engineers.

Our future increasingly depends on understanding the ocean, and understanding the ocean depends on technology. As a national leader in ocean exploration, NOAA Ocean Exploration is on board for the deep-sea technological revolution.

We hope you'll join us: oceanexplorer.noaa.gov.

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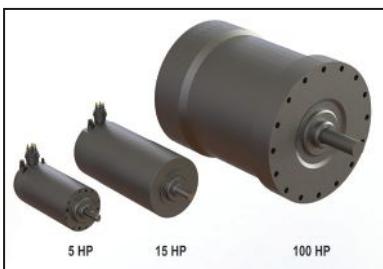
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» TRITON 36000-2 in South Georgia Antarctica.
(Photo credit: Richard Varcoe)

DEFINING A SUB-CATEGORY FOR OCEAN EXPLORATION



By Patrick Lahey
President, Triton Submarines

For centuries, civilizations have attempted to engineer vehicles to transport people below the waterline in the name of subsea exploration. For the most part, however, Deep Submergence Vehicles (DSVs) remained the purview of science fiction protagonists until twentieth-century advances in mechanical propulsion and sonar extended their reach and navigational capacity, most notably for defense applications. From there, the modern-day submersible became an operational reality and opened a viable gateway to our most enterprising subaquatic ambitions. To this day, even amid a growing appetite for crewless, machine-automated operations at sea, there is an insatiable fascination with manned expeditions to previously unfathomable depths.

BREAKING RECORDS

The Five Deeps Expedition (FDE) illustrates just how far we, as ocean explorers, have come in recent years. The 2018/19 record-breaking campaign to dive to the deepest reaches of Earth's five oceans—namely the Puerto Rico Trench in the Atlantic Ocean, South Sandwich Trench in the South Atlantic Ocean, Java Trench in the Indian Ocean, Challenger Deep in the Pacific, and Molloy Deep in the Arctic Ocean—is a tale of unprecedented industry collaboration between key strategic partners, all funded by a private businessman turned explorer, Victor Vescovo.

Triton were selected to deliver and deploy the *Hadal Exploration System*—which included the refitting of the 224ft research vessel DSSV *Pressure Drop* and the design and fabrication of three landers, a custom LARS, and Triton's headline-grabbing 36000/2 Full-Ocean-Depth (FOD) manned submersible.

The *Limiting Factor*, as the sub came to be known, was built around a titanium alloy pressure hull—weld-free and capable of withstanding 1,127 bar. Syntactic foam was used to ensure that the sub was heavy enough to dive but also sufficiently buoyant to roam the seafloor at FOD. Three ultra-wide angle 20cm-thick viewports, made from specialized acrylic, afford the pilot an extraordinary front-row view of the bottom of the world. Among the expedition's long list of world-firsts, one of the more celebrated was the deepest manned dive in history, to 10,925 meters at Challenger Deep in the Mariana Trench—that's 6.8 miles straight down.

SCIENCE IN ACTION

With high-profile feats of this nature, the headlines write themselves—*Touchdown: Mission Accomplished*—but it is what was observed, and the volume of data collected during the FDE that brings the scientific applicability of manned submersibles into sharp focus.

From December 2018 to August 2019, clocking up over 47,000 nautical miles, the expedition mapped over 450,000 square kilometers of previously unmapped seafloor using a Kongsberg EM 124 sonar (bathymetric imaging since made available to the Seabed 2030 project); captured over 500 hours of mesmerizing HD subsea footage; gathered 400,000 biological samples and 1.5 million meters of water data, including water from every deep; and significantly accelerated the understanding of Hadal Zone habitats and the roles its inhabitants—including up to 40 newly identified species—have on oceanic ecosystems. In short, while FDE might be more immediately associated with breaking records, the crew's nine months at sea will be celebrated for creating (scientific)

records that contribute to ocean science for years to come. The *Limiting Factor* remains the only human-occupied commercially certified FOD sub available for repeated dives to the deepest, darkest, and most curious chasms of the planet.

SAFETY FIRST

But whether designing a sub for deep-sea adventurers, filmmakers, or superyacht owners, safety is always the first consideration at Triton Submarines. The ocean is no place for compromise or complacency, so an overreliance on existing standards and design principles will only get you so far. Every aspect of a Triton build is subject to rigorous testing and certification, from conception through to sea trials. Each sub is equipped with manual overrides on all critical systems and comes with 96 hours life support/emergency battery power as standard. Without exception, stress-testing—under pressures of at least 1.2 times the vehicle's operating depth—is overseen and validated by an independent ABS (American Bureau of Shipping) or DNV surveyor. Remove this detailed third-party classification and we are essentially prototyping, and that is not our game. When working with new software, cutting-edge materials, and pioneering marine electrical engineering, industry accreditation is critical.

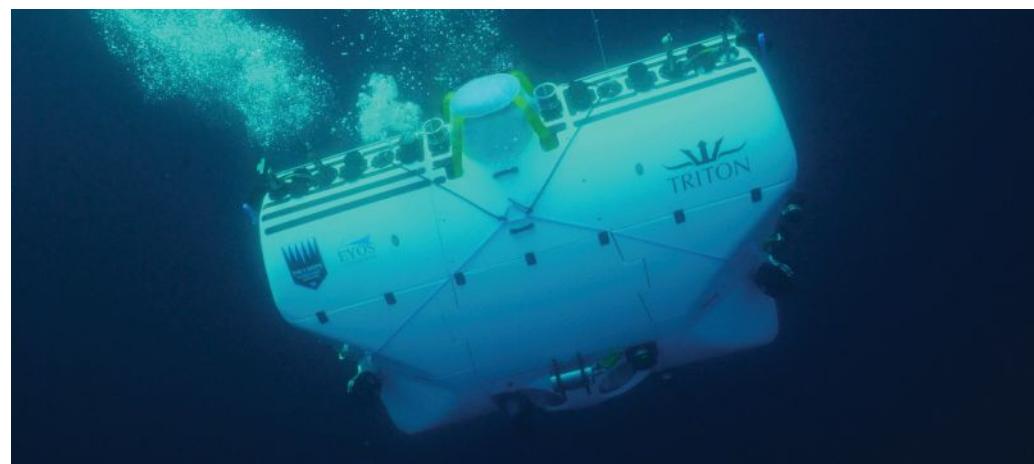
This independent certification also goes some way to debunking the myth (one almost certainly propagated by Hollywood's penchant for disaster movies) that subs are dark, claustrophobic, and inherently dangerous. Nothing could be further from the truth. In fact, statistically, civilian subs represent the safest form of transportation today; in more than three decades, ABS and DNV classed submersibles have retained a perfect safety record.

DESIGNING EXPERIENCES

Although a sub is a highly engineered, complex system of failproof systems, from an end-user perspective, Triton's design philosophy centers around the simplicity of operation, ease of maintenance, and reliability of performance. The singular objective is to deliver unforgettable, immersive underwater experiences. A key component of this is the appointment of our signature transparent pressure hulls, which frame our surprisingly roomy cabins, while our single lift point on most models simplifies deck handling. All orders come with full technical support and operational training to cover piloting, surface coordination, communications, launch and recovery, and routine and corrective maintenance. Triton's instructors are the most experienced in the business.



» TRITON 36000/2, AKA Limiting Factor, surfaces in the Mariana Trench.
(Photo credit: Reeve Jolliffe)



» TRITON 36000/2, the only certified FOD sub in the world, begins another dive.
(Photo credit: Reeve Jolliffe)

As passengers dip below the surface, the great unknown casts its spell. Surface references fade, depth perception takes on a new realm, and time stands still. The parallels with space travel are tempting, but then you see it: life. Plankton, fish, and reefs unexplored, as bottom features come into plain view. With the gentle manipulation of an easy-to-use joystick, the pilot settles into the director's chair of a very private nature documentary.

Words seldom capture this flood of emotion. Indeed, many of our private customers don't realize how much they need a sub until they experience one for the first time. Today, naval architects and yacht designers are looking to enhance the ownership experience, and for many that means exclusive access to the waters below. This attitude would have been unthinkable twenty years ago, but early adopters are changing the perception of subs and the experiences they now offer. I often joke, we don't create submarines at Triton; we create ocean explorers.

FUTURE OPPORTUNITIES

The personal submersible market has developed significantly since we set up shop in Florida in 2008. The team has grown from a handful of employees to a 40-strong staff of leading subsea engineering experts—with more than 400 years collective experience, this is the most qualified group of submersible designers, engineers, and operators on the planet.

Our first model was the *Triton 1000/2*, before launching the now industry-benchmark *Triton 3300/3* two years later. Responding to demand for units with a lower profile, in 2016 we unveiled our *Triton 1650/3*, the smallest, lightest three-person superyacht submersible available, which attracted Aston Martin and resulted in our partnership to develop a design intended to redefine subsea luxury; the limited edition *Project Neptune* submersible.

This spirit of cooperation will prove instrumental to the democratization of first-hand knowledge and experience of undersea environments. Obviously, not everyone is in a position to purchase a private sub, but working



» Triton's design philosophy centers around delivering unforgettable, safe, immersive underwater experiences, whether celebrating a special occasion a few hundred meters below the surface in a Triton 660/9 AVA (below) or diving to 4,000 meters in the Triton 13000/2, AKA the Titanic Explorer (top). (Image credits: Triton Submarines)



» Triton's 40-strong team of subsea engineering experts offers full technical support and operational training to cover piloting, surface coordination, communications, launch and recovery, and routine and corrective maintenance. (Photo credits: ON&T)



with the travel, leisure and tourism trade is one way of ensuring that more people can appreciate submarine life.

Our patent protected *Triton 660/9 AVA* (Advanced Versatile Acrylics) is designed for this very purpose. Undersea wedding? As long as the guest list is kept to nine people, set the date. Decisive boardroom meeting? Ensure there are no (terrestrial) interruptions, at 200 meters below. Not only does the elliptical cabin—the world's first non-spherical acrylic pressure hull—offer a more versatile footprint but it also minimizes AVA's displacement, which in turn limits crane weight. Component technology and advances in materials are allowing us to engineer things that once would have been considered fantastical.

OCEAN ENGAGEMENT

These twentieth-first-century breakthroughs in ocean science and technology are helping spread a wave of engagement not seen since Cousteau. Just look at OceanX, Ray Dalio's extraordinary investment in creating a global community of explorers, scientists and storytellers dedicated to inspiring future generations to protect the oceans, or the work REV Ocean is doing to promote "One Healthy Ocean." Projects like these recognize just how restricted our current knowledge of the oceans is and are committed to educating wider society about the vast breadth of discoveries that lie in wait. Their legacy will be one of powerful storytelling and lessons in how to harness partnerships to bring about meaningful change. The fact that both organizations use Triton subs to carry out their deep-sea dives is a point of enormous pride for the Triton family.

Beyond defying the odds, The Five Deeps Expedition also inspired our design team to envision a new breed of DSV for historical research. Following our 2019 dives to the wreck site of the *RMS Titanic*—12,500 ft down in the pitch dark, freezing waters off Newfoundland—we finalized the specifications for the *Triton 13000/2*, aptly dubbed the "Titanic Explorer." The sub features our versatile "Gull Wing" arrangement, designed to optimize pilot maneuverability and control, as well as the world's deepest diving acrylic hull—450 mm thick—for unparalleled viewing.

The recent leaps in submersible technology have amply demonstrated what is possible. It is now a question of resources and commercial viability. Today, when it comes to ocean exploration, Triton customers can commission their own legacy.

Triton Submarines is headquartered in Sebastian, Florida and supported by a second R&D, production and service facility in Barcelona, Spain.



» ORCHESTRA is designed to meet evolving connectivity needs in the mobility market. (Image credit: Inmarsat)

INMARSAT UNVEILS THE COMMUNICATIONS NETWORK OF THE FUTURE

Inmarsat has unveiled plans for ORCHESTRA, the communications network of the future. In the largest ever transformation of its current world-class services, Inmarsat ORCHESTRA will bring together existing geosynchronous (GEO) satellites with low earth orbit satellites (LEO) and terrestrial 5G into an integrated, high-performance solution.

Whether for a ship in a crowded port, an aircraft preparing to land at LAX, or a defense force deployed in a remote location, ORCHESTRA is designed to meet evolving connectivity needs in the mobility market with a service unmatched by any competitor offering, planned or in existence.

"An orchestra brings different instruments together, each supporting the other and playing its role in the masterpiece. We're building ORCHESTRA on the same concept," said Rajeev Suri, CEO of Inmarsat. "By combining the distinct qualities of GEO, LEO and 5G into a single network, we will deliver a service that is far greater than the sum of its parts. Our customers will benefit from dramatically expanded high throughput services around the world. This is the future of connectivity and Inmarsat is perfectly positioned to bring it to the world with its proven technology expertise, right base of customers and partners, and financial strength."

ORCHESTRA will open up a host of new and previously unattainable possibilities

for industries across the world. New services include close-shore navigation for autonomous vessels, next-generation emergency safety services for maritime crews, secure and tactical private networks for governments and direct-to-cloud connections for airlines. New segments set to benefit from ORCHESTRA include energy rigs and drilling platforms, mid-market business aircraft, coastal vessels, smart passenger ships and urban air mobility.

ORCHESTRA is unique because it draws together the benefits of multiple technologies to create one cohesive solution. LEO, GEO and terrestrial networks have never been combined at scale before to create a unified connectivity service for mobility customers. The result is a 'dynamic mesh network' that will deliver high-performance connectivity everywhere. Bringing together the lowest average latency and fastest average speeds with unique resilience, ORCHESTRA will eliminate the industry-wide challenge of congested network hot spots.

The new approach means that Inmarsat can easily boost capacity in high-density areas such as ports and airports, ensuring customer needs continue to be met well into the future with capacity scaled directly to match their requirements. The initial five-year (2021-2026) total investment for ORCHESTRA is expected to be in the order of \$100 m.

NEW ZEALAND FIRST COUNTRY TO SIGN UP WITH SEABED 2030

New Zealand recently signed up to Seabed 2030, a collaborative project to map the world's entire ocean floor by 2030. So far, 20 percent of the world's ocean floor has been mapped to modern standards.

The Chief Executive of Toitū Te Whenua Land Information New Zealand, Gaye Searancke, signed the Memorandum of Agreement with The Nippon Foundation-GEBCO Seabed 2030 Project, making New Zealand the first country to sign up to the project.

Jamie McMichael-Phillips, Seabed 2030 Director, signed the agreement on behalf of the Project.

Toitū Te Whenua, National Institute of Water and Atmospheric Research Ltd (NIWA) and GNS Science are working together to jointly govern data assembly and coordination in our region.

Speaking of the agreement, Ms. Searancke said: "New Zealand is proud to be leading the way with this work. Mapping the seabed floor is critical to our knowledge about climate and weather patterns, tides, wave action, sediment transport, tsunami wave propagation and underwater geo-hazards."

Mr. McMichael-Phillips said: "The New Zealand signing is significant for Seabed 2030 as it's the first full Memorandum of Agreement between a Government and the Project. As a host of one of our regional centers, New Zealand has provided steadfast support to Seabed 2030 from the outset and we look forward to building on our collaboration in the race towards achieving our mission."

"We call upon other countries to join us in our goal of a complete map of the ocean floor—an apparatus which will help us better understand planet Earth."



ALL AMERICAN MARINE LAUNCHES 50' RESEARCH VESSEL FOR NOAA

All American Marine (AAM) has launched a 50' Research Vessel for the National Oceanic and Atmospheric Administration (NOAA), designated for the Olympic Coast National Marine Sanctuary in Washington State. The twin-engine Teknicraft Design vessel was constructed by AAM to USCG Subchapter T standards. The vessel will carry up to 18 personnel on board on a near coastal route. Olympic Coast National Marine Sanctuary (OCNMS) includes 3,188 square miles of marine waters off the rugged Olympic Peninsula coastline. The sanctuary extends 25 to 50 miles seaward, covering much of the continental shelf and several major submarine canyons.

The semi-displacement catamaran hull for this vessel was developed by Nic de Waal of Teknicraft Design in Auckland, New Zealand. The design integrates a Teknicraft hull shape and is complemented by Teknicraft's signature integration of a wave



» The vessel will be used for seafloor mapping, habitat characterization, data collection, and marine wildlife observation. (Photo credit: AAM)

NEW REVOLUTIONARY MULTI-BEAM ECHOSOUNDER FROM TELEDYNE RESON

Detailed knowledge of the shape of the seafloor is crucial to humankind. Bathymetry data is critical for safety of navigation, environmental considerations, charting, and many other applications.

Teledyne Marine has developed a revolutionary multibeam echosounder which offers outstanding performance, mapping in greater details than ever seen before. The unrivalled true 800 kHz technology offers high-frequency resolution without compromising swath coverage, giving up to 150 degrees full swath width allowing for superior efficiency and short survey turn-around time.

The new SeaBat T51-R from Teledyne Marine pushes the boundaries of what is technically possible. It is the latest addition to our class-leading portfolio of marine survey solutions. Built on

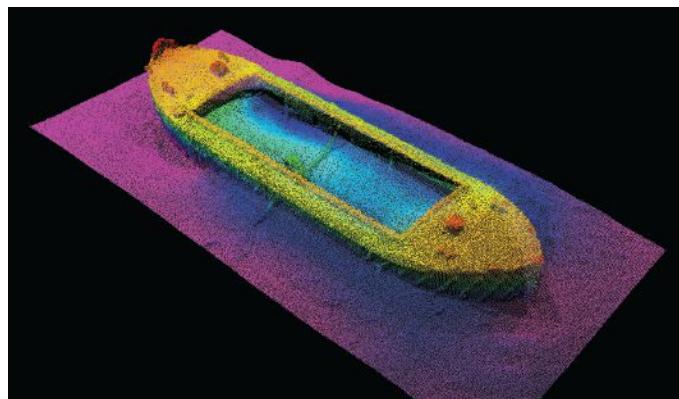
piercer that is positioned between the catamaran sponsons to break up wave action and ensure reduced drag while conducting research missions in and around the Olympic Peninsula region. The catamaran is also highly stable and has outstanding seakeeping ability. For the operator, one of the most valuable features of this vessel is the excellent fuel economy. Powered by twin Cummins QSC8.3 engines with twin propellers, this custom vessel will serve as a valuable asset for NOAA's specific mission. The vessel will host a variety of research missions and visiting scientists concentrating on seafloor mapping, habitat characterization, data collection, and the monitoring of the health of ocean species and marine wildlife.

"All American Marine worked diligently with Teknicraft to design a flexible platform that could quickly and easily be reconfigured depending on the current mission. This feature was critical for NOAA's research purposes," stated Ron Wille, All American Marine's President and COO.

Onboard the vessel there is approximately 250 square feet of working space on the aft deck, with a complete complement of working gear and an extensive grid of deck sockets. There is a flybridge with a bimini top covering on the upper deck, allowing vessel operations from a higher elevation while conducting research missions. The top deck also features an Interocean Conduction Wire Winch, Hauling Winch, and a Morgan300.4 crane. The main deck features an adjustable A-Frame for launching scientific equipment. Additional features of the research vessel include both a wet laboratory for examining specimens and a dry laboratory for processing data. Onboard the vessel's main deck is a fully equipped galley and comfortable dinette with settee/bunk, kitchenette, and wet head.

A larger, more stable vessel will not only expand the potential for OCNMS operations but also make it a more viable asset for our partners," said Kevin Grant, deputy superintendent of Olympic Coast National Marine Sanctuary. "This new vessel will help the sanctuary provide science-based solutions that address evolving environmental pressures on our ocean and coasts."

the renowned SeaBat T-series technology crafted from decades of sonar experience, the SeaBat T51-R helps you drive efficiency onboard with fast throughput of exceptionally clean data and precise imagery.



» Sunken barge off Copenhagen harbor. (Image credit: Teledyne RESON)

WHOI APPOINTS NEW CHIEF SCIENTIST FOR NATIONAL DEEP SUBMERGENCE FACILITY

Woods Hole Oceanographic Institution (WHOI), a world leader in ocean exploration, discovery and education, has named a new Chief Scientist for Deep Submergence (CSDS) for its National Deep Submergence Facility (NDSF). Dr. Anna Michel, an associate scientist in the Department of Applied Ocean Physics and Engineering, will be the first woman to serve in this high-profile role effective July 1, 2021.

The CSDS role places Michel at the forefront of deep submergence for the academic research community, working as a liaison to connect scientists with the WHOI teams that operate the NDSF underwater vehicles. The CSDS helps ensure NDSF meets the needs of the user community, provides project planning advice and manages the process for post-cruise assessment. The CSDS also plays a key role in shaping the future of deep submergence through the NDSF.

"I am looking forward to applying my experience to help support this important, collaborative program," Michel said. "The work of the NDSF enables the oceanographic community to explore, sample, and map the deep ocean and it is

exciting to be able to work with scientists on how best to support their research projects."

"This new position also allows me to continue to be a listener in the community; I'm interested in establishing initiatives that would bring more diversity to deep ocean science, and to find ways to improve and advance technology in terms of computer science integration, artificial intelligence and new sensor systems," Michel added.

Michel graduated with her PhD from the Massachusetts Institute of Technology (MIT) - WHOI Joint Program in

Oceanography/Applied Ocean Science and Engineering in 2007. In 2012, she began her career as an assistant scientist at WHOI. She went on to lead the Chemical Sensors Laboratory as an associate scientist, which works on developing new sensors for studying ocean chemistry, including methane sensing, carbon dioxide sensing, and microplastics sensing.

The NDSF operates, maintains and coordinates WHOI's three deep ocean vehicles including HOV Alvin, ROV Jason/Medea, and AUV Sentry.

The NDSF is sponsored by the National Science Foundation, the Office of Naval Research, and the National Oceanic and Atmospheric Administration and hosted at WHOI. Its operation is overseen by the University-National Oceanographic Laboratory System (UNOLS), an organization of 58 academic institutions and national laboratories involved in marine research.



» Anna Michel aboard the R/V Falkor. (Photo credit: Kevin McHugh, Schmidt Ocean Institute)

IMPORTANCE OF SIMULATION FOR OFFSHORE OPERATIONS

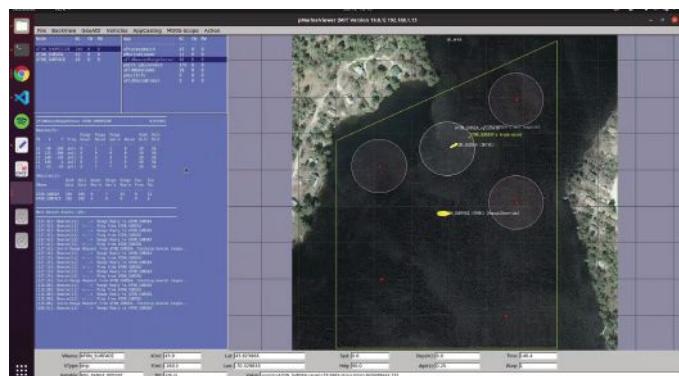
As the offshore industries head towards evermore remote and autonomous operations, simulation plays an increasingly critical role in identifying the different risks associated with the operating vehicles and sensor payloads.

The AROBOTNX ACTK - V1.1 (MOOS-IvP with ACTK) Simulation Tool offers a real-time offshore environment training platform for professionals operating in an environment where many unexpected things can happen.

Running simulated real-time missions with a subsea positioning system enables better visualization and operational understanding of vehicles, navigation sensor payloads, and environmental limitations.

AROBOTNX's tool showcases the capabilities of autonomous vehicles on a mission at surface & water depth with 'n' transponders to provide the acoustic ranges for vehicle positioning and with fewer transponders and INS, Sparse LBL Array delivers Subsea SLAM solution.

ACTKV1.1 simulates multi-vehicle deployment for subsea operations and calibrates the exact scope, different risks, and unexpected failures based on sensor values with inter-vehicle communication for Collision avoidance based on the Collision Regulations (COLREGS).



» ACTKV1.1 simulates multi-vehicle deployment for subsea operations. (Image credit: AROBOTNX)

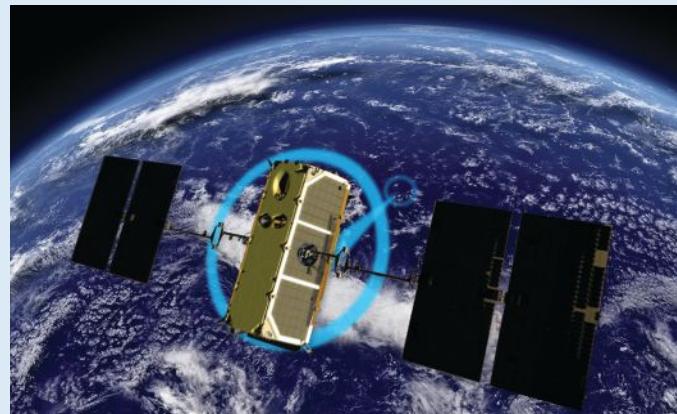
OCEANEERING AND DDK POSITIONING SIGN GNSS SERVICE AGREEMENT

Oceaneering International, Inc., and DDK Positioning Limited have entered into an agreement for the provision of GNSS (Global Navigation Satellite System) augmentation service and all associated software and hardware supporting Oceaneering's C-Nav® Positioning Solutions group offerings.

DDK Positioning's services are delivered exclusively through the Iridium® satellite communications network coupled with hardware developed by partner Topcon. This pairing of cutting-edge hardware and advanced communication infrastructure

will enhance the ability of Oceaneering's customers to precisely position their assets globally. This unified solution offers several benefits to Oceaneering's positioning customers including, two-way communication enabling machine control and feedback, and redundancy to cover potential signal losses.

From launch, DDK Positioning will provide its MAX service to Oceaneering clients, which can achieve accuracy to less than 10 cm (2 Sigma). The MAX service uses both GPS, Galileo, and GLONASS constellations with further systems to be added within a year.



Eric Smith, Director of Survey Services at Oceaneering, said: "There have been significant advances made in communications infrastructure and satellite positioning technology over the last several years. With this agreement, Oceaneering will be able to offer enhanced positioning technology allowing us to build on our strong industry track record while continuing to serve the positioning needs of our clients now and into the future."

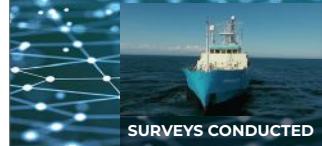
Kevin Gaffney, CEO at DDK Positioning, said: "This agreement demonstrates the need for an alternative GNSS augmentation service that increases the reach of services from Pole to Pole, with the added benefit of Iridium's resilience and reliability. We are looking forward to working with Oceaneering to enhance their service and product portfolio while delivering market leading services for many years to come."

CATHX FDI® SEABED

Let's capture YOUR ocean

An underwater photograph showing a yellow and green ROV (Remotely Operated Vehicle) suspended in the water column. The ROV has a large camera and lighting system at the front. The background is a clear blue ocean.

CATHX FDI® (Fast Digital Inspection) for Seabed is an optical survey service solution that can be deployed across a wide range of ROV's, AUV's and ROTV's to conduct inspections on man-made assets, organic life, or area surveys of the seafloor.

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OPTICAL SENSORS: ENABLING EXPLORERS TO SEE THE DEPTHS LIKE WE SEE THE SURFACE



By Becca Ellig
Marketing Manager,
Voyis Imaging Inc.

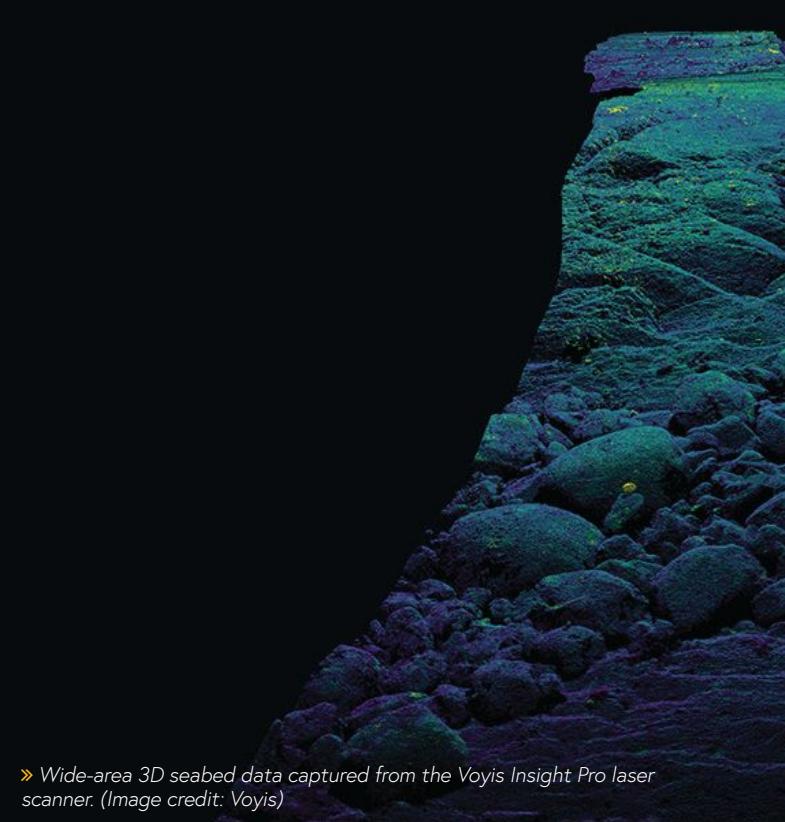
Human ingenuity has led to a world of discovery, yet our ocean's deepest secrets remain shrouded in darkness. The deep sea covers approximately 65% of the Earth's surface and has remained largely undocumented, with surveys being limited to low-resolution mapping from surface vessels and satellites, and localized observation with submersibles. Efficient wide area optical exploration in deep water is key to uncovering the ocean's mysteries and is vital for documenting and managing the habitats, archaeology, and critical infrastructure that call the ocean home.

MAKING THE DEEP SEA MORE ACCESSIBLE

Today we rely on robotic underwater vehicles, equipped with powerful sensors, to get us to these remote regions in order to survey large areas of the deep sea. These vehicles are constantly evolving, gaining new capabilities that enable us to travel further than before.

Whilst crewed submersibles have allowed humans to visit depths of over 4000 m, they are complex, high risk, and costly to operate, making them ineffective for expansive surveys. Remotely Operated Vehicles (ROVs) eliminate the human presence to reduce costs and improve safety, but their slow speed also makes them inefficient for capturing wide-area datasets. The ideal platforms are Autonomous Underwater Vehicles (AUVs) which can dive to depths of over 6,000 m, travel at speeds up to 6 knots, and can carry a wide range of sensor payloads.

The concept of using AUVs for wide area exploration was demonstrated by Ocean Infinity with their HUGIN AUVs in their search for the MH370 aircraft wreckage. During their search they noted that their fleet emitted 72% less CO₂ on average and covered 125,000 square kilometers of seabed in just 138 days—a far cry from the 837 days it would take typical survey vessels. With this incredible achievement it is evident that AUVs are enabling researchers to access the deep, at a lower cost, and with a reduced



» Wide-area 3D seabed data captured from the Voyis Insight Pro laser scanner. (Image credit: Voyis)

environmental impact. But getting there is just the beginning. Having tightly integrated, high-resolution sensors onboard is paramount to improving our understanding of the world's last frontier.

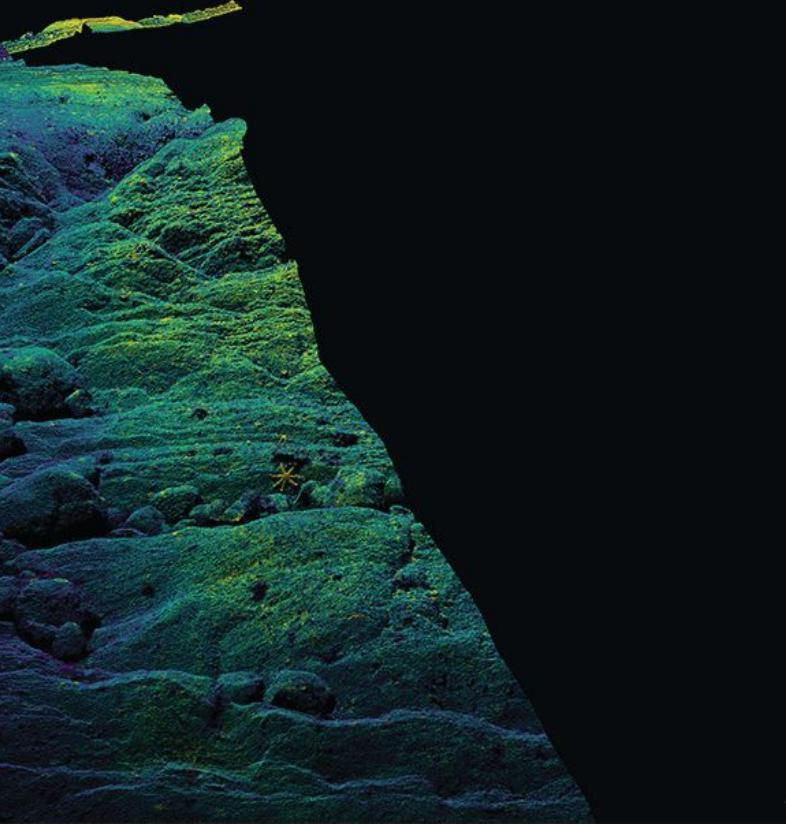
GAINING A DEEPER UNDERSTANDING

One of the main challenges with documenting and observing the deep sea is the trade-off that is typically made between coverage and resolution in subsea instruments. While some sensors can capture data across large areas, they do not have the resolution required for gathering quantifiable and actionable data.

For example, AUV side-scan sonar can achieve incredible coverage rates, mapping over 200 m on each side of the vehicle, but their limited resolution is best suited to detect objects, not to identify and interpret them. Conversely, optical sensors like 3D laser scanners and stills cameras can provide highly detailed quantitative and qualitative datasets but are not well suited to mapping the entire ocean when the typical image only has a 10 m swath. To achieve both coverage and resolution the sensors and vehicles must work together as a tightly integrated system, with acoustic sensors first detecting



» A color image mosaic of seabed made up of 49 individual images stitched together. (Image credit: Voyis)



features of interest and then optical sensors reacquiring the target for assessment with higher resolution data.

At Voyis, we are looking to overcome these challenges with our Recon AUV payloads that provide both 3D laser and high-resolution color image datasets simultaneously. This pre-configured module is outfitted with Voyis' Insight long-range laser scanner and Observer and Nova Imaging system which includes our new 6,000-m rated color stills camera. Wavefront's side-scan sonar can be integrated into the Recon payload for a complete package that achieves both wide coverage and high resolution.

ENABLING SENSOR AUTONOMY

With these AUV payloads it has never been easier to remotely collect incredible data on both small and large platforms. However, another core challenge is finding an efficient way to conduct this exploration and review the vast amount of data.

An AUV operating in the deep ocean cannot transmit large datasets back to the surface, and therefore must be evaluated by an operator once the vehicle is recovered. For wide-area surveys this process can take weeks and usually means that the surface vessel has moved on to different locations. When looking to combine sonar and optical data, the window of opportunity for an optical survey of a detected feature has usually passed. It is therefore paramount that we look to onboard data processing for the automatic detection of targets of interest to drive in-mission optical reacquisition, for a more efficient workflow.

With the integration of EIVA's Onboard workflow Manager and Deep Learning into Voyis' Recon payloads, this type of unsupervised decision making is now achievable. Both side-scan and optical data can be analyzed onboard the payload in real-time, identifying anomalies, perceiving the environment, and providing information to the vehicle that can enable true autonomy.

SEEING THE DEPTHS LIKE WE SEE THE SURFACE

When taking photos underwater at long ranges, water absorbs the visible light spectrum unevenly causing color images to appear mostly blue or green when in reality the ocean is filled with color. Voyis is making it possible to see the depths like we see the surface by instantly enhancing and correcting images as they are collected. Our robust machine-learning-based color correction algorithms help us to see consistent, true-color photos, that enable effective analysis of marine ecosystems.

When combined with navigational data, it is possible to deliver consistent images across incredibly long surveys. This uniformity produces wide area consistent image mosaics without variations in quality from image to image. Broad regions can be observed all at once to gather a better macro understanding and then zoomed in on to clearly see tiny details of your subject. Adding onboard analysis software, like EIVA's Deep Learning, enables the automated detection of marine life and seabed features, further accelerating the time-to-results.

All the recent innovations in platform and sensor technologies have made it possible to explore vast areas of our deep oceans more efficiency and with better data. The final step is putting it into action on a wider scale to enable further discoveries, which will require researchers, surveyors, vehicle designers, and sensor manufacturers all working together to *Illuminate the Unknown*.

To learn more visit www.voyis.com or contact sales@voyis.com.



» An image of a shipwreck going through Voyis' automated image enhancements and corrections. (Image credit: Voyis)

KHI'S SPICE AUV FITTED WITH SONARDYNE'S NAVIGATION TECHNOLOGY

Kawasaki Heavy Industries' (KHI) has chosen a suite of subsea navigation, positioning and communications technologies from marine energy, defense and science company Sonardyne to navigate, track and control its first commercial SPICE autonomous underwater vehicles (AUVs).

The SPICE (Subsea Precise Inspector with Close Eyes) AUV, complete with a submerged docking system and unique robotic arm for non-destructive testing, has been designed and built by KHI for intelligent and low-logistic pipeline and subsea asset inspection operations down to 3,000 m water depth.

To support accurate and long-duration navigation on its missions, while minimizing complexity and payload space consumption, the vehicle is fitted with Sonardyne's industry leading hybrid navigator SPRINT-Nav.

For underwater positioning and communications, the SPICE AUV is using Sonardyne's AvTrak 6—a combined transponder, modem and emergency locator beacon all in one. KHI has also been using Sonardyne's Mini-Ranger 2 Ultra-Short Baseline (USBL) system with a Robotics Pack to support tracking and communications during development and testing.

Two SPICE (Subsea Precise

Inspector with Close Eyes) AUVs have already been ordered by UK-based subsea services company Modus Subsea Services for cable and pipeline inspections, as well as more conventional surveys. One is due to be delivered to Modus this year.

"Our goal with the SPICE AUV is to enable operational efficiency of inspection operations, to reduce cost and reduce the burden and risk experienced by crews working on support vessels offshore. We believe that Sonardyne's instruments will support the highly accurate navigation of the SPICE AUV, supporting our goals," said Noriyuki Okaya, Development & Design section, AUV Department Kobe Shipyard, at KHI.

SPRINT-Nav combines Sonardyne's SPRINT INS sensor, Syrinx 600 kHz DVL and a high accuracy intelligent pressure sensor into a single housing, making it one of the smallest combined inertial navigation instruments on the market. SPRINT-Nav's tight integration of raw sensor data at a low level provides unprecedented navigational performance and precision for subsea vehicles, consistently outperforming competing systems in customer

trials. The SPRINT-Nav 700, selected by KHI, is equipped with the highest performance available sensors, including Honeywell ring laser gyros and accelerometers.

Built for simple integration on AUV platforms, AvTrak 6 combines the functions of transponder, transceiver and telemetry link in one low power unit, leaving more payload space and power for other instruments. It enables AUVs to undertake simultaneous LBL ranging, USBL tracking via a surface vessel and robust telemetry for AUV to vessel and AUV-to-AUV communications.

Mini-Ranger 2 is ideal for use from smaller vessels, where survey-grade positioning performance is required. It can simultaneously track 10 targets at very fast update rates, is quick to install and has a standard operating range of 995 m, extendable to 4,000 m. Sonardyne's Marine Robotics software pack unlocks valuable additional capability when used with a compatible subsea vehicle mounted instrument such as AvTrak 6. This includes secure data exchange and remote control of multiple AUVs deployed in swarm scenarios.



» Kawasaki Heavy Industries' (KHI) SPICE AUV. (Image credit: KHI)

NEW RF PERFORMANCE AND MATERIAL OPTIONS FOR THE BIRNS MILLENNIUM™ SERIES

BIRNS recently announced impressive new performance characteristics in its acclaimed BIRNS Millennium™ 1V RF connector series, and the addition of all titanium connector components to the entire BIRNS Millennium line. The latest comprehensive third-party testing yielded impressive new results for its range of open face pressure resistant, deep submergence RF connectors. The most recent results, at GPS frequencies of 3GHz, include excellent 1.83:1 Voltage Standing Wave Ratio (VSWR), and incredibly low insertion losses of just -.212dB.

The innovative 1V coax series provides an ultra-compact 75Ω contact in the same footprint as a 50Ω contact. Cable assemblies in this series are ideal for HD/SD video with signal frequencies to 3GHz,

for shortwave antennas, or for low-power RF needing minimal signal attenuation. And, due to its advanced design, the 1V will fit into any of the many BIRNS coax 1C configurations, offering a range of flexible, powerful new options in a small space. This exclusive technology provides system developers the ability to mix 50Ω and 75Ω lines in a single connector, with the highest performing pressure-resistant RF contacts in the industry.

If a subsea system requires all titanium connector components, the entire BIRNS Millennium series now has options of all titanium parts, from the coupling ring and shell to the snap rings. The series also offers selections that combine titanium and Delrin, as well as stainless steel and phosphor bronze.

» The entire BIRNS Millennium series now has the option of all titanium components. (Photo credit: BIRNS)





» The Gombessa 6 saturation barge and the submerged turret. (Photo credit: Jordi Chias, Gombessa Expéditions)

MARLINK PROVIDES SEAMLESS CONNECTIVITY FOR SCIENTIFIC RESEARCH VESSEL

Marlink, a leading provider of smart network solutions, has teamed up with environmental research group Andromède Océanologie to support its 'Gombessa 6' project with smart hybrid connectivity.

The research team is composed of an oceanographic trimaran and the saturation barge of the National Institute of Deep Diving (INPP) towed by M/V Pionnier, owned by long-time Marlink connectivity partner SeaOwl, which operates the platform supply vessel on behalf of the French Navy. SeaOwl and Marlink have previously collaborated on other innovative projects including the Remote Operated Services at Sea (ROSS) initiative.

From impact studies to the implementation of ecological restoration measures, Andromède Océanologie supports maritime projects with a strategy to integrate any coastal or offshore project into its operations. The 'Gombessa 6' project will study and report on coralligenous atolls off the Cape Corse in the 'Parc naturel marin du Cap Corse et de l'Ariate'.

On its current three-week mission, connectivity provided by Marlink will enable the Andromède Océanologie team to collect and transmit large amounts of data on these mysterious structures. First discovered in 2012 by Corte University and named for their circular shape, the origin and growth dynamics of the atolls are still unknown but their shape could result from

hydrodynamic action or anthropogenic sources.

Satcom systems onboard M/V Pionnier were upgraded by Marlink at the port of Toulon in late June and the boat set sail on schedule on June 28. The VSAT system will provide the researchers with seamless high-quality connectivity throughout the mission, enabling the team to transfer critical data at high-speed as well as streaming video.

To demonstrate its ability to go 'Above and Beyond' in connecting remote locations, Marlink collaborated with the European Space Agency to facilitate a duplex video call between Andromède Océanologie team leader Laurent Ballesta on M/V Pionnier and French ESA astronaut Thomas Pesquet, currently onboard the International Space Station.

"Marlink's support to Andromède Océanologie is a real-life example of how we go 'Above and Beyond' to support vital research initiatives evaluating the ecological status of the world's oceans," said Tore Morten Olsen, President, Maritime, Marlink. "By providing research teams with the smart hybrid connectivity they need to better understand the impact of human activities on our oceans, we play our part in sustainability and demonstrate stewardship of the planet."



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THE STUDY OF DEEP-SEA MINING SEDIMENT PLUMES?

Oceanographers at MIT and the Scripps Institution of Oceanography have carried out an at-sea experiment to study the sediment plume that mining vessels would potentially release back into the ocean.

Their observations have led to the development of a model for making realistic predictions about how sediment plumes generated by mining operations would be transported through the water column.

The model allows operators to predict the size, concentration, and evolution of sediment plumes under various marine and mining conditions. The hope is that these predictions can be used by biologists and regulators to help assess any potential impact that plumes could have on the surrounding marine ecosystem.

According to Thomas Peacock, professor of mechanical engineering at MIT, the study is the first of its kind on midwater plumes and findings will likely contribute to discussions surrounding the development of regulations over the next two years.

There are two types of sediment plumes associated with proposed

deep-sea mining operations; first, collector plumes generated on the seafloor as collectors harvest nodules 4,500 meters below the surface and, second, midwater plumes caused by sediment discharge pumped into the ocean's aphotic zone.

Peacock's study focused on the midwater plume and how the sediment would disperse once discharged into the water table.

In 2018, the researchers boarded the research vessel Sally Ride and set sail 50 kilometers off the coast of Southern California.

Over one week the team conducted a total of six plume experiments, using a Phased Array Doppler Sonar (PADS) and an episometer developed by Scripps scientists to monitor the plumes development and drift. The data showed that the sediment formed a highly turbulent cloud when expelled from the pipes. In short, the sediment becomes dilute so quickly that it struggles to stick together.

What is key to determining the extent of the plumes, according to Peacock, is the strength of the ocean turbulence, the volume of sediment discharged, and the environmental threshold level at which there is impact.

Based on their findings, the researchers have developed formulae to calculate the scale of a plume depending on a given environmental threshold. For instance, if regulators determine that a certain concentration of sediments could be detrimental to surrounding sea life, the formula can be used to calculate how far a plume above that concentration would extend, and what volume of ocean water would be impacted over the course of a 20-year nodule mining operation.

The team is now working on collector plumes, having recently returned from several weeks at sea to perform the first environmental monitoring of a nodule collector vehicle in the deep ocean in over 40 years.

This research was supported in part by the MIT Environmental Solutions Initiative, the UC Ship Time Program, the MIT Policy Lab, the 11th Hour Project of the Schmidt Family Foundation, the Benioff Ocean Initiative, and Fundación Bancaria "la Caixa."

FLYING SHIP TECHNOLOGIES SECURES SALES FOR WING-IN-GROUND-EFFECT MARITIME VESSELS

Flying Ship Technologies, Corp. has signed a \$100 million sales agreement with a European customer for the purchase of wing-in-ground-effect maritime vessels.

"We're elated to announce this agreement," said Flying Ship CEO Bill Peterson. "These vessels will provide fast, low-cost delivery to a wide range of coastal locations around continental Europe and the surrounding islands. Flying Ships will improve the quality of life for consumers by enhancing existing trade routes and opening new routes to deliver fresh foods, medical supplies, and

e-commerce, while being carbon-neutral and a fraction of the cost of air freight."

Flying Ships serve an untapped opportunity in the expanding global logistics market for fast, cost effective delivery of time-critical, price-sensitive goods. The global logistics market is growing annually and projected to be more than \$15 trillion over the next 5 to 7 years.

"This order is the first of many for Flying Ship vessels. As the world looks for ways to reduce greenhouse gases and the logistics



» Flying Ship looks to tap the expanding global logistics market. (Image credit: Flying Ship Technologies)

market continues to surge, we expect even more interest in Flying Ships as a green alternative to ships, trucks, rail and air freight for inexpensive, fast delivery of goods," Peterson said.

SEAROBOTICS TO SUPPLY CUSTOM LONG-ENDURANCE ASV TO CANADA'S MARINE INSTITUTE

SeaRobotics Corporation (SeaRobotics), a leading developer of marine robotics and autonomous systems, has announced the development of a new multi-mission autonomous surface vessel (ASV) in partnership with The Fisheries and Marine Institute of Memorial University of Newfoundland (Marine Institute).

The SR-Endurance 8.0, the latest model from SeaRobotics' Endurance Class of ASVs, was designed to enhance the Marine Institute's training and research program in ocean mapping, observation and characterization.

The eight-meter, self-righting ASV features a hybrid diesel-electric propulsion system (allowing for a quieter operating mode needed for acoustic research), collision avoidance technology, GPS navigation, and customizable

levels of autonomy based on the mission at hand. Autonomy levels range from remote control (no intelligence/operator in the loop), basic (minimal intelligence), mature (crewed oversight), and advanced autonomy (operator out of the loop/full automatic mission implementation). While in the field, the Marine Institute will track and monitor the ASV from a shore-based command center as it continuously collects ocean data during its non-stop 14-day missions.

The ruggedized ASV is equipped to handle a wide range of payloads and can be outfitted with a variety of interchangeable sensors and sonars, including a multibeam echo sounder for 3D seafloor mapping. The SR-Endurance 8.0 is rated for operations in waves up to four meters high and Beaufort wind scale seven (near gale-force winds).

"We are delighted to partner with the Marine Institute's School of Ocean Technology in the development of this uniquely capable ASV for ocean research and education," said SeaRobotics president Don Darling. "We consider intelligent, versatile and dependable ASVs like the SR-Endurance 8.0 as instrumental to both the advancement of



» The SR-Endurance 8.0 has been designed for crewless ocean operations. (Image credit: SeaRobotics)

essential ocean research and the future of crewless marine operations."

Speaking of the announcement, Paul Brett, head of the Marine Institute's School of Ocean Technology, said:

"This compact and efficient ASV represents the next generation of technology needed to change the way we map and characterize the planet's oceans. Not only will the SR-Endurance 8.0 expand our capabilities in Atlantic Canada, but it will also provide students and researchers alike with the enviable opportunity to work with truly cutting-edge autonomous platforms."

Delivery of the SR-Endurance 8.0 is expected in the spring of 2022.

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FEATURE

» RTsys' range of AUVs includes two-men-portable units as well as ultra-compact micro AUVs. (Photo credit: RTsys)

ENHANCING TRUST UNDERWATER



By Pierre-Alexandre Caux,
Business Director, RTsys

RTsys, part of the Neotek group, is a French company that specializes in the design and manufacture of passive and active underwater acoustics and Autonomous Underwater Vehicles (AUVs). The 40-strong team of seasoned engineers is headquartered at an exclusive R&D facility in Brittany, with direct access to the Atlantic Ocean for sea trials and FATs.

Ongoing investments in R&D have culminated in a range of cutting-edge equipment widely used in the defense sector (MCM and ASW) and among the marine scientific community (IFREMER, KIOST, SHOM, DSO), as well as the offshore energy and aquaculture industries.

Every RTsys product comes equipped with an electronic board reference SDA® (Synchronous Data Acquisition), a proprietary technology that enables the company to provide genuine turnkey solutions without the need for third-party suppliers.

Today, the company's portfolio comprises four business lines: AUVs, PAM, MCM, ASW.

AUTONOMOUS UNDERWATER VEHICLES (AUVs)

RTsys' range of AUVs includes two-men-portable units as well as ultra-compact micro AUVs. These powerful, long-endurance vehicles support a wide range of interchangeable payloads—including SSS (both 2D and 3D image data), CTD and any other water quality sensors—while the INS and DVL enhance navigation to an accuracy of less than 5 meters. These are just some of the features that have made the COMET-300 and NemoSens AUVs popular among scientific, commercial and military operators for seabed mapping, cable and pipeline tracking, coastal water quality monitoring, windfarm inspection, marine, UXO detection, and MCM operations.

COMET-300 (AUV) and NemoSens (μ AUV)

Not only are μ AUVs the easiest underwater vehicle to transport, deploy and recover, but they represent the most cost effective AUV platform and so increasingly attractive among universities and research institutes conducting biological studies, water, CTD and O² monitoring, seabed mapping, acoustic survey, and more.

Micro AUVs can be launched and recovered by one person, from shore or small boat (zodiac, RHIB) without the need of a dedicated LARS (Launch And Recovery System).

Larger AUVs, however, can incorporate greater battery and payload capacity to extend mission duration and support broader sensor suites. The development and launch of COMET-300—released in 2015—has proven instrumental to the engineering of NemoSens and has afforded the RTsys team with a unique understanding of the market dynamics and opportunity that exist in the AUV industry.

The international AUV market is a mature one these days, but

price is still an issue for many potential customers. And so, R&D efforts at RTsys have been geared towards bringing down overall costs.

Open software architecture allows users to easily integrate new payloads without having to send the AUV back to RTsys, leaving operators empowered to test and master new applications for their hardware without third-party assistance. Operators can fully customize navigation, although some safety parameters cannot be changed in order to preserve the AUV's integrity.

Finally, COMET-300 and NemoSens both incorporate a unique capacity for underwater communication based on RTsys' own protocol.

That protocol—which is compatible with the whole RTsys product range—includes both underwater communication and sparse LBL. This technology allows for a real-time follow-up of the AUV positioning, with transmission of status info, as well as data sample.

It also offers the possibility to enhance repositioning features, leading to a constant positioning accuracy of 5 meters over the whole deployment, even for an AUV not equipped with a DVL.

PASSIVE ACOUSTIC MONITORING (PAM)

RTsys is leading manufacturer of acoustic recorders, buoys and software for both post-processing analysis (up to 180 days autonomy) and real-time assessment, and the company's PAM solutions address 3 fundamental needs: Long-term analysis, Real-time monitoring, Multiparameter studies.

From post-processing (recorders) to real-time monitoring (buoys) and multiparameter assessments (stations), RTsys provides a wide range of solutions to marine biologists and PAM operators.

The acoustic monitoring and recording combined with multiparameter sensor logs offer the best package for a wide community of users, from Marine Renewable Energy installation (vessel traffic noise monitoring) and pile driving (noise and environmental impact assessment) to scientific users looking to monitor ambient noise and water quality.

RTsys also specializes in 6,000-m depth multiprotocol dataloggers with up to 12 sensors capable of working simultaneously to support various protocols (RS232, RS485, Ethernet, Video, and more).

MINE COUNTERMEASURES (MCM)

RTsys also provides EOD Divers and Special Forces with a range of AUVs and diver-held navigation and sonar systems to optimize operational efficiency and safety during MCM missions. SonaDive is designed to aid diver navigation and underwater object detection. The embedded navigation system relies on several sensors: INS, DVL, pressure sensor, and a deployable floating GPS. The native acoustic communication, thanks to the Sparse-LBL technology, ensures constant navigational accuracy (less than 5 meters, like the AUV range). Divers can communicate amongst themselves and with the surface in real-time via the acoustic modem, with a range of more than 2 km (up to 5 km using RTsys relay beacons).

Sonar and navigation data are recorded, allowing for mission replay, data analysis and export. With 6 hours of battery life, endurance can be extended by swapping batteries during a mission.



» NemoSens (μ AUV) can be launched and recovered by one person, from shore or small boat. (Photo credit: RTsys)



» RUBHY is a remotely controlled buoy that offers a range of applications in the field of underwater noise monitoring. (Photo credit: RTsys)

ANTI SUBMARINE WARFARE (ASW)

RTsys produces specialist acoustic systems for at-sea testing and training, torpedo firing exercises and acoustic signature measurements. The SIERA system offers the most reliable solution for the characterization and calibration of underwater acoustic systems (hull-mounted sonars, dipping sonars, variable depth sonars, buoys), while SEMA can act as an autonomous and recoverable acoustic target for ASW training. Easy to deploy from both a RHIB or a frigate, the navigation route is plotted with either waypoints or segments. Different types of training modes such as passive, active and combined acoustics can be programmed. SEMA is easy to operate and recover and is reconfigurable in one hour with a spare battery.

For more information, visit: rtsys.eu

BP AND QUAYBRIDGE TEAM UP TO ACCELERATE OFFSHORE WIND GROWTH

bp has formed an exclusive consultancy agreement with Quaybridge, a leading UK-based renewables consultancy with global expertise in offshore wind. The two will work together to advance bp's global offshore wind portfolio as part of its zero-carbon growth strategy, and accelerate the building of in-house offshore wind knowledge for bp.

As part of the new agreement, members of the Quaybridge team will work closely with bp's Renewables Growth business development team. Quaybridge worked with the bp and EnBW teams and successfully won 'preferred bidder' status for the Mona and Morgan Irish Sea leases in the recent UK Round 4 leasing round.

The bp/EnBW consortium and Quaybridge are participating independently in the ongoing ScotWind leasing round, which will not be in the scope of the consultancy agreement between bp and Quaybridge.

David Anderson, bp's svp renewables growth, said: "Investing in the right skills is critical to success. Quaybridge is trusted and respected in the offshore wind industry for their deep technical expertise and their entrepreneurial and agile spirit. We believe this partnership will give us a cutting edge in a hugely competitive industry as we look to accelerate our global portfolio and deliver our ambition to be a leader in offshore wind energy."

Quaybridge was formed by renewables consultancy Everoze in 2018, drawing many years of offshore wind development expertise

together into an agile multi-disciplinary team, spanning technical and consenting specialisms. Quaybridge's services for bp will be global in nature.

Team Director for Quaybridge, Colin Morgan, commented: "It's fantastic to have the opportunity to support bp under this new agreement. The whole team is really excited at the prospect of continuing to deliver success in offshore wind development with such a capable and ambitious partner as bp."

Last year, bp formed a partnership with Equinor to develop offshore wind projects in the US, including acquiring a 50% stake in projects with a planned potential 4.4 GW gross generating capacity. With partner EnBW, it was named preferred bidder for two Irish sea leases in UK Round 4, with a total gross generating capacity of 3 GW. Onshore in the US, bp has a gross generating capacity of 1.7 GW, operating nine wind assets across the country. bp is currently bidding with partners to develop offshore wind off the coasts of Scotland and Norway.

Rapidly growing its renewables business is core to bp's strategy—by 2030 bp aims to have developed around 50 GW of net renewable generating capacity, up from 3.3 GW in 2020. The strategy also includes plans to increase bp's annual low carbon investment 10-fold, to around \$5 billion a year, and also reducing oil and gas production by around 40% from 2019 to 2030.



CHECK THE TECH

MESOBOT: SHINING A LIGHT ON THE TWILIGHT ZONE

The ocean's twilight zone (TZ), as the name suggests, is defined by the amount of light that penetrates the water above it, as opposed to any specific depth reading. It starts at approximately 200 meters below the surface and continues down to 1,000 meters, after which the so-called Midnight Zone begins. The twilight zone is home to abundant and diverse sea life, but it also plays a vital—and under-studied—role in removing carbon from the atmosphere, which in turn regulates the planet's climate.

Therefore, amid the mounting concern for ocean sustainability, an ongoing commitment to the scientific exploration and analysis of the ocean's twilight zone is of critical importance. But studying such vast expanses—over two-thirds of Earth's surface—poses obvious operational challenges. Recent advances in marine robotics look set to provide new solutions.

ROBOTIC SURVEILLANCE

One such robotic device is Mesobot, a new hybrid platform (which essentially means it can be piloted manually via a lightweight tether or autonomously without) that has been engineered to render a completely new perspective on life in the twilight zone by enabling operators to deploy cameras and lights to quietly shadow individual animals.

At 1.5 meters in length, Mesobot's streamlined form and quiet propellers allow the unit to hover and transit with minimal disturbance, ideal for tracking and recording slow-moving and fragile zooplankton, gelatinous animals, and particles in mesopelagic habitats, while its red lights—imperceptible to most species—enable authentic in-situ behavioral observation.

In addition to capturing high-quality images, Mesobot can carry a sampler as part of its payload to gather important scientific samples, such as environmental DNA (eDNA), which it collects by pumping seawater through filters.

Mesobot is housed in an hydrodynamically efficient yellow case and outfitted with a suite of oceanographic and acoustic survey sensors that allow it to track a target at depths of up to 1,000 meters (3,300 feet). This ability to follow a specific species for over 24 hours without the need for human intervention will deliver invaluable insight into animal behavior during diel vertical migration, known as "the greatest migration on Earth" because of the vast number and diversity of creatures that undertake it each night.



▲ Mesobot, an underwater robot capable of tracking and recording high-resolution images of slow-moving and fragile zooplankton, gelatinous animals, and particles, is providing researchers with deeper insight into the vast mid-ocean region known as the twilight zone. (Photo credit: Evan Kovacs/©WHOI)

MESOBOT: AT A GLANCE

UNIQUE CAPABILITIES » Mesobot can follow slow-moving animals automatically

OPERATIONAL CONFIGURATIONS » Tethered ROV or untethered autonomous vehicle

MAXIMUM DEPTH » 1,000 meters

ENDURANCE » Greater than 24 hours using lithium-ion batteries

CAMERAS » Two monochrome cameras for stereo imaging, 4K color video/still camera for scientific imaging

SIZE AND WEIGHT » 1.5 m (L) x 1.5 m (H) x 1 m (W), 250 kg

PAYOUT CAPABILITY » Up to 20 kg for added samplers and sensors

Speaking exclusively to ON&T, WHOI senior scientist Dana Yoerger said that Mesobot would prove instrumental to advancing scientific knowledge of the twilight zone:

"The need to better understand the specific behaviors, interactions, morphological structures, and the use of bioluminescence of midwater organisms for extended periods called for the custom design and development of a platform that was truly fit-for-purpose. Mesobot's unique ability to survey, track, and record compelling HD imagery will help us decipher the role these creatures play in transporting carbon dioxide from the atmosphere to the deep sea, as well as how the commercial exploitation of TZ fisheries might impact the marine ecosystem."

Mesobot is a collaborative initiative between Woods Hole Oceanographic Institution (WHOI), the Monterey Bay Aquarium Research Institute (MBARI), Stanford University, and the University of Texas Rio Grande Valley, and funded by the National Science Foundation and the Ocean Twilight Zone project.

Find out more here www.whoi.edu.

» In addition to capturing high-quality images, Mesobot can carry a sampler and sensors to gather critical scientific information. (Image credit: WHOI)

API ANALYSIS: US OIL & GAS INDUSTRY A DRIVER OF EVERY SECTOR OF THE US ECONOMY

The American Petroleum Institute (API) has released a new analysis of the natural gas and oil industry's impact on the U.S. economy and highlighted its importance to the nation's post-pandemic recovery. The study, prepared by PricewaterhouseCoopers (PwC) and commissioned by API, is based on the latest government data available at the state, national and congressional district level, showing that the industry is a driver of every sector of the U.S. economy and supports 11.3 million total American jobs in 2019 across all 50 states. The industry's total impact on U.S. GDP was nearly \$1.7 trillion, accounting for nearly 8% of the national total in 2019.

"As America's economy comes back, the natural gas and oil industry will serve as the foundation for long-term growth and prosperity," API President and CEO Mike Sommers said. "Every state across the country—both blue states and red states—rely on American energy to fuel each sector of the economy and support millions of U.S. jobs. This study reinforces that America's economic outlook is brighter when we are leading the world in energy production, and it serves as a reminder of what's at stake if policymakers restrict access to affordable, reliable energy and make us more dependent on foreign sources."

A subset of the study, produced for API and the American Exploration and Production Council (AXPC), also quantified the economic impacts of the onshore upstream subsector in 14 states. It found that the industry supported 3.2 million jobs across the economy, including 690,500 direct jobs.

"From West Virginia to New Mexico, domestic production of onshore oil and natural gas supports millions of good-paying jobs,



provides low-cost energy for American families and business, and ensures our country's energy security," said AXPC CEO Anne Bradbury.

As economic activity, travel patterns and consumption continue to grow during the post-pandemic recovery, the U.S. Energy Information Administration expects global oil and liquid fuels consumption to surpass 2019 levels in 2022. The PwC report demonstrates how the natural gas and oil industry is essential to economic recovery in other sectors, like manufacturing, agriculture, industrial and others, as well as opportunities for job creation. According to the findings, in 2019, the industry directly and indirectly:

- Supported **more than 11.3 million total jobs** or 5.6 percent of total U.S. employment.
- Generated **an additional 3.5 jobs elsewhere in the U.S. economy** for each direct job in the U.S. natural gas and oil industry.
- Produced **\$892.7 billion in labor income**, or 6.8% of the U.S. national labor income.
- Supported nearly **\$1.7 trillion to U.S. gross domestic product**, accounting for 7.9% of the national total.

VISION FOR FIRST LARGE-SCALE OFF-SHORE HYDROGEN PARK IN THE GERMAN NORTH SEA

Project partners RWE, Shell, Gasunie and Equinor signed a declaration of intent to further intensify their collaboration on the AquaSector project—the vision of the first large-scale German offshore hydrogen park. The project aims to demonstrate that in Germany offshore based hydrogen production enables an efficient, cost-effective and sustainable way to produce green hydrogen.

The AquaSector project intends to install 300-MW electrolyser capacity to produce up to 20,000 tons per year of green hydrogen offshore. The green hydrogen is planned to be transported via a pipeline, called AquaDuctus, to Heligoland starting in the year of 2028.

The partners see the AquaSector project also as a proof of concept for the realization of the AquaVentus vision of producing up to 10 GW of green hydrogen offshore by 2035 and transporting it via an extended pipeline to mainland Germany.

Compared to the transport of electricity generated offshore, the hydrogen production at sea and the transport via pipeline could offer clear economic advantages. The pipeline could replace five High Voltage Direct Current (HVDC) transmission systems, which would otherwise have to be built. It is by far the most cost-effective option for transporting large volumes of energy over long distances.



» The AquaSector hydrogen park. (Image credit: AquaVentus)

The first step in the AquaSector project for the partners is to carry out a detailed feasibility study. The study will provide important initial indications of the conditions under which the large-scale offshore hydrogen park can be successfully realized as well as the technical and commercial challenges which need to be overcome in regards to offshore hydrogen production.

AQUALISBRAEMAR LOC COMPLETES SABLE REMOVALS CAMPAIGN

AqualisBraemar LOC, the energy and marine consultants, has completed its assignment in connection with the decommissioning and removal campaign of the Sable Project off the coast of Nova Scotia, Canada.

AqualisBraemar LOC was appointed in 2017 by ExxonMobil to act as marine warranty surveyor to ensure the safe removal and transatlantic transportation of seven platforms including topsides and jackets with a combined total weight in excess of 45,000 mt.

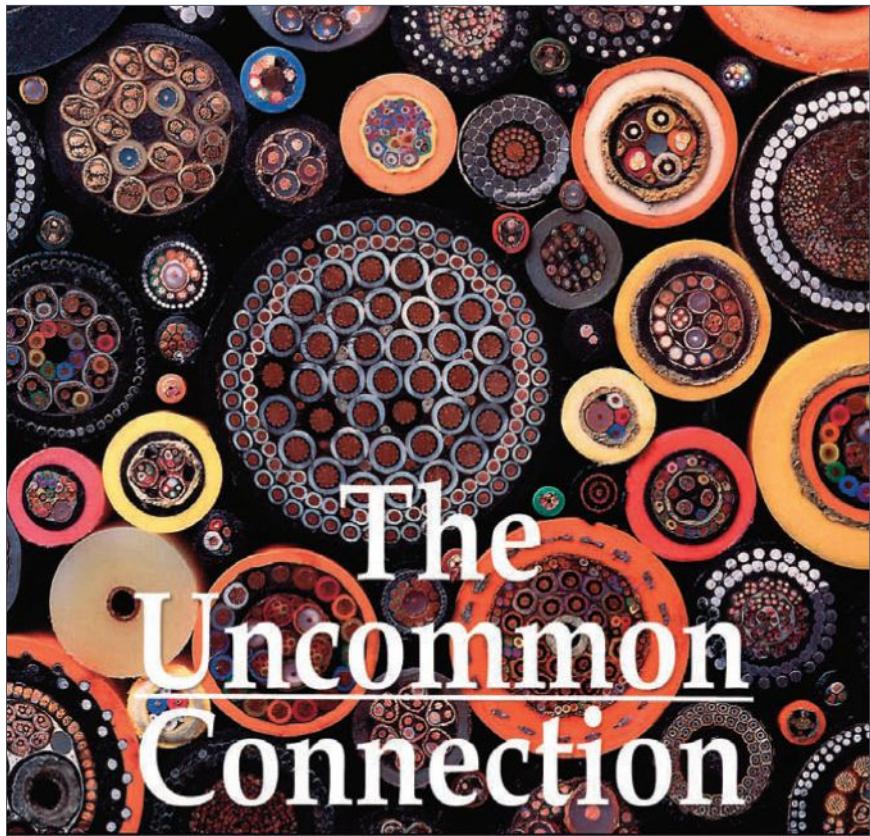
The work was led and executed by AqualisBraemar LOC's Canadian operation, with support from the group's global decommissioning team including the UK, for the load-in operations.

Over 6,000 hours in total were spent on the project, with the majority executed in 2020, in the midst of the pandemic. The last shipment arrived in the UK in early 2021. Ninety-nine percent of the material will be recycled.

"Sable was a large and complex project in that it consisted of seven platforms and subsea infrastructure at five different locations. Our global reach enabled us to provide a seamless transition of expertise, supporting the removal activities and load-in operations across the Atlantic, despite significant restrictions imposed by COVID-19," said Ewan Browell, head of AqualisBraemar LOC's Canadian operation.



» Sable Project decommissioning and removal, off the coast of Nova Scotia, Canada. (Photo credit: ExxonMobil Canada)



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» Left to right: Maersk Intrepid, Martin Linge, Floatel Endurance. (Photo credit: Jan Arne Wold & Øyvind Gravås / Equinor)

MARTIN LINGE OIL & GAS FIELD IN THE NORTH SEA COMES ON STREAM

The Martin Linge oil and gas field in the North Sea came on stream on June 30. The field is powered from shore, resulting in low CO₂ emissions, and operated from its onshore control room.

"This is a big day for everyone working on the Martin Linge project, for Equinor and for our partner Petoro. I would like to thank everyone who has worked hard to deliver this project," said Arne Sigve Nylund, Equinor's executive vice president for Projects, Drilling & Procurements.

Expected recoverable resources are approximately 260 million barrels of oil equivalent (boe). At plateau the field will produce around 115,000 boe per day.

"Martin Linge is an important contribution to Norwegian oil and gas production. Thanks to new infrastructure in this area it will be possible to realize new discoveries in the future. Equinor has formed a cross-disciplinary team who is looking into the opportunities of a wider area surrounding Martin Linge," said Rune Nedregaard, senior vice president for operations south of Exploration & Production Norway.

The Martin Linge platform receives power via the world's longest alternating-current sea cable measuring 163 kilometers from the onshore substation at Kollsnes in Western Norway.

The platform was connected to shore power in December 2018 and was soon followed by the storage vessel on the Martin Linge field. This is the world's first storage vessel receiving power from shore.

Martin Linge is also the first platform on the Norwegian continental shelf to be put on stream from shore. The production wells and processing plant are operated from the control room in Stavanger, and the offshore operators use tablets in the field to interact with their colleagues in the onshore control room and operations center. Onshore control room will reduce costs in the operating phase.

Equinor acquired Total's interests in the field in March 2018. At the same time, it took over the operatorship and responsibility for completing the field development project.

Approximately 2,500 people offshore and onshore have worked on preparing the platform for production. In general, offshore completion is challenging for a project extending over several winter seasons.

MALAYSIA TO LEAD GLOBAL OFFSHORE NATURAL GAS PRODUCTION FROM UPCOMING PROJECTS IN 2025

Malaysia is expected to contribute about 12% or 3.1 billion cubic feet (bcf) of global natural gas production in 2025 from key offshore planned and announced projects (new-build projects) that are expected to start operations between 2021 and 2025, according to GlobalData, a leading data and analytics company.

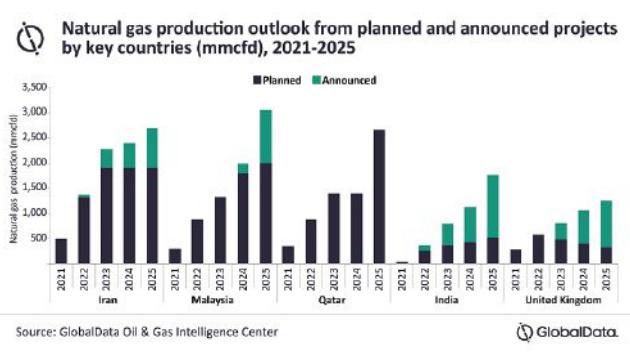
GlobalData's report, Global Offshore Upstream Development Outlook, 2021–2025 reveals that 2.0 bcf of natural gas production in Malaysia in 2025 is expected from planned projects with identified development plans, while 1.0 bcf is expected from early-stage announced projects that are undergoing conceptual studies and are expected to get approval for development. A total of 19 natural gas projects are expected to start operations in Malaysia during 2021–2025.

Of these, Kasawari, Jerun and B14 are some of the key projects that are expected to collectively contribute about 50% of the natural gas production in the country in 2025.

Effuah Alleyne, Oil & Gas Senior Analyst at GlobalData, commented: "The oil and gas industry has seen trends shifting towards the need for power sustainability, supported by impacts of the pandemic and governments globally contending with environmental and economic issues. Key themes including renewable energy, decarbonization and clean energy mean that natural gas projects will provide high valued opportunities in the short to mid-term."

GlobalData identifies Iran as the second highest country globally with 2.70 bcf of natural gas production in 2025 or about 11% of the total global natural gas production in the year. Qatar follows with natural gas production of 2.67 bcf from planned and announced offshore projects in 2025.

Among the companies, Qatar Petroleum, National Iranian Oil Co, and Royal Dutch Shell Plc lead globally with highest offshore natural gas production of 2.6 bcf, 2.4 bcf and 1.2 bcf respectively, in 2025 from planned and announced projects.



REM OFFSHORE AND VARD SIGN CONTRACTS FOR 2+2 CONSTRUCTION SERVICE OPERATIONS VESSELS

VARD, one of the major global designers and shipbuilders of specialized vessels, and the Norwegian shipping company Rem Offshore, have announced the contracts of two Construction Service Operations Vessels (CSOVs) with an option for two additional vessels.

The CSOVs are tailor-made for worldwide services and maintenance operations at offshore wind farms. The VARD 419 design, developed by Vard Design in Ålesund, Norway, is a highly versatile platform for all offshore windfarm support operations, focusing on onboard logistics, security, comfort, and superior operability.

The first vessel will be delivered from VARD in Norway in first half of 2023. The hull will be built at Vard Braila in Romania. The second vessel will be built and delivered by Vard Vung Tau in Vietnam, scheduled for delivery in 2024. VARD's specialized high technology subsidiaries will be involved with major deliveries onboard, and in the shipbuilding process of the vessels.

Rem Offshore's Chairman, Aage Remøy said: "Rem Offshore has during the last few years increasingly focused attention on building a sustainable platform for growth in offshore wind. Our shareholders are



driving this development together with our Rem colleagues onshore and offshore. We are proud to continue our newbuild programme in Norway and support the local maritime industry."

VARD CEO Alberto Maestrini added: "We are proud to be chosen as the preferred partner for Rem Offshore in this exciting project, and we are looking forward to working together with their team. These contracts confirm VARD's leadership in the CSOV market, both in terms of innovative ship design, breakthrough technologies and shipbuilding quality."

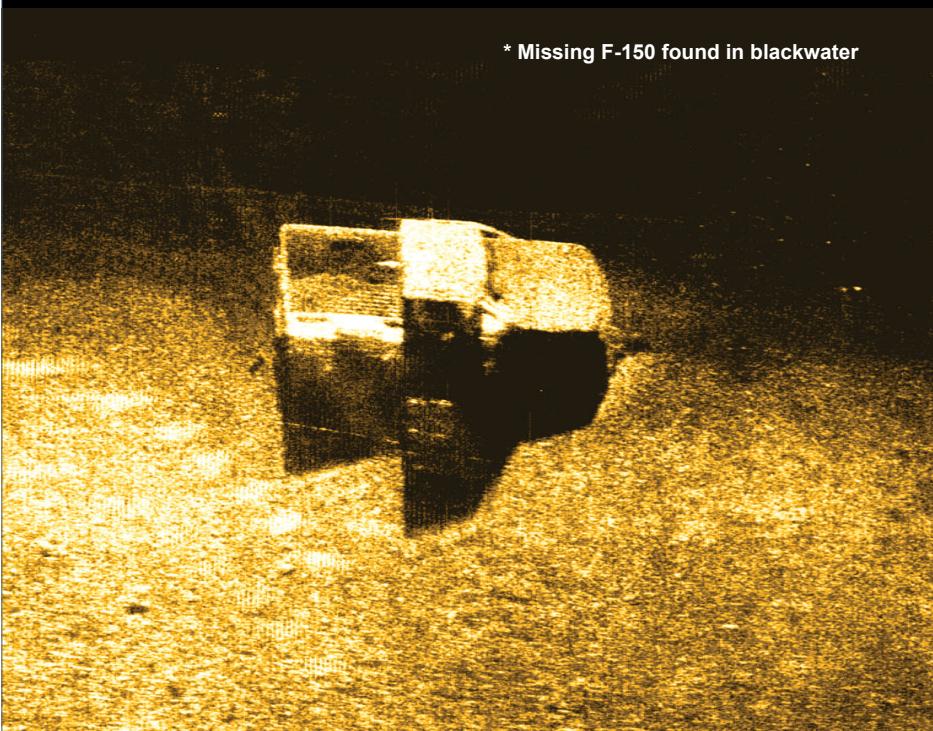
With a length of 85 meters and a beam of 19.5 meters, the vessels will have a height-adjustable motion-compensated gangway with elevator system, a height-adjustable boat landing system, and a 3D-compensated crane. The CSOVs will have an accommodation for 120 persons.

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THE FIRST PORT ON THE JOURNEY TO AUTOMATION



By Adam McConnell,
Head of Product Marketing,
Cathx Ocean



» CATHX FDI® Seabed can be deployed across a wide range of ROV's, AUV's and ROTV's. (Image credit: Cathx Ocean)

Have you ever wondered how to significantly reduce the amount of vessel time required to conduct inspections on seabed assets? How can you both mitigate risk and minimize your carbon footprint when inspecting subsea elements? Is there a way to do all this while also capturing the sorts of superior image and measurement data that allow you to make informed decisions in the maintenance of your seabed assets?

Cathx Ocean, an Irish company founded in 2009, is a leading global innovator in the subsea imaging and measurement industry and is poised to bring CATHX FDI® Seabed to

market in August 2021, a full service offering that covers a wide range of optical surveys on assets, organic life and area surveys of the seafloor. CATHX FDI® Seabed can be deployed across a wide range of ROV's, AUV's and ROTV's.

WHAT IS FDI®?

CATHX's Fast Digital Inspection (FDI®) is a complete suite of subsea optical survey solutions enabling superior surveys of underwater assets such as Oil & Gas pipelines, Subsea Cable Routes, Offshore Wind Energy, Marine Environments, Deep Sea Mining, Defense, Law Enforcement and Fisheries industries.

Cathx Ocean has been developing FDI® technology in the field over the past two years to substantially improve subsea optical imaging for ROV and AUV systems. The proprietary and patented technologies allow imaging of large areas at high speed, radically reducing the vessel time required to perform surveys in a range of applications by over 80%.

REDUCING COSTS, CARBON & RISK

CATHX FDI® Seabed systems deployed on multiple pipelines in the North Sea conducted optical surveys on 300 km of pipeline in 6 days instead of 36 days. This significantly reduced vessel time required with a Work



» CATHX FDI® Seabed systems offer a complete suite of subsea optical survey solutions enabling superior surveys of underwater assets, such as O&G pipelines. (Image credit: Cathx Ocean)

Class ROV travelling at 2 knots. With the running of ships costing up to €100,000 per day, reduced time at sea with CATHX FDI® Seabed creates substantial cost savings for business unit owners as well as greatly reducing environmental impact. As the time required to conduct subsea surveys is considerably reduced, CATHX FDI® Seabed requires less in-field personnel and so diminishes human risk during deployment.

SUPERB IMAGE & MEASUREMENT QUALITY

The Visual Perception hardware allows for the survey vehicle to capture high quality UHD imagery with accurate measurable laser data at speeds of 5 knots and larger areas than traditional video techniques. CATHX FDI® Seabed systems capture visual data in a unique way, allowing the survey vehicles to travel faster than previously thought possible with video inspections and improves the quality of the data captured. All of this is achieved with precise time synchronization. The lighting is activated at the exact moment the camera captures an image, and the lasers fire when the lighting is off. This approach allows tight spatial co-registration of image and laser data and is the key to facilitating rapid deliverable generation as well as automation. The strobe lighting provides a large increase in lumen output in comparison to standard ROV lighting. This almost eliminates motion blur as well as overcoming the traditional poor visibility when it comes to the impact of debris, meaning larger areas of data can be collected at greater fly heights. The CATHX FDI® Seabed systems not only deliver Ultra High Definition 2D Imagery, but also 3D Point cloud laser data that can be easily inspected using Integrity Management Software such as Eiva, Navimodel, QPS, Ginsy, and Fugro Starfix.

DESIGNED FOR THE CUSTOMER'S FUTURE

CATHX FDI® Seabed hardware technology has been designed to integrate with all ROV's and AUV's on the market. In addition, Cathx are building application specific solutions for un-crewed and autonomous vehicles, the CATHX FDI® Seabed offering today is the first Port on the way to being the ideal solution for the AUV's of the future.

The CATHX FDI® SEABED proposition is available to Cathx Ocean clients as a single project offering called CATHX FDI® SEABED SERVICE, or a multi-year licence based offering called CATHX FDI® SEABED SOLUTION.

The CATHX FDI® SEABED SERVICE allows for the integration assessment for the ROV and the configuring of the image and measuring system based on your specific survey requirements. From the initial planning session through to the reporting on the Data Inspection, the Cathx Ocean Operations team is available to support and guide clients to obtain the clearest visualization of their seabed resources or assets.

Cathx Ocean's aim is to provide clients with real value when employing CATHX FDI® SEABED SOLUTION. This multi-year licensed solution is offered when buyers are considering servicing multiple clients in a specific region, offering the full benefits of the CATHX FDI® SEABED SOLUTION but over a 1 – 5-year period.

CATHX FDI® SEABED SOLUTION allows the buyer to diffuse the cost of the service in their OPEX budgeting rather than through CAPEX outlays; by spreading this investment over a predetermined timeframe, Cathx FDI® SEABED SOLUTION offers clients a more flexible and cost-beneficial proposition.

It also allows the buyer to take advantage of the latest perception systems and software releases as they come to market, but clients will additionally be able to compare their asset data year on year, or mission by mission.

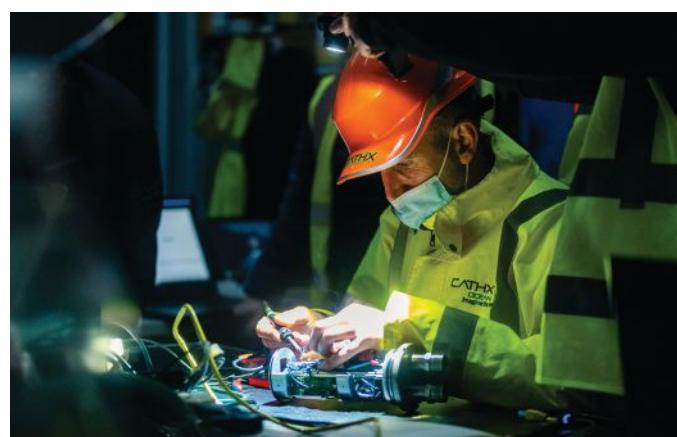
Like all businesses, Cathx Ocean had to reevaluate how to deliver hardware and services to customers amid the advent of COVID-19. "When COVID-19 happened, we had to go back to the drawing board as to how we not only sold but delivered our products and services to our clients." According to Cathx Ocean founder and CEO Adrian Boyle. "Fast Digital Imaging has been created during field tests, four years of development and in collaboration with our clients to help them conduct their seabed inspections and asset surveys quicker, safer whilst delivering the best visual data of their assets. This provided them with the strongest and clearest data to help them maintain their assets and assist reducing their expenditure and carbon footprint."

CATHX FDI® Seabed is just the first port in our journey and commitment to delivering the ability for asset owners and AUV and UUV operators to avail a fully autonomous and uncrewed visual perception and inspection service. All areas of the Cathx Ocean business are working towards developing the next generation of hardware, operational and support services to make capturing ocean data a faster, more cost effective, more carbon conscious and safer proposition.

To find out more information about CATHX FDI® Seabed, visit cathxocean.com or contact the sales team at sales@cathxocean.com.



» The CATHX FDI® Seabed systems not only capture Ultra High Definition 2D Imagery, but also 3D Point cloud laser data that can be easily inspected using Integrity Management Software. (Image credit: Cathx Ocean)



» From planning through to reporting, the Cathx Ocean Operations team is available to support clients to obtain the clearest visualization of seabed resources. (Image credit: Cathx Ocean)

ROTECH SUBSEA COMPLETES 2ND PHASE CABLE TRENCHING SCOPE AT TAIWAN OWF

Subsea controlled flow excavation (CFE) and suspended jet trenching innovator, Rotech Subsea, has completed the second phase of major trenching scope of works at a state-owned offshore wind farm in Taiwan.

Rotech Subsea returned to Taiwan waters in Q2/3, 2021 for a Tier 1 offshore energy construction giant—and long-term European client—for Phase 2 post-lay trenching works at the state OWF. Phase 1 works at the site had been successfully completed in Q2/3, 2020.

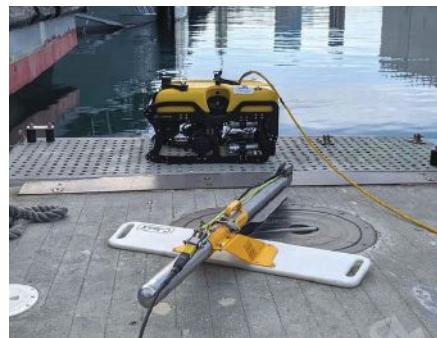
The scope of work consisted of burying the remaining 10 cables on site to 2 m TOC, meaning a total of 21 cables (4 export and 17 array) had been buried to client specification. Rotech Subsea's state-of-the-art TRS1 and TRS2 tools CFE tools were mobilized on a support vessel using its 400-t crane. Operating in water depths of between 20-30 m, soil conditions experienced ranged from soft sand to slightly stiff clay.

The 10 array cables were buried to client specification with ease with Rotech Subsea's TRS1 excelling, lowering the cables to client spec in one pass at 2 m/min. A second pass—requested by the client as a flushing pass—was carried out at 4 m/min. The TRS2 lowered the cable with three passes at an average rate of 3 m/min.

SEAMOR MARINE ROV LOCATES AND SURVEYS DOWNED CARGO PLANE OFFSHORE HAWAII



» The downed Transair flight 810. (Photo credit: SEAMOR Marine)



» SEAMOR Marine's Chinook ROV. (Photo credit: SEAMOR Marine)

In mid-July, SEAMOR Marine's Chinook ROV was used by Honolulu-based Sea Engineering, Inc. to help locate and survey a downed Boeing 737 cargo plane. The plane crashed shortly after takeoff about two miles offshore from Ewa Beach in Oahu, Hawaii, and sank to the seafloor at a depth of 350 to 450 feet—a depth too dangerous for divers to navigate. The only two passengers onboard Transair flight 810, both pilots, were rescued by helicopter.

"We're proud of the seasoned Sea Engineering, Inc. crew that was able to safely and efficiently take on this mission and locate the wreckage within a week of the National Transportation Safety Board arriving in Honolulu," said Robin Li, President of SEAMOR Marine. "Our Chinook ROV's rugged design and powerful thrusters are made for depths and harsh sea conditions like these. The main standard-definition camera, with 180-degree rotation and 30x zoom capability, brought the submerged aircraft clearly into focus with exceptional detail."

"This and other successfully completed scopes of work in the Asia-Pacific region firmly establishes Rotech Subsea's CFE suite of tools as the method of choice for cable trenching in the region," said aid Director of Subsea, Stephen Cochrane. "Our experience and performance in these scopes mean we are now seeing more and more that our Suspended Jet Trenchers are being chosen as a primary method for trenching, over other contact trenching systems and ploughs. Because of the enhanced capabilities of the RS tools, they can provide deeper and narrower trenches than ever before, with trenching speeds more than double that of competing Mass Flow Excavation tools."

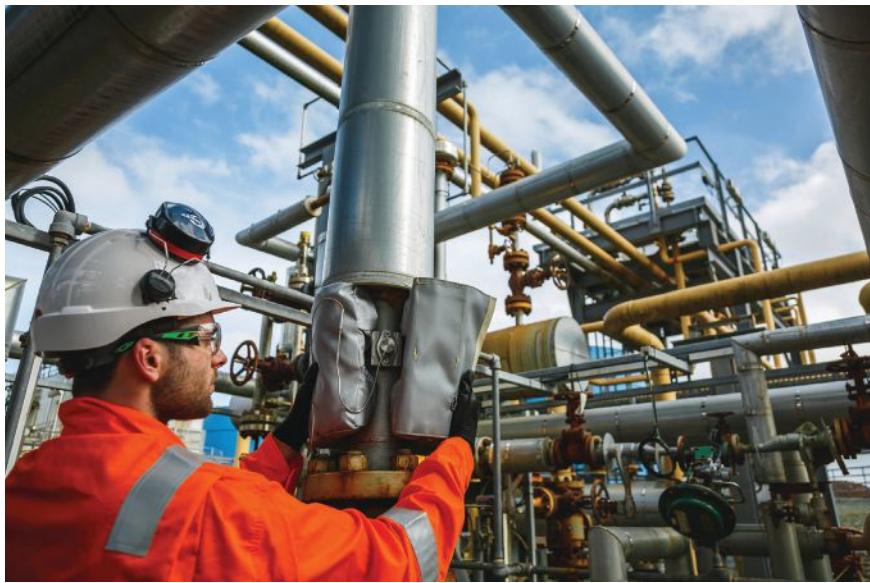


» Rotech Subsea's TRS1 and TRS2 tools CFE tools were mobilized on a support vessel using its 400-t crane. (Photo credit: Rotech Subsea)

Sea Engineering, Inc. used their 43-foot workboat, Huki Pono, for the ROV operations to locate and survey the wreckage, which included the airplane's wings and tail, both engines, and forward fuselage.

"Our team was able to mobilize the ROV onto our vessel within one day of 'Notice to Proceed.' The SEAMOR Chinook played a key role in our ability to locate and survey the plane, at a final depth of 350 to 450 feet below the surface," said Andrew Rocheleau, President at Sea Engineering, Inc.

"The Chinook continues to be dependable, fast to mobilize and produces quality data for all of our projects in the Pacific region—from wave energy to the offshore oil and gas, geophysical surveys and marine pollution, and emergency salvage and response," Mr. Rocheleau added.



OCEANEERING SECURES THREE-YEAR INTEGRITY MANAGEMENT SERVICES CONTRACT IN PNG

Oceaneering International, Inc. announces that its Integrity Management and Digital Solutions (IMDS) segment has won a new multi-year contract in Papua New Guinea (PNG) with a major operator.

The contract is for a duration of three years plus two one-year extensions. The scope of work, which is already underway, includes conventional and advanced non-destructive testing, on-site inspection, data services, monitoring and diagnostic services, integrity management, and integrity engineering services for both brownfield operations and greenfield projects, both onshore and offshore.

The work will take place across multiple sites in PNG. Oceaneering is using a diverse workforce to deliver this work scope including PNG nationals. The project will be supported by Oceaneering's Australian and Indonesian operational bases.

Roy Andrich, Regional Director for IMDS in APAC, Oceaneering, stated: "The award and subsequent transition of this project demonstrates Oceaneering's ability to successfully manage large transitional projects against external challenges such as COVID-19 and international travel restrictions. The transition was completed safely, on-time, and on budget without any impact to ongoing operations. We look forward to building upon our collaborative relationship with our valued client as well as further developing local PNG talent."

Oceaneering is a global provider of engineered services and products, primarily to the offshore energy industry, with a focus on deepwater applications. Through the use of its applied technology expertise, Oceaneering also serves the defense, aerospace, and entertainment industries.

TORTUGA ROVS CHOSEN FOR PANAMA CANAL INSPECTION

In charge of the management, maintenance and modernization of the Panama Canal, the Panama Canal Authority (ACP) recently launched a competitive tender to replace their aging ROVs. Subsea Tech was awarded the contract to supply 2 Tortuga ROV units fitted with several accessories and sensors.

The Panama Canal is 77 km long and crosses the Isthmus of Panama in Central America, connecting the Pacific and Atlantic Oceans. It is fed by Lake Gatún, whose water is used to fill/empty several successive locks located at the junctions with the 2 oceans. The fluidity of ship traffic in the canal is therefore directly dependent on the proper lock operation. As part of its responsibilities, ACP must regularly inspect the infrastructures—integrity of the lock gates, presence of debris, structural condition of pipes and valves feeding the locks—in order to maintain them in optimal operational conditions.

The Tortuga is a lightweight and compact ROV offering the capacities of an inspection-class vehicle and capable of operating in highly variable current and visibility conditions. Its large payload capacity allows the simultaneous integration of numerous accessories and sensors, such as imaging sonar, USBL positioning system, DVL, manipulator, etc. It is therefore perfectly suited for the inspection missions expected by ACP.

In April 2021, a team of 8 people from ACP participated in a training provided by Subsea Tech and its local partner Robotic Subsea Services (RSS), specialized in ROV services in Panama and sub-region.



» The lightweight and compact Tortuga ROV. (Photo credit: Subsea Tech)



» ROV inspection is critical to the burgeoning aquaculture industry in Chile. (Photo credit: Mariscope Meerestechnik)

AAE TECHNOLOGIES AND MARISCOPE REACH 25 USBL SYSTEM INTEGRATIONS MILESTONE

German ROV manufacturer Mariscope Meerestechnik's recent delivery of an applied acoustics Alpha USBL system marks a significant milestone in their partnership with applied acoustics and the aae technologies group, as it's the 25th such system that Mariscope has acquired for integration into their renowned range of subsea vehicles.

Established in 1994 by Christian Haag, Mariscope has become a leading name in the field of ocean robotics and, like aae technologies, proudly promotes its independence and flexibility. In a relationship spanning several years, aae technologies and Mariscope have developed a good understanding of each other's businesses, enabling the continual and seamless supply of appropriate USBL systems for Mariscope's engineers to incorporate into the ROV's at factory level.

The bulk of these systems have been shipped to Mariscope's South American subsidiary, Mariscope Ingenieria based in Puerto Montt, Chile, in support of the region's burgeoning aquaculture industry, an industry that relies heavily on ROV intervention for the inspection and cleaning of salmon enclosures and their mooring lines. USBL tracking is a critical feature of these inspections as it gives the operators and service providers real time positional data of the vehicles as they carry out their surveillance.

With Chile being the second largest producer of salmon in the world, the Chilean Government is constantly updating its regulations and environmental standards, including a shortening of the time intervals between inspections and a requirement to log accurate positional records showing the areas of ROV inspections. It's in this area where Mariscope are perfectly placed to lead the way in servicing this industry, technologically and geographically.

aae technologies Business Development Manager Gavin Willoughby commented: "I've witnessed first-hand Mariscope's operation in Chile, and have seen the quality of service and support given to the local industry, something that aligns perfectly with our own culture. I'm very proud that we continue to be a part of the Mariscope success story, and I look forward to many more years of successful cooperation."

UNI-PACT USV EMPOWERS FMS NEXT-GEN SURVEY WORK

Unique Group has successfully supported First Marine Solutions' (FMS) Survey and Positioning Business line, and their end client Well-Safe Solutions, in completing a cutting-edge, carbon-conscious debris survey in the Port of Cromarty Firth, Scotland, using Unique's proprietary USV, Uni-Pact.

Uni-Pact's innovative design reduced the process complexity, offering a lightweight and easy-to-deploy solution. Delivered to the project location at Saltburn Pier fully mobilized and calibrated, the vessel was deployed in under an hour, completing the full scope of work in less than 90 minutes.

Uni-Pact's control interface enabled the surveyor to work remotely from Copenhagen, Denmark, with onsite support at Cromarty including the launch and recovery implementation, as well as communication coordination and safeguarding visual oversight of operations provided by FMS's Survey Engineer and Unique Group's USV Pilot/Engineer.

Carl Lafferty, Survey and Positioning Manager at First Marine Solutions, said: "FMS has a clear determination to operate world leading technology to reduce overall cost for our clients, whilst lowering the HSE and environmental impact and producing paper free, modern survey data deliverables. We are delighted to have partnered with Unique Group in delivery of this debris survey project, with Uni-Pact allowing us to complete the campaign in an efficient and environmentally friendly manner."

David Rennie, ASV Global Technical Manager at Unique Group, added: "FMS and Unique Group are extremely pleased with the survey data results and Uni-Pact's performance in this project. With a varied range of unmanned vessels in our rental asset pool, the extent of operations we can perform to increase productivity, efficiency and safety in operations is maturing."



» Uni-Pact performing autonomous survey at the Port of Cromarty Firth, Scotland. (Photo credit: Unique Group)

SUBSEASAIL AWARDED SBIR PHASE 1 GRANT FROM DEPARTMENT OF ENERGY

SubSeaSail, LLC (SSS) has been awarded a Small Business Innovation Research (SBIR) Phase 1 grant from the Department of Energy (DoE) Water Power Technologies Office (WPTO). It was one of twelve companies selected from nine different states, based on their proposals and ability to impact the future of marine energy.



» SubSeaSail's semi-submersible, monohull design will incorporate a Passive Acoustic Array and magnetometers

The SubSeaSail one-year grant is for \$206,500 which will be used to create a low-cost, user-friendly environmental monitoring vessel for offshore marine energy sites. The vessel will be designed to work on the surface and continue to monitor and measure when submerged down to 30 meters. The vessel will be based on the company's patented semi-submersible, monohull design and incorporate a unique SSS developed Passive Acoustic Array to monitor underwater soundscapes and 3rd party magnetometers to measure electro-magnetic fields generated by in-water hydrokinetic installations.

The ability to autonomously provide near and far field monitoring from a 100% renewable energy vessel that can sail to locations, maintain position, submerge for periods of time to listen/measure/monitor, return to the surface to monitor while re-charging batteries, transmit data, and remain at sea for extended periods for a fraction of the cost of other systems will be unique. This configuration will also have a variety of additional applications across academia, government, military and the private sector.

www.subseasail.com

FUGRO REVOLUTIONIZES SUBSEA INSTALLATION FOR GUPCO IN EGYPT

Fugro has revolutionized a subsea installation program for Gulf of Suez Petroleum Company (GUPCO) with its innovative QuickVision® technology. Used for the first time in Egypt, the contactless positioning solution replaced the conventional survey sensors typically attached to subsea structures during installation.

Under a contract with Dragon Oil (GUPCO), Fugro delivered subsea positioning support for the installation of multiple subsea structures off the coast of Egypt. To meet the requirements for improved safety and lower project costs, Fugro deployed their Quick Vision solution. This state-of-the-art vision technology uses a smart camera, attached to a remotely operated vehicle, that can determine the heading and attitude of a subsea structure as it is landed. This eliminates the requirement to pre-install a sensor package on the structure, and retrieve it once installation is complete, which reduces the time and costs associated with a dive support vessel.

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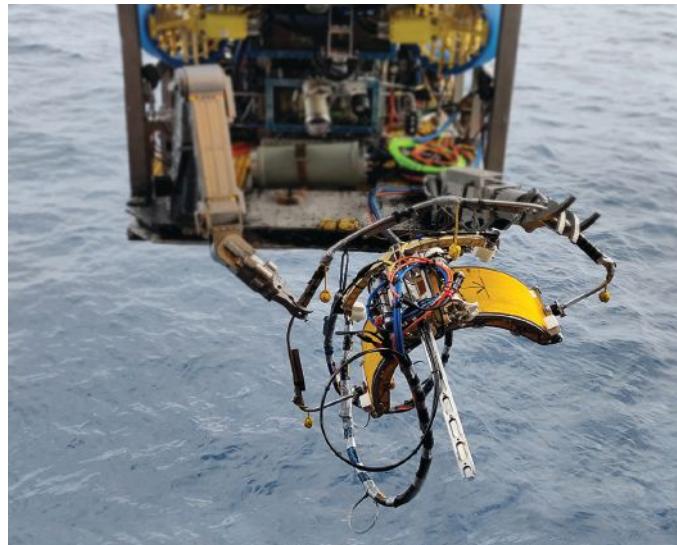
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TSC SUBSEA'S NEW ARTEMIS® vCOMPACT FOR TIGHT ACCESS INSPECTIONS

TSC Subsea, global specialist in developing advanced subsea inspection solutions for challenging situations, has designed a new ROV-deployed automated scanning tool which addresses the issue of carrying out tight access field joint inspection through difficult to penetrate pipeline coating.

The ARTEMIS® vCompact, a smaller, lightweight, more-flexible version of the standard ARTEMIS®, was designed, developed and built by TSC Subsea's engineers to work in tandem with inspection class ROV for the remote inspection of pipelines and structures.



» ARTEMIS® vCompact. (Photo credit: TSC Subsea)

SUBSEA 7 AWARDED MAJOR CONTRACT BY AKER BP OFF-SHORE NORWAY

Subsea 7 has been awarded a significant contract by Aker BP for the Kobra East Gekko (KEG) field development, located in the Alvheim area of the North Sea.

The project involves a subsea tie-back of approximately 8 kilometers to the Alvheim FPSO, via the existing Kneler B subsea manifold. The contract scope includes engineering, procurement, construction and installation (EPCI) of the pipelines, spools, protection cover and tie-ins using key vessels from Subsea 7's fleet. The production pipeline is a pipe-in-pipe design.

Project management and engineering will commence immediately at Subsea 7's offices in Stavanger, Norway. Fabrication of the pipelines will take place at Subsea 7's spoolbase at Vigra, Norway and offshore operations are expected to take place in 2022 and 2023.

It was designed and built in a turnaround time of less than six weeks to meet the precise requirements of a project for Beach Energy in Australia's Bass Strait, to carry out wall thickness inspection on the 20" Otway pipeline near the Thylacine A platform.

The location of the pipeline joints required the inspection to be conducted remotely within a very narrow field joint section which was too confined for the standard ARTEMIS®. The solution, in the form of the ARTEMIS® vCompact, was developed.

Its design incorporates TSC Subsea's industry-leading Acoustic Resonance Technology (ART). ART is the only high-resolution technology that penetrates and inspects through thick subsea coating with lightweight, high-precision 3-axis scanning to produce high accuracy wall thickness measurements and corrosion mapping.

Strong magnetic feet fix the scanner firmly in position. The ROV then detaches and stands off, negating the need for it to hold station accurately for long periods of time. The tooling utilises motorised and encoded manipulators which enable the probe to accurately follow the areas to be inspected. Inspection data is transferred to a topside computer and can be analysed from anywhere in the world.

"The ARTEMIS® vCompact successfully completed its operations for Beach Energy with flying colours, with all inspections being performed within two days," said Stephan Freychet, Senior Project Manager. "All the data from the remote inspection was analysed remotely by a team in Norway."

"Having proven its credentials, there is huge potential for its use in and around subsea structures and pipelines where accurate remaining wall thickness measurements are critical for safe operations."

www.tscsubsea/artemis-vcompact



Monica Bjørkmann, Vice President for Subsea 7 Norway commented: "This award continues our long-standing collaboration with Aker BP, through the Aker BP Subsea Alliance. The partnership enables Subsea 7 to engage early in the field development process, optimizing design solutions and contributing to a positive final investment decision. Subsea 7 looks forward to continuing our alliance with Aker BP for the KEG field development, with a focus on safe, efficient and reliable operations."



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» Global Marine's cable maintenance vessel, Cable Retriever. (Photo credit: Global Marine)

SEAIOCMA EXTENDS CABLE MAINTENANCE DEAL WITH GLOBAL MARINE

Global Marine, part of the Global Marine Group, has been awarded a contract extension of SEAIOCMA (South East Asia and Indian Ocean Cable Maintenance Agreement) for another five years, running until December 30, 2025.

Global Marine has been providing maintenance services continuously to SEAIOCMA since its inception in 1986. During that time, Global Marine has completed more than 600 repairs, and the fiber network included within the zone has expanded from 34,000 kilometers of cable maintained to today, where it encompasses more than 120,000 kilometers.

The SEAIOCMA zone agreement, a co-operative club managed by 45 cable owners, provides the repair of submarine cables that carry international telecommunications traffic. SEAIOCMA spans the area between Djibouti in the west, Perth in the south, Guam in the east and the northern tip of Taiwan.

A depot constructed in 2019 by Global Marine located in Subic Bay, Philippines, provides a strategic base for Global Marine's cable maintenance vessel, *Cable Retriever*, which serves the zone year-round. The depot is ideally situated to facilitate rapid response times for vessel mobilization within 24 hours of call-out, with spare cable and other essential kit on hand to complete system repairs.

The extension of the SEAIOCMA agreement, renewed on January 1, 2021, demonstrates the continued customer recognition of Global Marine's reliability in support of long-term contracts,

as well as its ability to deliver leading subsea maintenance to customers globally.

"There is no greater endorsement of success than a contract extension from an existing customer," said Bruce Neilson-Watts, Managing Director of Global Marine. "We are delighted that SEAIOCMA has again placed confidence in our capabilities to deliver a high standard of operational repairs."

Over our long and successful history together, Global Marine has established an impressive track record as a trusted, reliable partner with SEAIOCMA. This is primarily due to our resilient, flexible approach to fiber optic cable system maintenance and repairs, as well as our innovative subsea engineering solutions that deliver results against technical challenges, ensuring minimal disruption to operations."

Joshua Ang Joon Ping, Chairman of SEAIOCMA said: "I am extremely pleased that it has been possible to agree terms and conditions with Global Marine, ensuring the SEAIOCMA region will continue to receive a high level of maintenance cover. This is particularly key given the ongoing global pandemic, and the increasing dependence placed on the subsea telecommunications network to enable digital connectivity."

KRAKEN AWARDED RaaS CONTRACT FOR SUBSEA CABLE SURVEY

Kraken Robotics Inc. has been awarded a Robotics as a Service (RaaS) contract from Newfoundland and Labrador Hydro (formerly Nalcor Energy) for the Marine Inspection of Strait of Bell Isle Submarine Cable. This cable provides power to Newfoundland from Labrador.

Under the contract, Kraken will deploy its KATFISH™ towed SAS sonar system including our Automatic/Remote Launch and Recovery System (ALARS) deployed on the R/V Ocean Seeker. This contract will be executed in Q3, 2021.

The Strait of Bell Isle (SOBI) cable crossing design consists of three HVDC cables installed in three HDD cable conduits on



» Kraken's Ocean Seeker is a 72-foot high-speed catamaran equipped with the Kraken KATFISH™, Tentacle Winch™, and ALARS. (Photo credit: Kraken Robotics)

DEME INSTALLS FIRST SUBSEA CABLE USING LNG-POWERED SHIP

In a groundbreaking project, DEME Offshore has successfully installed the DolWin6 High Voltage DC (HVDC) cable in the North Sea deploying its DP3 vessel *Living Stone*. This is the first time a cable laying vessel has installed cables while powered on LNG, dramatically reducing emissions.

Living Stone picked up the cables directly from the Nexans manufacturing facility in Halden, Norway, at the beginning of June and transported them to the offshore site in the German Bight. DEME's dedicated

vessel showcased its unique capabilities. *Living Stone* has two turntables so it is ideally suited for installing bundled HVDC cables. The HVDC cable pair was bundled together with the fiber optic cable on board *Living Stone* and seamlessly installed.

DolWin6 has a transmission capacity of 900 MW and is owned and operated by transmission system operator TenneT. The HVDC cable runs from several offshore wind farms in Germany via Norderney to German mainland.

each side of the SOBI that protect the cable from icebergs. Each cable is routed along the seabed between the conduit exits on the seafloor from Shoal Cove to Forteau Point, Newfoundland and Labrador. Under the contract, Kraken will survey the three cables along the crossing. Each cable route is approximately 31 kilometers long with 27 kilometers laying on the seabed and 4 kilometers protected by cable conduits. Kraken's Synthetic Aperture Sonar (SAS) technology will provide ultra-high 3cm resolution seabed imagery and 3D 25 cm resolution bathymetry.

The R/V Ocean Seeker is based out of the Kraken facilities in Dartmouth, Nova Scotia. The Ocean Seeker is a state of the art 72-foot high-speed Catamaran Survey vessel which holds the Kraken KATFISH™, Tentacle Winch™, and ALARS. Due to the KATFISH's ability to process SAS data in real-time, data will be instantly viewable onboard the vessel during the survey and any cable or rock berm anomalies identified will be geolocated providing the ability to collect additional data as needed. During these survey operations, the Ocean Seeker will perform 12-hour daily operations of the SOBI submarine cables.

Kraken has tested and validated a robust positioning solution consisting of a tightly integrated Ultra Short Baseline (USBL) and Inertial Navigation System (INS) solution, based on iXblue GAPS USBL (on vessel) and iXblue PHINS C3 INS (on KATFISH™). The iXblue GAPS USBL acoustically tracks the position of the KATFISH™, and automatically provides position updates to the iXblue PHINS C3 INS installed in the KATFISH™, via Ethernet communication (over the fiber optic tow cable). The vessel is positioned using a Hemisphere A222 with RTL corrections.

The KATFISH™ Navigational System includes a sophisticated Fiber-Optic Gyro (FOG) based INS, aided by a Doppler Velocity Log (DVL) and Depth Sensor integrated into the KATFISH™ towbody and a FOG-aided USBL positioning system integrated on the tow vessel.



» DEME Offshore's DP3 vessel *Living Stone*. (Photo credit: DEME Offshore)

Bart De Poorter, General Manager DEME Offshore Renewables, said: "We are pleased to see another campaign successfully concluded by our cable installation vessel *Living Stone*.

Carrying out the project on LNG is another major milestone, highlighting once more the unrivalled technical capabilities of *Living Stone* and its crew."

DLM HAS CUSTOM BUILT A HOLD BACK TENSION ELEMENT FOR NKT

Dynamic Load Monitoring (UK) Ltd. (DLM) has expanded its already extensive range of line tension measurement technology, with a new device for measuring tension and creating holdback force on a single piece of subsea cable.

The product, which combines the established Saddleback product from DLM's catalogue with an additional Hold Back Tension element, is being primarily used by the vessel NKT Victoria, with further devices in the pipeline for a number of customers.

When consulted about a solution for measuring line tension and creating a holdback force for a cable lay project, DLM, a specialist in the design, manufacture, repair and calibration of load cells and load monitoring equipment, devised the Saddleback Holdback Tensioner (SB-HBT).

The SB-HBT works by creating additional line tension on the subsea cable running through it, specifically for bundled cable lays. A Saddleback can measure line tension from 0 to 5,000 kg and is suited for more delicate cable, including telecommunication cables or large cable where a Running Line Monitor is unsuitable. Moreover, a twin pair of Dunlop 18 x 7 SMO LCE tires are connected to a hydraulic cylinder to clamp the two wheels

together, and a disc braking system is used to control the rotational speed of the wheels on the SB-HBT. The device can create 750 kg of clamping force between the wheels and holdback 500 kg of line tension. On the top wheel there is an encoder to measure speed and distance.



» An Enerpac cylinder compresses the top and bottom wheels together. (Photo credit: DLM)

Chris Scrutton, technical manager at DLM, said: "This is the first requirement we have had [for the SB-HBT] but we have discussed it with other potential customers; this seems to be a reoccurring problem aboard vessels. It can be used when a cable laying vessel is completing a new lay project, and needs to control the departure speed to small diameter

cables being bundled alongside larger cable diameters. The reason for doing this is that the small diameter cable often does not bundle tightly enough with the larger diameter cables and can run free of the bundle when departing off of the vessel."

In this instance, NKT, a provider of turnkey cable solutions that meet the ever-growing demand for power, is using the SB-HBT on a 22mm-diameter fiber optic cable. The 'holdback' (holdback force is essentially a term for adding line tension to a cable) element of the device creates additional tension to control the departure speed of the cable for bundling with DC power cable prior to being laid subsea.

An Enerpac cylinder compresses the top and bottom wheel together to create grip pressure onto the cable before the brakes are employed to slowly rotate the wheels. Without clamping the two wheels together, the cable would simply run free. The (orange) HBT element houses all of the components, while the Saddleback is the item bolted to the front of the frame.

Scrutton added: "This was another project where we were approached by a client with a design brief to develop a product for their application. NKT had a specific requirement for a device that could measure the line tension and create the holdback force. The concept went from a design discussion to a delivered product in less than six months."

ASN MARINE ANNOUNCES THE ACQUISITION OF TWO VESSELS

Alcatel Submarine Networks (ASN) Marine has announced the acquisition of two new ships as part of its strategy to modernize and expand installation capacities in a context of growth of the submarine telecommunications market.

The two vessels are the *Ile de Molène*, which joined the ASN fleet on May 7 and the *Ile d'Yeu*, which joined on June 17. Both vessels will now go through a heavy engineering and upgrade program to meet the expectations of ASN's customers and the missions that they will be carrying out.

L'Ile de Molène will be assigned to the maintenance of customers' telecommunications cables in the Atlantic and North Sea. She is expected to start operating in the first half of 2022. *L'Ile d'Yeu* will join ASN's installation fleet at the end of 2022 and will be immediately assigned to the installation of a

transoceanic telecommunication system. These vessels will be equipped with the latest generation of equipment enabling ASN to offer the level of performance and efficiency expected by its customers, telecom operators and GAFAM (OTTs). These two vessels are operated by Louis Dreyfus Armateurs under French flag.



» *Ile d'Yeu* (left) and *Ile de Molène* (right) will go through a heavy engineering and upgrade program. (Image credit: ASN)

CABLE SHIP AURORA DELIVERED TO NEXANS

The final milestone in the construction of *Nexans Aurora* was reached on May 31, 2021, when the state-of-the-art DP3 Cable Lay Vessel the flagship vessel of the *Nexans* fleet, was delivered by Ulstein Verft.

The 149.9 meter-long and 31 meter-wide vessel is specialized in transport and installation of subsea high voltage cable systems and a variety of subsea construction tasks. *Aurora* is equipped with purpose-designed equipment for cable and umbilical transport and laying, including bundle laying, protection and jointing.

The vessel will play a vital role in *Nexans'* turnkey supply of advanced subsea high voltage systems to support the electrification of the world, including providing vital connections between countries and regions, offshore renewable solutions as well as electrification solutions for other offshore installations.

"I am proud to see the *Nexans Aurora* delivered on time despite the parallel handling of the COVID-19 pandemic, with all the implications, restrictions and delays being dealt with in areas such as production, sourcing, travel restrictions, quarantines and much more," said Ulstein Group CEO, Cathrine Kristiseter Marti.

Nexans' project manager, Frode Beyer, added: "This is a memorable day for the project team and for *Nexans* and I would like to express my gratitude to everyone who has contributed to this project's success. We are now looking forward to bringing the *Nexans Aurora* out into the world to contribute to *Nexans'* purpose

'Electrify the Future,' for a greener place to be."

The vessel will be named in a ceremony in Ulsteinvik on June 8, before she departs for her home port of Halden and *Nexans'* subsea high voltage cables competence center.



» The 149.9 m *Nexans Aurora*.
(Photo credit: Per Eide Studio)

JAN DE NUL CONNECTS CRETE TO THE GREEK MAINLAND

For the very first time in history, the island of Crete has been connected to the Greek mainland by means of a subsea electricity link.

A project commissioned by grid operator ADMIE, and awarded to Hellenic Cables in which Jan De Nul Group installed the 135-km long cable over a very challenging seabed, at up to approximately one kilometer in depth.



» CLV *Isaac Newton*. (Photo credit: Jan De Nul)

Crete had been planning to connect to the Greek mainland, in order to achieve a more reliable, cheaper and environmentally friendly electricity supply.

The Crete-Peloponnese Interconnector is also known as the 'Interconnection of Records': two submarine AC cables of about 135 km each as well as 42 km of underground AC cables on land, connect Cretan Chania with Neapoli on the mainland.

Tobias Boderé, Project Manager at Jan De Nul Group, said: "A challenging seabed with rough rocks, cable tensions of 75 tonnes, large water depths of up to 1 km and the installation of an unprecedented length of cable in very challenging adverse weather conditions: all thanks to the tireless efforts of our crew on board the *Isaac Newton*, we have bridged these 135 km. Together we successfully delivered the installation of one of the most challenging interconnectors in the world."

Due to the proximity of the 'Hellenic Trench' fault line, the seabed between Crete and the Greek mainland is very rough with steep cliffs. Jan De Nul installed several types of protective material to protect the cable, ensuring its stability and durability. The cable route was optimized and the different types of customized cable protection systems (CPS) were successfully installed.

BOLLINGER SHIPYARDS DELIVERS 45th FAST RESPONSE CUTTER HONORING COAST GUARD HERO AND FIRST AFRICAN AMERICAN INDUCTED INTO THE PRO FOOTBALL HALL OF FAME

Bollinger Shipyards has delivered the USCGC EMLEN TUNNELL to the U.S. Coast Guard in Key West, Florida. This is the 168th vessel Bollinger has delivered to the U.S. Coast Guard over a 35-year period and the 45th Fast Response Cutter ("FRC") delivered under the current program.

Named in honor of Coast Guard hero and NFL great Emlen Tunnell, the cutter is the fourth of six FRCs to be home-ported in Manama, Bahrain, which will replace the aging 110' Island Class Patrol Boats, built by Bollinger Shipyards 30 years ago, supporting the Patrol Forces Southwest Asia (PATFORSWA), the U.S. Coast Guard's largest overseas presence outside the United States.

Earlier this year at the commissioning ceremony of the USCGC CHARLES MOULTHROPE, U.S. Coast Guard Commandant Admiral Karl Schultz lauded the "enhanced seakeeping" capabilities of the PATFORSWA-bound FRCs, saying "these ships are truly going to be game changing in their new theater of operations" and "offer increased opportunities for integrated joint operations with our Navy and Marine Corps colleagues" as the Coast Guard seeks to be part of the whole-of-government solution set in the region.

PATFORSWA is composed of six cutters, shoreside support personnel, and the Maritime Engagement Team. The unit's mission is to train, organize, equip, support and deploy combat-ready Coast Guard Forces in support of U.S. Central Command and national security objectives. PATFORSWA works with Naval Forces Central Command in furthering their goals to conduct persistent maritime operations to forward U.S. interests, deter and counter disruptive countries, defeat violent extremism and strengthen partner nations' maritime capabilities in order to promote a secure maritime environment.

Each FRC is named for an enlisted Coast Guard hero who distinguished themselves in the line of duty. Emlen Tunnell was instrumental in saving the lives of two shipmates in two different heroic actions. His exploits as a Coast Guardsman and then as a ground-breaking African American in the world of professional sports, Tunnell, through his incredible achievements both on and off the field, demonstrated the Coast Guard's core values of Honor, Respect, and Devotion to Duty.

Tunnell was the first Black player signed by the New York Giants and later played for the Green Bay Packers. He ended up playing 14 seasons in the NFL and when he retired as a player, he held league records with 1,282 interception return yards, 258 punt returns, 2,209 punt return yards, and 79 interceptions—the second most interceptions in NFL history today.

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

"ESPC is enabling higher-level Navy preparation for subseasonal-to-seasonal prediction," said Bill Kerr, the technical director at FNMO. "For instance, knowing ahead of time the typhoon season in the Western Pacific will be particularly light or particularly heavy allows better force protection preparation and application of resources."

Kerr believes this initial implementation is just the tip of the iceberg for how ESPC will revolutionize environmental forecasting.

"The real payoff for this technology is still in the future, when ESPC becomes a rapidly evolving testbed for Navy R&D, and the same systems provide dynamically reconfigurable modeling capabilities in one coupled system for operations," Kerr said. "It's good now, but it's going to be game-changer for environmental forecasting."

» FRC-45 Emlen Tunnell



DAMEN COMPLETES MAINTENANCE AND MODERNIZATION OF HNLSM SNELLIUS

Damen Shipyards Den Helder has returned the HNLMS *Snellius* to the Royal Netherlands Navy (RNLN) following her midlife upgrade. The hydrographic survey vessel required a complex and diverse scope of work taking almost a year to complete. The vessel was delivered ahead of the agreed date.

The Defensie Materieel Organization (DMO, the Defense Materiel Organization of the Dutch Ministry of Defense) and the Directie Materiële Instandhouding (DMI – the Directorate for Materiel Conservation) were responsible for this major maintenance work on the ship. They commissioned the yard in Den Helder to carry out both the mid-life update and the necessary multi-annual maintenance simultaneously. Part of the project was carried out in the covered dock of Damen Shiprepair in Harlingen.



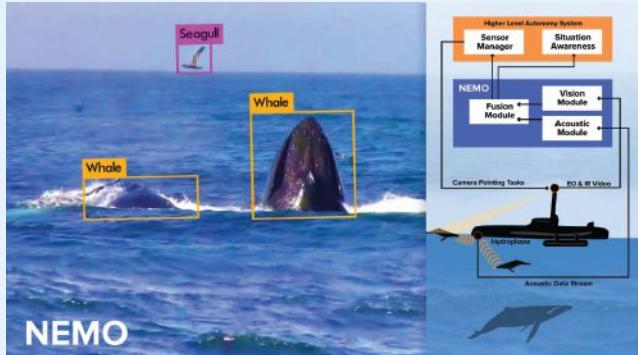
» HNLMS *Snellius*

The assignment was carried out in close collaboration with numerous partners from the Dutch maritime industry, such as Nevesbu, Wartsila, Braspenning, Eekels, RH Marine, Bakker Sliedrecht and Kongsberg. Many of the platforms and Sewaco systems were replaced or overhauled during the project. A number of works were also carried out to prepare the fifteen-year-old vessel for the second half of her lifecycle.

Following the completion of the work, the vessel underwent an extensive test period and is now ready to once again perform hydrographic work for the RNLN. Previously, her sister ship, HNLMS *Luymes*, underwent virtually the same maintenance and modernization program at the yard and is now also operating successfully again.

HNLMS *Luymes* (A803) and HNLMS *Snellius* (A802), which came into use in 2003 and early 2004, marked the beginning of a new chapter for the Dutch Hydrographic Service. The two hydrographic survey vessels, which are equipped with the most modern technology in hydrography, have the important task of mapping the seabed. They do this in particular in the North Sea and parts of the Caribbean. The ships were built by Damen Schelde Naval Shipbuilding (DSNS) with, as usual, a strong participation from the Dutch maritime industry. More than 80% of the purchase value was awarded to Dutch maritime suppliers, including various small and medium-sized companies.

The delivery of HNLMS *Snellius*, HNLMS *Pelikaan*, HNLMS *Luymes* brings to a successful conclusion a series a large-scale mid-life upgrade projects.



» NEMO accurately detects and classifies marine mammals in both visual and acoustic feeds. (Image credit: Charles River Analytics)

CHARLES RIVER ANALYTICS RECEIVES CONTRACT FOR NAVAL DETECTION OF MARINE MAMMALS

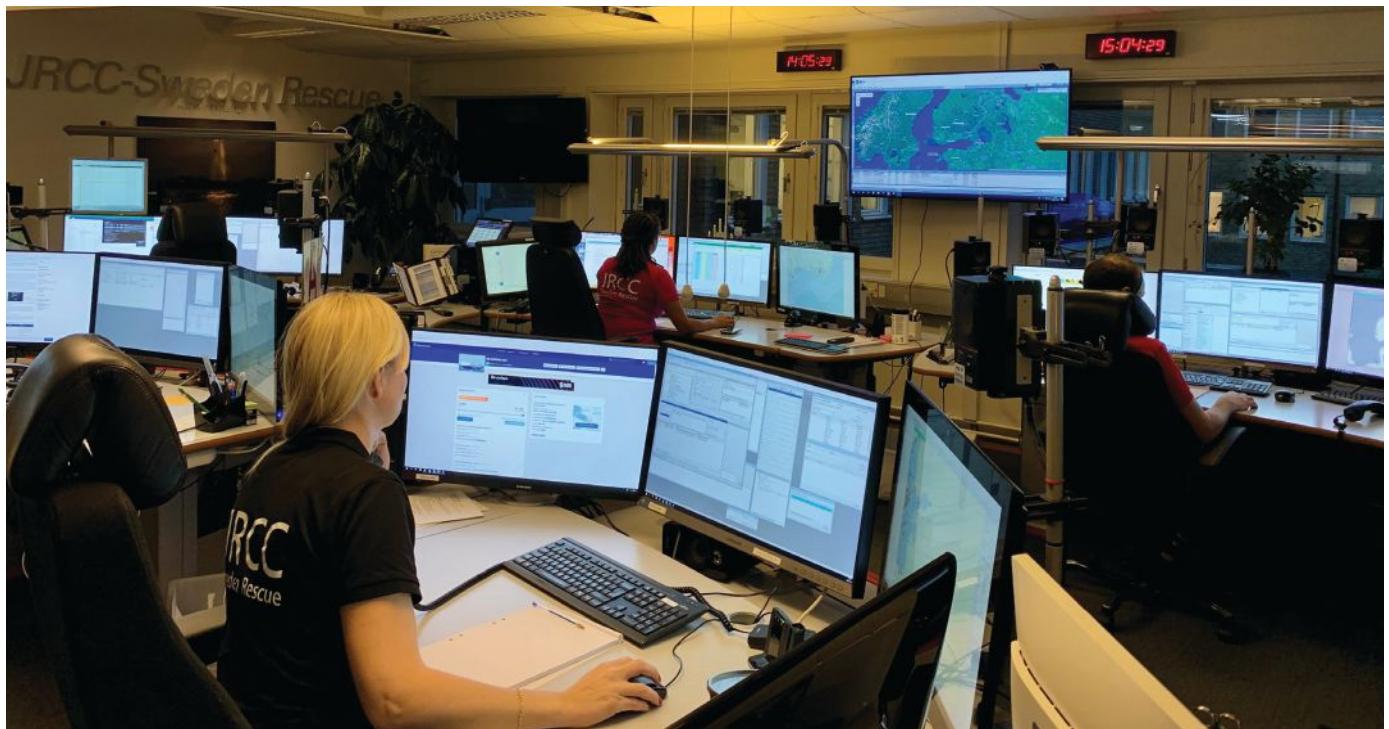
Charles River Analytics was awarded a ~\$1.5 million follow-on contract from the Defense Advanced Research Projects Agency (DARPA) to develop a multi-sensor fusion module that incorporates deep learning to autonomously and accurately detect whales and other aquatic mammals.

To protect marine mammals from collisions and sonar exposure, sailors must keep a vigilant lookout. Operators of remotely operated vehicles must also stay alert, and uncrewed surface vehicles (USVs) currently limited and narrow video feeds create risk, too. To reduce the strain on human lookouts, and give USVs the ability to steer clear, NEMO (Nautical Evaluation of Mammal Observation) will improve visual detection and classification onboard crewed and uncrewed vessels by developing new animal and ship detectors.

Charles River is working with marine mammal experts at the New England Aquarium to understand whale behavior patterns. These experts shared some indicators of the presence of whales, including circling birds, foaming patterns, and blows. This knowledge was incorporated into the multi-sensor module, to improve detection of whales which are near the surface but not visible. Collaborators at Raytheon contributed physics-based acoustic simulations to help model the effects of range, background noise, and sea state on acoustic detection reliability.

"At Charles River Analytics, we work on a lot of interesting tech to support autonomy," said Ross Eaton, Director of Marine Systems in Charles River's Sensing, Processing, and Applied Robotics Division and Principal Investigator on the NEMO effort. "NEMO is especially cool because we're also working to protect some of the most vulnerable animal populations on the planet. Being able to work on interesting science that will have a positive impact on the natural environment is a win-win for our team."

NEMO will reduce fatigue for human lookouts and improve safety on any vessel on which it is installed and will serve as a key building block for future marine autonomy development.



» JRCC's control center in Gothenburg, Sweden. (Photo credit: Lina Buurstra, JRCC)

ARTIFICIAL INTELLIGENCE HELPS RESCUE LEADERS INTERCEPT EMERGENCY CALLS

Since June 21, Sweden's sea and air rescue leaders have been testing artificial intelligence to monitor "Mayday" calls in the Baltic Sea and around the Swedish coast. The new system, which is now being used in live tests, assists the rescue leader in identifying emergency calls by means of AI and Machine Learning.

The tests are underway within the framework of the Heimdall Innovation Project, which aims to develop functional AI technology to gain assistance with intercepting and interpreting incoming emergency calls and presenting them in an operator-friendly interface. The idea is that of Tobias Nicander, a rescue leader at the Swedish Maritime Administration's sea and air traffic control center, who had experienced work-induced stress and wanted better technical support to facilitate the operator.

The Swedish Maritime Administration's sea and air traffic control center JRCC in Gothenburg, Sweden, works around the clock throughout the year to assist those in distress and lead rescue efforts at sea and in the air. Interception depends on the operator's ability to perceive the individual emergency call that is often made via a radio transmission with low audibility. If the system detects an emergency call, this is noted in the operator's interface. During the current stage of the project, the Heimdall system will be tested on emergency calls that the rescue leaders observe through interception designed to calibrate and further improve reception.

The Artificial Intelligence and Machine Learning technology has made immense progress in recent years, but the application areas in shipping and sea/air rescue are still few, which makes

the project unique. The company Tenfifty is responsible for the technical AI input in the project.

"This is a perfect example of how to create a reliable AI service where man and machine work together. Technology designed to convert speech to text using neural networks has made immense strides in recent years and it is extremely pleasing to be able to use technology for social benefit," said David Fendrich, CTO at Tenfifty.

Maranics AB is responsible for building user interfaces within the project and creating the data capture that goes beyond speech-to-text such as data on weather, ship information and position. The solution is based on pilots that the company has implemented and tested together with the DNV classification society.

"The Heimdall project is an excellent example of digital support in operations conducted under great pressure. With the help of filtered, structured and easily accessible digital information, we hope to create a safer work situation for the operator," said Mattias Larsson CIO at Maranics AB.

SURFACE WARFARE CENTER, CRANE DIVISION (NSWC CRANE) AND HYDRONALIX SIGN CRADA FOR AISUM PRIZE CHALLENGE HARDWARE SUPPORT

Naval Surface Warfare Center, Crane Division (NSWC Crane) and Hydronalix, Inc. of Green Valley, AZ, have signed a Cooperative Research And Development Agreement (CRADA) entitled AISUM Prize Challenge Hardware Support.

NSWC Crane is hosting an Artificial Intelligence for Small Unit Maneuver (AISUM) Prize Challenge with contestants from industry and academia. With the strategic goals of developing software that can be supported by a variety of hardware, non-proprietary robotic autonomy baseline component architecture and software were

required. This collaboration is anticipated to fulfill the need for a developmental platform prototype for demonstrating AI algorithms in support of Small Unit Maneuver and Counter-UAS Autonomy research.

The new ADAPT UAS Hydronalix platform will be built or modified to support the hardware requirements needed to demonstrate algorithm development objectives of navigation, mapping, and object recognition in enclosed spaces in a representative contested environment.

The new ADAPT UAS will provide competitors with a stable flying aircraft, without use of GPS and able to position hold with lost C2 link, that also has a sense and compute payload that can be used for open source algorithm development and testing. Algorithm development (provided by AISUM contestants) will be for artificial intelligence, navigation, object detection, and mapping of enclosed spaces. The new ADAPT drone to be used in project was operated with USMC 1st Explosive Ordnance Disposal (EOD) Company Littoral Explosive Ordnance Neutralization (LEON) in EUCOM USN 6th Fleet Baltic Operations Exercise in June

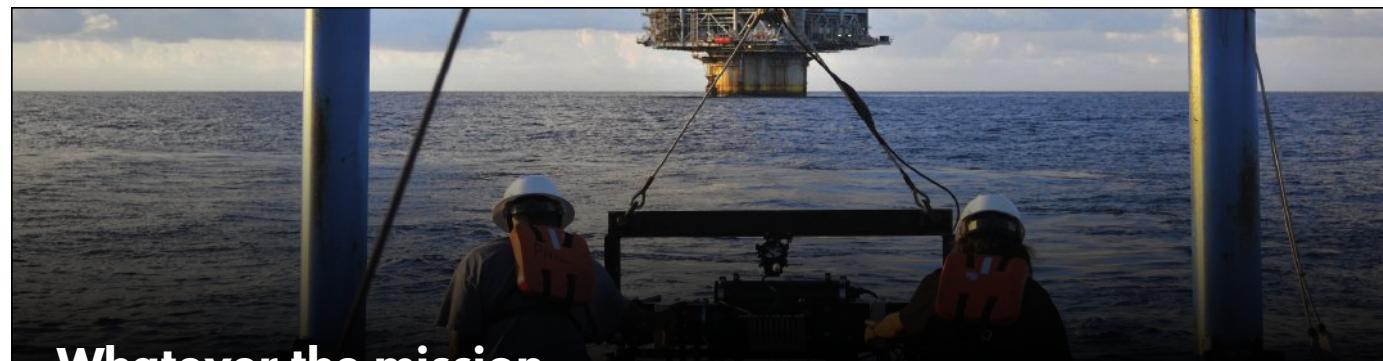


» ADAPT UAS Hydronalix Platform at BALTOPS 50, Putlos, Germany, June 2021. (Photo credit: Hydronalix)

2021, for vessel to shore re-supply missions. The UAS was developed by Hydronalix under a SBIR Phase I and II program funded by ONR and managed by NAVSEA.

Hydronalix CEO, Anthony Mulligan said: "We are pleased to enter into this CRADA with NSWC Crane as it will aid us in keeping our disposable UAS drone technology at the leading edge to assist in keeping the warfighter out of harm's way. We look forward to working closely with scientists at NSWC Crane and leading UAS research teams from around the country."

The program will carry thru June 2022. For more information contact Blake Busey at blake.busey@navy.mil, or Drey Platt at drey.platt@hydronalix.com



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DMC TO PROVIDE RUDDERS AND STEERING GEAR SYSTEMS FOR SPANISH NAVY VESSELS



» F110 frigate class

Spanish shipbuilder Navantia has contracted Damen Marine Components (DMC) for a series of rudders and steering gear systems. The equipment is for five vessels that Navantia is constructing for Armada Española – the Spanish Navy.

These next-generation vessels are of the F110 frigate class. DMC's scope involves supplying Navantia with Twin Van der Velden ATLANTIC Rudders specifically

developed for minimum noise and vibration throughout the system; from the rudder blades to associated equipment such as the bearings, cylinders and hydraulic power units.

The ATLANTIC Rudder is also well-known for its low drag and low vibrations. Its slim profile ensures minimal resistance – especially on high-speed vessels.

Wim Knoester, Director Sales & Marketing DMC, said: "We are very pleased to be selected by Navantia as the supplier for the maneuvering system on this program. With this order, DMC strengthens its position in this market segment."

The order also includes skegs and extended trunks as well as Twin EBST 425-35 steering gear system including rudder angle indicators.

DMC will deliver the equipment between 2023 and 2028. Navantia is scheduled to deliver the vessels between 2026 and 2031.

They are being constructed as a replacement for the Spanish Navy's Santa Maria-class frigates. The vessels will feature anti-submarine capabilities and will undertake fleet protection, maritime security in joint and combined missions.

ISRAEL SHIPYARDS TO SUPPLY SHALDAG MK V VESSELS TO THE ISRAELI NAVY

Israel Shipyards Ltd., a leading shipbuilding and repair company in the Eastern Mediterranean serving naval and commercial marine markets—has announced the signing of an agreement to supply its SHALDAG MK V vessels to the Israeli Navy. The company will provide four vessels which have been adapted to the Navy's unique configuration requirements.

Over the years, the Israeli Navy has used a variety of Israel Shipyards' vessels for ongoing security missions—including the SHALDAG MK III and the Saar 4 and Saar 4.5 fast attack missile vessels—protecting the maritime borders of the State of Israel. Recently, it was decided to equip the Navy with advanced vessels that will enable an upgrade of the force's capabilities for its routine security missions. To that end, the SHALDAG MK V has been adapted to the Navy's configuration requirements.

The largest member of the SHALDAG Class, the SHALDAG MK V, is a combat-proven, all-aluminum, light and fast vessel driven by powerful waterjets, with a high payload capacity, providing exceptional maneuverability and seakeeping. Delivering a high firepower-to-displacement ratio, it was designed for naval security missions and is a recognized leader in the protection of Exclusive Economic Zones (EEZs) and littoral waters.

The vessel has a speed of above 40 knots, can accelerate from zero to 40 knots in less than one minute, has a turning diameter of 150 m and a minimal draft—enabling operation in shallow waters. Easy to operate and maintain, the SHALDAG MK V is equipped with advanced, lightweight weapon systems, navigation systems, and combat management systems.

Eitan Zucker, the company's CEO, said: "We are pleased with our long-standing cooperation with the Israeli Navy, and with the opportunity for our flagship vessel to become part of the Navy and its missions—protecting our country's maritime borders."



» SHALDAG MK V is a combat-proven, all-aluminum, light and fast vessel. (Image credit: Israel Shipyards)

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COMMODITY PRICE VOLATILITY NOT SURPRISING IN LIGHT OF CURRENT NEWS

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

Crude Oil:

The Delta variant has become the focus of politicians, the media, and stock and commodity markets. Will it force governments to institute new lockdowns that may take the form of requiring people to be fully vaccinated to participate in everyday life? Although we are on our way to herd immunity, the reaction of politicians to the upturn in COVID-19 cases has been to impose new economic restrictions. That will have an impact on oil demand, especially as lockdowns and more stringent economic restrictions are implemented worldwide.

Fear of a slowdown in oil demand's recovery, or possibly a reversal of recent gains, has commodity traders keying off political utterances about controlling the virus. Our nearby oil price chart for 2021 highlights that oil prices steadily improved until hitting \$75 per barrel barrier. Since then, oil prices have become more volatile. Has \$75 become the new ceiling? More importantly, is whether \$65 is a new price floor.

Oil price ceilings and floors are tools for assessing support for a current oil price. As evidence the oil demand/supply relationship is strong enough to lift oil prices higher, breaking through a "ceiling price" is seen as a significant confirmation. Usually such a move takes time, the reason why the price threshold becomes known as a "ceiling." Likewise, when the oil price fails to fall below a price threshold when the demand/supply balance seems weak, it becomes a "price floor."

We will not speculate on how much the Delta variant will impact oil demand, nor will we focus on the next variant, or the one after that. What we know is that COVID-19 variants will continue emerging and impact economies depending on their transmissibility, degree of contagion and creation of serious health issues. Each time a variant emerges, commodity markets will focus on the global oil demand downside and its impact on prices, rather than the health of the economic recovery. This is only human nature, and oil markets are shaped by humans.

If one were to ignore the Delta variant and only focus on underlying oil demand and supply, we are impressed by two factors. First, the global demand recovery has been quicker than assumed last year. Global mobility has reached or even surpassed 2019 levels in some regions. Only air travel lags, and it is showing strength. On the water, global trade continues rebuilding. Cruising is impacted by government restrictions and hesitation by potential passengers, limiting its recovery.

The other key oil market factor has been the adherence by public oil companies to financial discipline that has limited new well drilling and oil production growth. Moreover, OPEC+ has shown a commitment to limiting the pace of adding new oil supply to the market, which minimizes the risk of a new supply glut anytime soon. All of this suggests higher oil prices on the horizon. The timing will be dictated by COVID-19 variants.

Natural Gas:

Natural gas markets have struggled to balance demand (consumption driven by air conditioning during extreme heat waves and LNG exports) and supply (constrained by producers adhering to financial discipline and not drilling new gas wells, producing less associated gas from oil wells, and valuing returning cash to shareholders rather than growing assets and production). None of these factors look to pressure gas prices either higher or lower in the foreseeable future.

The massive heat domes that gripped the Pacific Northwest and Southwest in late June, are gone. In the Northeast, July was wetter than normal and temperatures moderate. As a result, gas demand for generating electricity eased, especially when gas prices jumped to \$4 per thousand cubic feet. At that price, cheaper coal regained some lost market share.

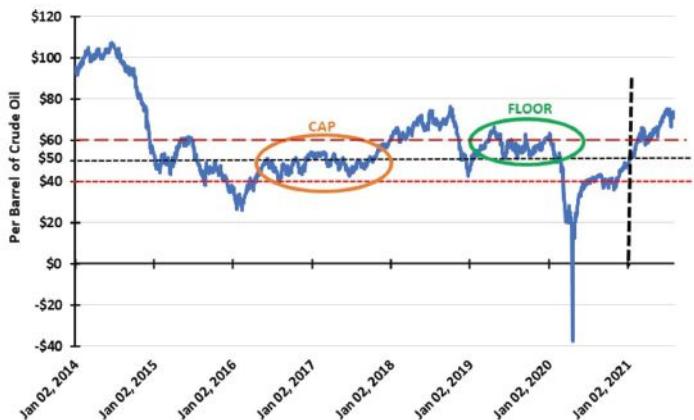
LNG exports have been a bright spot for gas, as international prices, driven up by winter-depleted storage and a hotter spring strained electricity grids in Europe and Asia forcing them to use more coal and gas because renewables failed to deliver the power expected. Higher prices boosted LNG profit margins, leading to increased cargoes offsetting weak power generation demand.

Domestic gas output is growing slowly, as expected. Because storage is trending below the 5-year average storage volumes, gas prices are climbing to reverse this trend. The most recent weekly storage report showed a smaller injection than expected, which is bullish for prices as they will need to be higher to coax more gas into storage. At the time of this report, the current storage deficit to last year's storage was 542 billion cubic feet and 185 Bcf below 5-year average volumes.

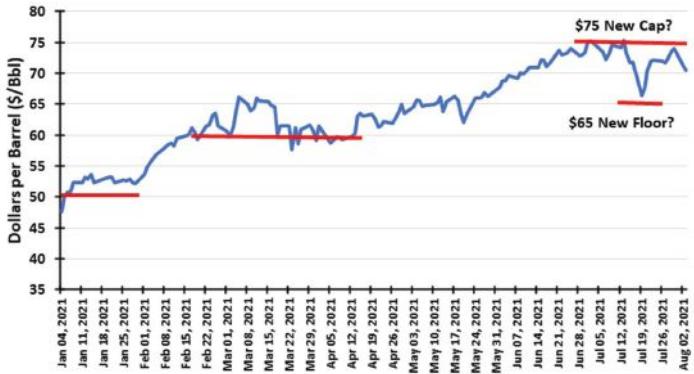
Nearby, we show a chart plotting the difference between 2021 weekly storage volumes and the 5-year average and compared to gas futures prices. The greatest deficit was experienced at the start of July. After narrowing somewhat during July, the latest report showed the deficit had almost returned to the earlier peak. As a result, gas prices reached \$3.65/Mcf at the time of the earlier peak in early June before flatlining for three weeks while the deficit shrank. With a widening deficit, gas prices jumped, crossing the \$4/Mcf threshold. They climbed even higher in early August, before retreating when the latest storage report was issued. The price decline suggests the market believes they are high enough to rebuild storage heading into winter.

A \$4/Mcf price was last seen in late 2016. Since then, natural gas has been the least-respected fuel in the energy mix, often fighting to keep prices from sinking to new lows. Does breaking the \$4/Mcf barrier mark the start of a new era for gas? Only time will tell.

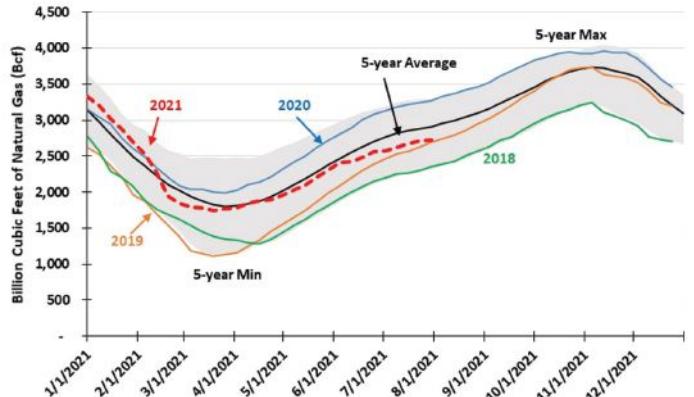
As \$60 Is New Price Floor - Might Oil Prices Go Higher?



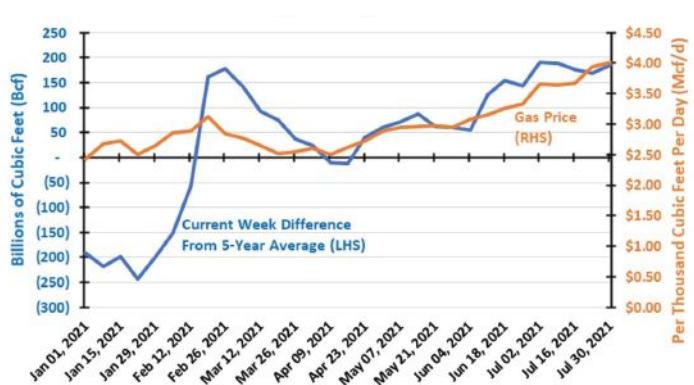
Daily Oil Futures Prices During 2021



Gas Storage Falling Further Below 5-Year Average Driving Prices Higher



How Gas Prices Reacted To Greater Shortfall From 5-year Average Storage Volumes





AMERICAS

Offshore Well Intervention LATAM

Virtual » September 8-9
www.offsetnet.com/latam

US Hydro

Virtual » September 13-16
<http://ushydro2021.org>

Global OCEANS

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

Offshore Wind Executive Summit

Galveston, TX » October 5
www.offshorewindsummit.com

SIPEX

Virtual » October 5-7
<https://surinamecilexpo.com>

MTS Dynamic Positioning

Houston, TX » October 12-13
<https://dynamic-positioning.com/overview>

ACP Offshore Windpower

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

Offshore Well Intervention GoM

Houston, TX » November 8-9
www.offsetnet.com/owi-gom

BlueTech Week

Virtual » November 15-19
www.tmablue.tech.org/bluetech-week

WorkBoat

New Orleans, LA » December 1-3
www.workboatshow.com

EUROPE

Submarine Networks EMEA

London, UK » September 1-3
www.terrapinn.com/conference/submarine-networks-world-europe

SPE Offshore Europe

Virtual » September 7-10
www.offshore-europe.co.uk

Seanergy

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

Ocean Business

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

Offshore Energy

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

Eastern Mediterranean Conference

Cyprus » November 10-12
www.emc-cyprus.com

Ocean Energy Europe

Brussels, Belgium » December 6-7
www.oceanenergy-europe.eu/annual-event/oee2021

Undersea Defence Technology (UDT)

Rostock, Germany » December 15-17
www.udt-global.com

OTHER REGIONS

Gastech

Dubai » September 21-23
www.gastechevent.com

Submarine Networks World

Virtual » September 29-30
www.terrapinn.com/conference/submarine-networks-world/

Mediterranean Offshore Conference

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

Offshore Well Intervention West Africa

Virtual » October 12-15
www.offsetnet.com/owi-wa

ADIPEC

Abu Dhabi » November 15-18
www.adippec.com

Telecoms World Asia

Virtual » November 16-17
www.terrapinn.com/conference/telecoms-world-asia/index.stm

Offshore Well Intervention Australia

Perth, Australia » November 23-24
www.offsetnet.com/owi-aus

Asia-Pacific Deep Sea Mining Summit

Singapore » December 8-9
www.asia.deepsea-mining-summit.com

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	TECHNOLOGY & INDUSTRY FOCUS	2021 EDITORIAL CALENDAR
JANUARY Editorial: Dec. 28 Ad: Jan. 14	» The Essential 2021 Offshore Toolkit	Technologies: ROV tooling & control, Subsea cables, Remote inspection, Supply vessels, turbines, tethers, and more. Industry Focus: Offshore Energy & Renewables, Marine Survey, Scientific, Defense	
FEBRUARY Editorial: Jan. 25 Ad: Feb. 11	» Ocean Observation	Technologies: Buoys, ADCP, Data Software, Sensors, Drifters, Gliders, and more. Industry Focus: Marine Survey, Scientific, Offshore Energy & Renewables	
MARCH Editorial: Feb. 22 Ad: Mar. 11	» Unmanned Vehicles & Marine Robotics » Distribution: GIPEX ☰ / June 28-30	Technologies: USVs, AUVs, ROVs, Aerial drones, Control systems, Seafloor residency, and more. Industry Focus: Offshore Energy, Marine Survey, Defense, Academic, Subsea Infrastructure	
APRIL Editorial: Mar. 22 Ad: Apr. 08	» Defense & Security	Technologies: Autonomous Navigation, Comms & Telemetry, Magnetometers, GIS, Sonar, and more. Industry Focus: Subsea Defense, Government, Offshore Energy, Subsea Infrastructure	
MAY Editorial: Apr. 19 Ad: May 06	» Marine Renewables » Distribution: SIPEX ☰ / June 1-3 Floating Wind Solutions / June 28-29 Int'l Partnering Forum / Aug. 24-26 H2O Conference ☰ / June 7-10	Technologies: Turbines, Subsea Cables, Inspection Drones, Subsea Batteries, Grid Integration, Connectors, and more. Industry Focus: Offshore Wind, Wave Energy, Tidal Energy, Alternative Offshore Energy	
JUNE Editorial: May 17 Ad: June 03	» Bathymetric Mapping & Hydrographic Survey Marine Tech Expo ☰ / July 12-13	Technologies: Oceanographic Equipment & Instrumentation, Sensor Suites, ADCP, Buoys, ROVs, and more. Industry Focus: Marine Survey, Academic, Geotechnical Services	
JULY Editorial: July 01 Ad: July 15	» Unmanned Vehicles Buyers' Guide ☰	Technologies: ROVs, AUVs, USVs, Towed & Bottom Crawling Vehicles, and Gliders. Company Focus: Exclusive company/product spotlights and editorial features available	
AUGUST Editorial: July. 26 Ad: Aug. 12	» Deep-Sea Exploration » Distribution: Global OCEANS / Sept. 20-23 Seanergy ☰ / Sept. 21-24 US Hydro ☰ / Sept. 13-16	Technologies: Seabed samplers, Mining machines, Geotechnical tooling, Seafloor imaging equipment, and more. Industry Focus: Offshore Energy, Marine Mining, Scientific	
SEPTEMBER Editorial: Aug. 23 Ad: Sep. 09	» Offshore Build, Inspection & Maintenance » Distribution: Ocean Business / Oct. 12-14 Offshore Energy / Oct. 26-27 ACP Offshore Windpower / Oct. 13-15	Technologies: Inspection drones, Turbines, Subsea cables, Power substations, Battery technology, Grid integration, Connectors, and more. Industry Focus: Offshore Operations & Maintenance, Offshore Energy & Renewables	
OCTOBER Editorial: Sep. 20 Ad: Oct. 07	» Submersibles » Distribution: Ocean Energy Europe / Dec. 6-7 UDT / Dec. 14-16	Technologies: Manned submersibles, Navigation systems, ROVs, Submarines, Resident Subsea Vehicles, and more. Industry Focus: Offshore Energy, Defense, Academic, Marine Mining	
NOV./DEC. Editorial: Oct. 18 Ad: Nov. 11	» Subsea Engineering & Infrastructure	Technologies: Subsea drills, Prospecting tools, Deck handling equipment, and more. Industry Focus: Offshore Energy, Defense, Marine Mining, Government	
SPECIAL ISSUE Editorial: Nov. 18 Ad: Dec. 1	» The Future of Ocean Technology	Tech and Industry Focus: Our Special Edition unites an exclusive roll call of industry thought leaders to discuss the innovative breakthroughs set to redefine how we work in marine environments over the coming decade.	

SEA-KIT IS FIRST TO RECEIVE LLOYD'S REGISTER UNMANNED MARINE SYSTEMS CERTIFICATION

The first ever Unmanned Marine Systems (UMS) certificate has been awarded to SEA-KIT International by Lloyd's Register, representing an important milestone for the maritime industry.

SEA-KIT has worked closely with Lloyd's Register since early 2020 in a concerted effort to achieve the highest standards for the Unmanned Surface Vessel (USV) sector, culminating with their latest 12 m X-class USV for leading geo-data specialist, Fugro, being awarded the new UMS certification on 28 June 2021. Not only is this an important

achievement for SEA-KIT, but it also represents a significant recognition by Lloyd's Register for the wider maritime community.

Paul James, Lloyd's Register's Naval Centre of Expertise Manager, said: "Lloyd's Register has been working on the safety assurance of Unmanned Marine Systems since the launch of our UMS Code in 2017. Early on, we recognized the industry's need for a cost effective and robust method to demonstrate that unmanned novel and complex systems are safe. The Lloyd's Register naval team welcomed the opportunity to work with SEA-KIT to delve into the design, operation and construction of its latest Unmanned Surface Vessel. We are pleased to provide certification and safety assurance of SEA-KIT's unmanned system."

Ben Simpson, SEA-KIT CEO, said: "We thrive on challenging ourselves to continuously raise the bar and this is yet another example of hard work by the whole team paying off. Everyone here at SEA-KIT was integral to this achievement. We are absolutely delighted to be the first to receive UMS certification from Lloyd's Register and hope that this will be the first of many as we continue to push

boundaries and set the highest standards in the development of safe, multi-mission USV platforms."

Unmanned systems technologies continue to gain a stronghold in the offshore sector. Fugro's SEA-KIT USVs are already working on commercial projects around the world, with multiple additional builds planned that include a larger vessel later this year.

Ivar de Josselin de Jong, Global Director Remote Inspection at Fugro, said: "This is a ground-breaking milestone as it provides the framework needed to certify the safe design and build of our Blue Essence USV fleet. It will enable us, our clients and the Flag States to achieve the ambitious net-zero targets that we have set. A world-first for the industry, it's great to be able to contribute to the transformation of the maritime business in this way."

SEA-KIT has identified numerous applications for its USV technology in other marine sectors and recently ran a series of live capability demonstrations for maritime defense and security stakeholders from its base in Tollesbury, Essex.



» USV Maxlimer. (Photo credit: SEA-KIT)

RE2 ROBOTICS CELEBRATES 20 YEARS OF INNOVATION

Over the past two decades, RE2 has developed numerous next-generation robotic systems for a variety of defense and commercial customers. From its early days creating teleoperated unmanned vehicles for the Department of Defense, through the development of today's intelligent mobile systems for customers in multiple markets, RE2 has remained a leader in the design and development of robotic arms.

Originally founded on July 20, 2001 as a defense subcontractor to Carnegie Mellon University by alumni Jorgen Pedersen, the company incubated

at the National Robotics Engineering Center (NREC) in the Lawrenceville neighborhood of Pittsburgh. Today, anchored in Pittsburgh's Robotics Row, the RE2 campus encompasses two buildings on a city block in Lawrenceville and includes space for indoor, outdoor, and underwater testing of robotic systems.

One of RE2 Robotics innovations is the RE2 Sapien™ Sea Class. Originally engineered for the U.S. Navy to operate in harsh marine environments, the RE2 Sapien Sea Class is a dual-arm, highly dexterous, electronically driven manipulation system designed for ocean use, whether relatively shallow or thousands of feet deep.

RE2 Sapien™ Sea Class presents an unmatched level of human-like control in the field of underwater robotics. Whether

used for commercial applications, industrial tasks, or military operations, RE2 Robotics is committed to creating state-of-the-art robotic technologies and is focused on developing products that can keep humans divers safe.

"We are incredibly proud of the success we have achieved over the past 20 years here in Pittsburgh," said Pedersen, president and CEO. "From day one, we have been focused on creating technology that helps humans to do their jobs safely and efficiently, and we remain dedicated to that mission today. We look forward to more innovation in the years ahead, as we continue to focus on developing intelligent robotic technologies that enhance worker safety and productivity."

Since its founding, RE2 has shipped more than 650 robotic arms to customers worldwide and received \$3.75 million in



» RE2 Sapien™ Sea Class. (Photo credit: RE2 Robotics)

SeaState

THE ON&T PODCAST

SEASON 2 / EPISODE 7



NASA & OCEAN EXPLORATION

Dr. Scott Parazynski is a highly decorated physician, astronaut, and tech CEO, recently inducted into the U.S. Astronaut Hall of Fame. He is a widely sought-after keynote speaker on innovation, risk management, mentorship and leadership under extreme adversity. Scott has lived and traveled all over the world, spending many of his grade school years in places such as Senegal, Lebanon, Iran and Greece. A graduate of Stanford University and Stanford University School of Medicine, he went on to train at Harvard and in Denver for a career in emergency medicine and trauma.

In 1992 he was selected to join NASA's Astronaut Corps and eventually flew 5 Space Shuttle missions and conducted 7 spacewalks. Mission highlights included a global ozone mapping flight; leading the first joint US-Russian spacewalk while docked to the Russian space station Mir; serving as Senator John Glenn's crewmate and "personal physician" and the assembly of the Canadian-built space station robotic arm. In October 2007, Scott led the spacewalking team on STS-120, during which he performed 4 Extravehicular Activities (EVAs).

The final EVA is regarded by many as one of the most challenging and dangerous ever performed. The tremendous coordinated effort in orbit and on the ground by Mission Control has been likened to the Space Shuttle and Space Station era "Apollo 13 moment."

In addition to being a diver and accomplished mountaineer, Scott is also a commercial, instrument, multiengine and seaplane-rated pilot. On May 20, 2009, he became the first astronaut to stand on top of the world, the summit of Mount Everest. As a life-long explorer, he and a colleague recently set the first boot prints adjacent the world's youngest lava lake, inside the crater of Masaya Volcano in Nicaragua.

He is a prolific inventor/product developer and serves as a board director of several companies. He is also the founder and CEO of Fluidity Technologies, which focuses on developing revolutionary input devices powered by machine learning to intuitively move through physical and virtual space.



» Dr. Scott Parazynski is a decorated physician, astronaut, and tech CEO, recently inducted into the U.S. Astronaut Hall of Fame.

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as never seen
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98% Seafloor
Coverage

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ULTRAHD



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KRAKEN COMPLETES ACQUISITION OF PANGEO

Kraken Robotics has completed the acquisition of PanGeo, a services company specializing in high-resolution 3D acoustic imaging solutions for the subseabed with offices in St. John's, Newfoundland and Aberdeen, United Kingdom. Upon closing, PanGeo is now a wholly owned subsidiary of Kraken Robotic Systems Inc. Under Kraken's ownership, PanGeo will continue to operate as a trusted name in sub-seabed imaging and will complement Kraken's turnkey offering of high-resolution subsea imaging services.

Karl Kenny, Kraken President and CEO said: "We are pleased to have completed this acquisition and to welcome the PanGeo employees to the Kraken team. Together we offer a holistic solution of world-leading technologies and services in subsea acoustic and optical imaging, autonomous robotics, and subsea batteries for customers in the defense and commercial markets. We are also excited for the increased exposure to the offshore renewable energy market and believe we can bring technologies to bear that will drive down customer costs, improve safety, and reduce their emissions footprint."

PanGeo recently secured \$2 million in funding from Canada's Ocean Supercluster for the development of wider scanning capability and increased efficiency called GeoScan.

GeoScan Project Details

Under this new \$3.4 million project, PanGeo will work with Cellula Robotics of British Columbia and the Marine Institute of Memorial University of Newfoundland to reconfigure the Acoustic Corer™ 3D technology to allow for a wider area scan and the ability to

image geohazards to depths greater than 30 meters sub-seabed. In addition to providing wider area scans, PanGeo will incorporate new Artificial Intelligence (AI) processing technology to improve data acquisition and accelerate data processing. Ultimately this

technology will lead to a reduction of personnel offshore and improved vessel efficiencies in support of Canada's net zero reduction targets for 2050. This project will run through to March 2023.



» GeoScan Conceptual Drawing. (Image credit: Kraken)

PanGeo's 3 D Advanced Acoustic Technology De-Risks Offshore Installations

PanGeo's wide-area GeoScan will interrogate for sub-seabed hazards and support efforts in de-risking offshore wind, oil and gas, and other offshore installations. As the offshore wind farm sector grows and matures, foundations are getting bigger with more power generation per turbine. Turbine capacity has increased from 1.5 GW to now 14 GW which has driven the size of monopile foundations from 5 meters to 10 to 12 meter diameters, thereby creating the market pull for wider area scanning requirement. Solutions provided by the GeoScan will contribute to de-risking foundation installations by imaging and identifying geohazards allowing prime contractors to microsite pile locations and reduce costly pile refusals.

NEKTON AND SCHMIDT OCEAN INSTITUTE KICK OFF JOINT QUEST TO INSPIRE THE PUBLIC

Ocean exploration organizations Nekton and Schmidt Ocean Institute recently announced that they have entered into a new partnership to work collaboratively on expeditions and to advance public



understanding of the ocean by engaging cultural sectors such as fashion, food, and sports.

The two not-for-profit organizations released a white paper, *Ocean Rising: The Quest to Inspire the Public* that outlines industry actions that have brought awareness to ocean science and sustainability. The paper looks at different sectors and areas of collaboration, highlighting new opportunities to engage the arts, broadcast media, social media, sports, gaming, fashion, food and others.

A virtual workshop was held on July 7 as part of the UN Decade of Ocean Sciences for Sustainable Development Labs, in tandem with the white paper release, to discuss how each sector plays a critical role in defining culture and shaping human behavior.

"Our goal is to inspire people about the ocean. This is our planet, but an unknown

one, full of wonder and mystery, with incredible landscapes and alien creatures," said Dr. Jyotika Virmani, executive director of Schmidt Ocean Institute. "This is the United Nations Ocean Decade and elevating the understanding and appreciation for our ocean is a high priority. Through this collaboration our goal is to bring the ocean to everyone."

"We protect what we love, and we need to find new ways for people to fall in love with the ocean," said Nekton Chief Executive Oliver Steeds. "To connect the ocean to people, we need to connect our cultures to the ocean. That's the first key challenge we are looking to address together."

Both Nekton and Schmidt Ocean Institute plan to collaborate on public outreach and address other marine research and ocean data challenges together during the Ocean Decade, which started in January 2021.

SMD MAKE SENIOR LEADERSHIP CHANGES

SMD has announced several changes to its senior leadership team. These are part of a long-term plan as it prepares for the next stage of its development.

Mike Jones, who joined SMD in 1992 and has led the company as CEO since late 2017, moves to Chairman of SMD. He will focus on the strategic development of the SMD Group, as well as helping the new leadership team and chairing the Board.

Julian Zhu takes over as CEO. Julian has been a Director of SMD since 2015, and over the past 3½ years has led their innovation developments as Chief Strategy and Marketing Officer. Julian has responsibility for the SMD Group's operations in both Newcastle and Shanghai.

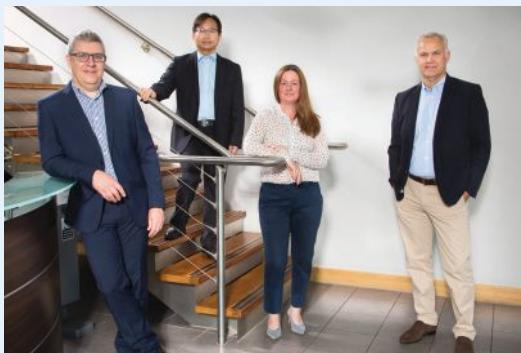
Dr Paul Davison, who first joined SMD in 1994, and was most recently Managing Director for Equipment and Service, becomes Deputy CEO, Sales & Marketing. This carries responsibility for all front of house activities in sales, project management, service and marketing.

Sarah Lawson becomes Chief Operating Officer, from her previous role as Operations Director. Sarah has recently finished a secondment with the Government's Vaccine Taskforce, using her strategic commercial skills in the roll out of the UK vaccine programme. Sarah now carries responsibility for all back of house

activities in planning, procurement, engineering, logistics, production, and commissioning.

Richard Howarth has stepped down as CFO, but remains as an adviser while SMD recruits a new UK-based CFO. Richard has been with SMD since 1998 in various commercial, finance and customer support roles.

Chris Wilkinson is also stepping down as CTO, a role he has held since he joined SMD in 2014 and remains as an adviser during the transition to a new CTO early next year.



» From left to right: Paul Davison, Julian Zhu, Sarah Lawson, Mike Jones. (Photo credit: SMD)

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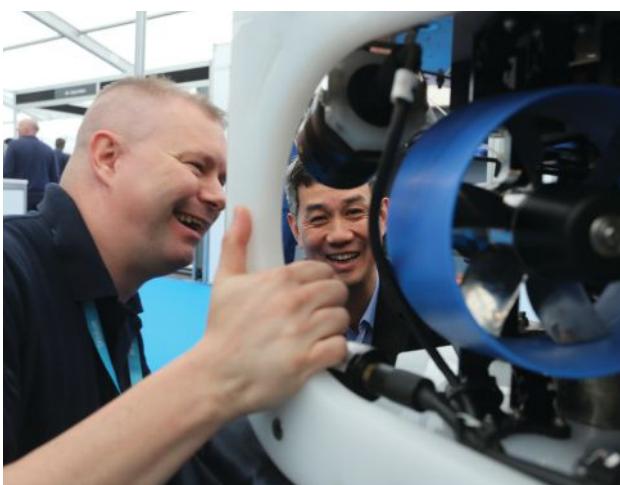
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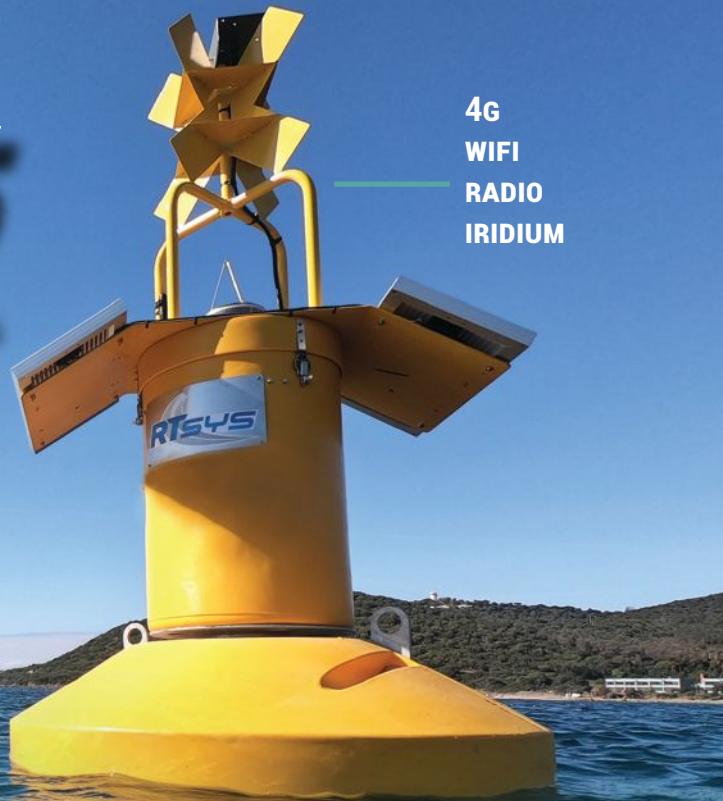


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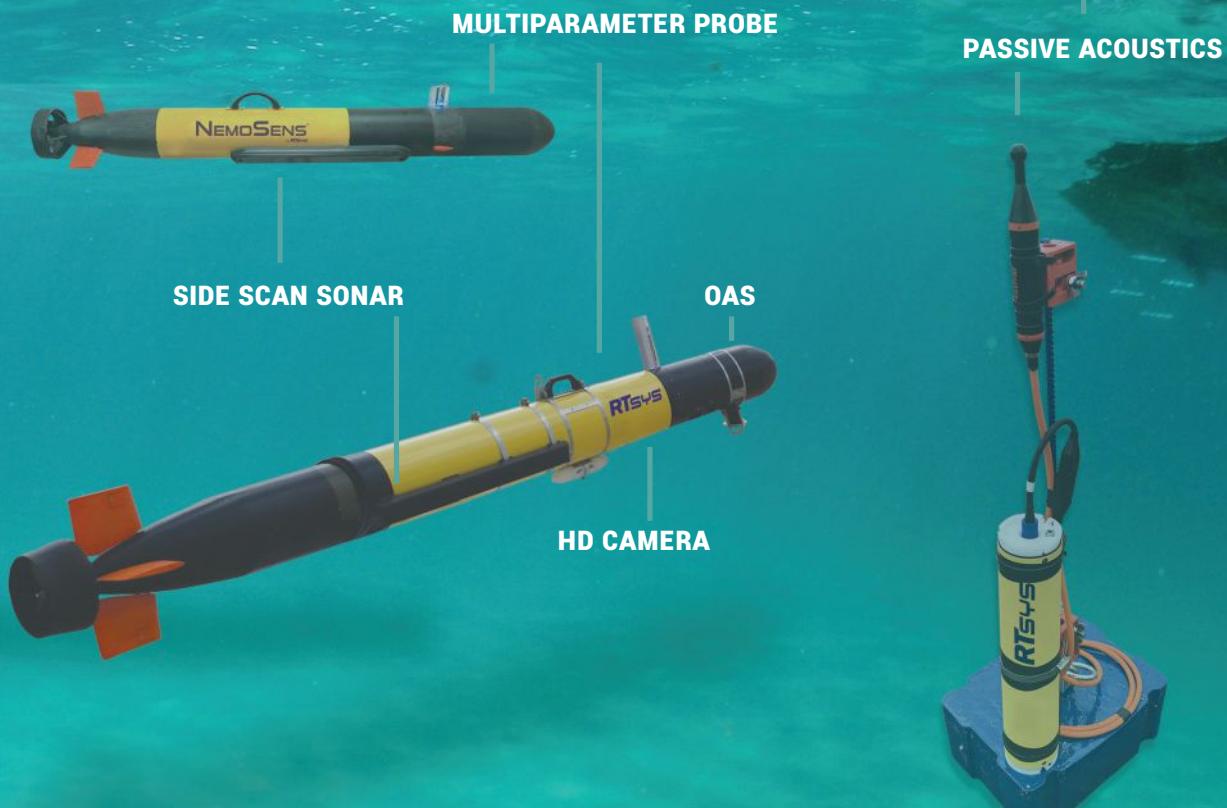
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