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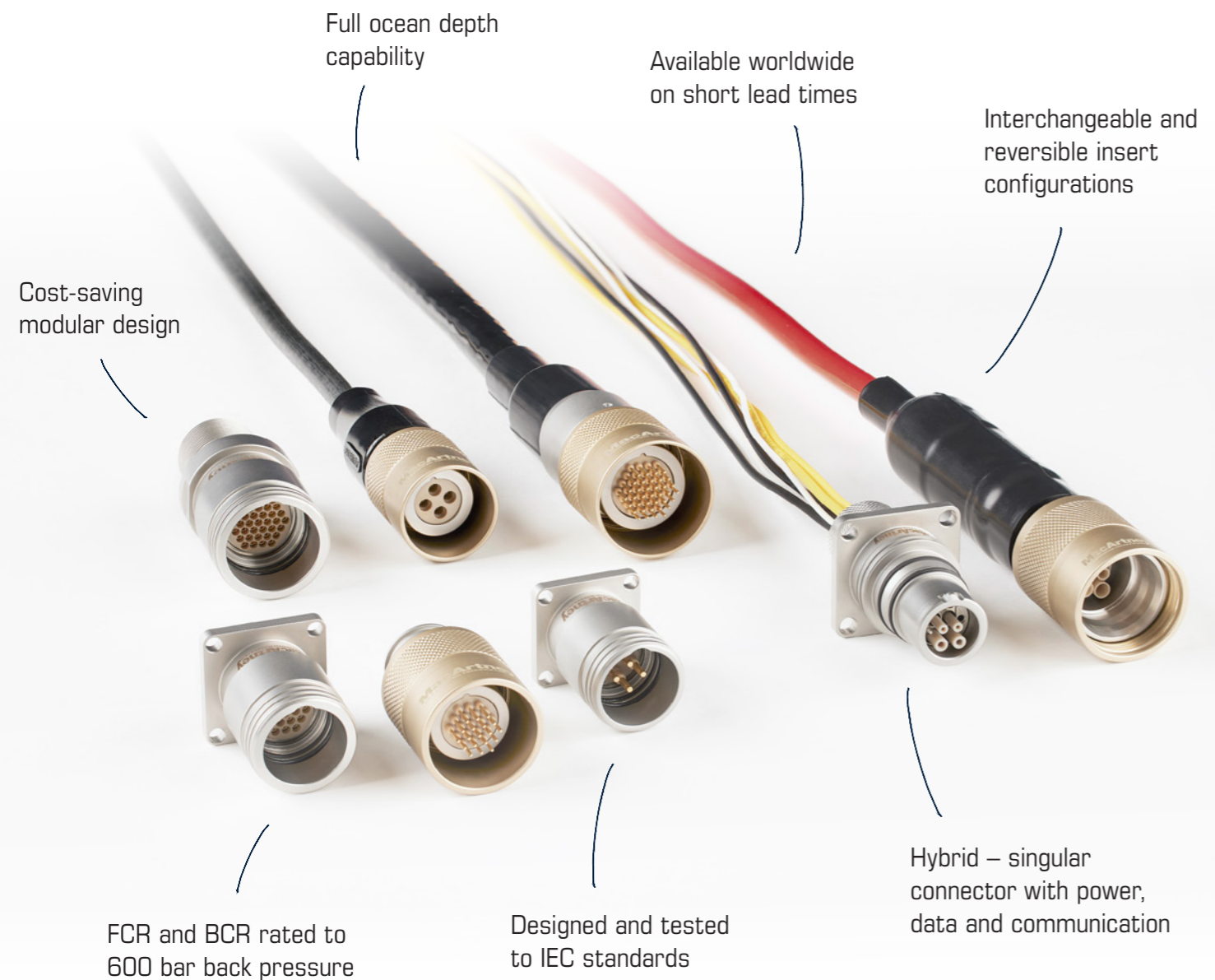
UNDERWATER
TECHNOLOGY



ISSUE 2 2024

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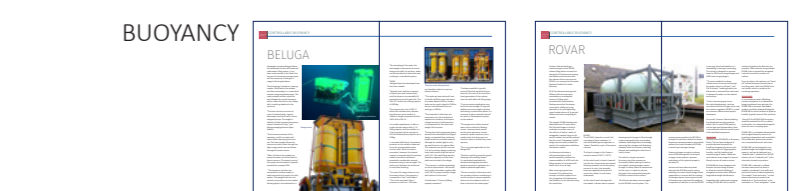
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Front cover: Oceaneering's Freedom working with an Exail USV
Image: Oceaneering

CONTENTS



TELEDYNE + VALEPORT

Teledyne Marine has agreed to acquire Valeport, a market leader in the design and manufacture of oceanographic and hydrographic instrumentation.

The independent family-owned business, which was established in 1969, designs and manufactures instrumentation for the oceanographic and hydrographic communities with a worldwide customer base that includes: subsea, hydrographic, meteorological and positioning, oceanographic, ports, harbours, dredging, energy and scientific research sectors.



Matt Quartley, Managing Director of Valeport said: "Our family is very proud of Valeport's journey to date, but the time is right for the next phase of its journey, and I am so pleased that this will be as a part of Teledyne Marine."

"The prospect of working with the rest of the Teledyne group to bring our customers an even greater range of superb, high-quality products is something that we are incredibly excited about, and will undoubtedly be to the benefit of Valeport, Teledyne and most importantly, all our customers."

HYPERION CRUDE OIL SENSOR

Valeport recently added a crude oil sensor to the optical sensor range. Hyperion Crude Oil sensor delivers high performance measurements of hydrocarbons in a compact & robust package, ideal as a standalone sensor, for ROV and AUV integration or used as part of a multi-sensor array.

Offered as standard in a 6000m depth rated Titanium housing, the Hyperion Fluorometer has a wide range (9-28 V DC) isolated power supply with data output up to 32 Hz via RS232, RS485 or Modbus communications.

Hyperion Fluorometers can be supplied with sensor guards and a shaped anti-sag connector cover. If required, a more robust Kevlar weave protected cable can be supplied.

"The sensor is designed to detect hydrocarbons in water to 0.2ppb," said Head of Marketing Guy Frankland.

"Valeport has redeveloped its environmental fluorometry sensors to expand the range of parameters that can be accurately measured. We also have sensors to accurately detect Chlorophyll a, Fluorescein, Phycocyanin, Rhodamine and Turbidity. We are now expanding within the UV spectrum to measure Crude Oil, and our R&D department is constantly looking to extend the Hyperion range."

Created for inshore, coastal and oceanographic monitoring, the Valeport Fluorometer optical sensor range delivers high-performance, precision data. The range currently includes sensors for: Chlorophyll a, Crude Oil, Fluorescein, Rhodamine, Phycocyanin and Turbidity.



Hyperion sensor

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SAAB



OCEANEERING FREEDOM AUV COMPLETES U.S. NAVY AND DEFENSE INNOVATION DEMO

Oceaneering International's Subsea Robotics segment recently completed a successful one-week Autonomous Underwater Vehicle (AUV) demonstration for the U.S. Navy and Defense Innovation Unit (DIU) at Oceaneering's subsea autonomy testing facility in Norway.

During the week, Oceaneering demonstrated its portfolio of capabilities to design, engineer, operate, and maintain the Freedom AUV, which was picked to evaluate capabilities of the platform for potential future development of a Large Displacement Unmanned Undersea Vehicle (LDUUV) prototype. The demonstration included several days of at-sea testing where Oceaneering successfully demonstrated many of the autonomous capabilities of the Freedom™ AUV, including undocking, docking, obstacle avoidance, precision payload placement, survey, and transit.

Peter Buchanan, Senior Director for Oceaneering's Subsea Robotics segment, stated: "Despite the unpredictable weather conditions, we maximized our time and successfully displayed Oceaneering's proficiency in tackling complex challenges, proving our ability to solve the unsolvable. This week has truly exemplified the power of innovation and teamwork in pushing boundaries and achieving remarkable results. Spending the time with an informed and enthusiastic team from the U.S. Navy and DIU has been extremely beneficial to our team."

The demonstration of Oceaneering's Freedom AUV represents an important milestone in the progression of U.S. defense capabilities for maritime defense and preparedness. Ultimately, advanced UUVs will supplement submarine fleets by conducting autonomous sensing and delivering payloads in challenging, dispersed, deep-sea environments. These events serve as critical baseline assessments to understand capability gaps and inform future development priorities.

Oceaneering previously announced in February 2024 that DIU had selected the company to test and develop the Freedom for its LDUUV effort. This one-week demonstration is the first phase of this contract. Phase two, if executed, will contain prototype development tasks.



OCEANEERING REMOTE OPERATIONS

Oceaneering has announced that its Subsea Robotics segment has achieved a new milestone, successfully completing its first onshore piloting of a remotely operated vehicle (ROV) from an onshore remote operation centre (OROC) in Macaé, Rio de Janeiro, Brazil.

This important milestone was possible due to the partnership between Oceaneering and Petrobras, that worked together to ensure secure offshore connectivity for piloting of an ROV.

It utilised the existing LTE coverage in the field and required a complex setup process to establish a bridge between the data networks of both companies, achieving low latency, without compromising their respective cyber security policies.

The Oceaneering team was tasked with several work scopes in water depths ranging from 5 m to 1100 m (16 ft to 3600 ft). The team performed tasks such as inspections and high-level activities such as hull inspections with cleaning and interventions.

The work scope was carried out over 14 days in November 2023 onboard the CBO Manoella vessel. The Oceaneering team used the 220 hp heavy work class Millennium Plus ROV for the remote operations from land. The Brazilian team operated the vehicle on four different scopes with 100% uptime.

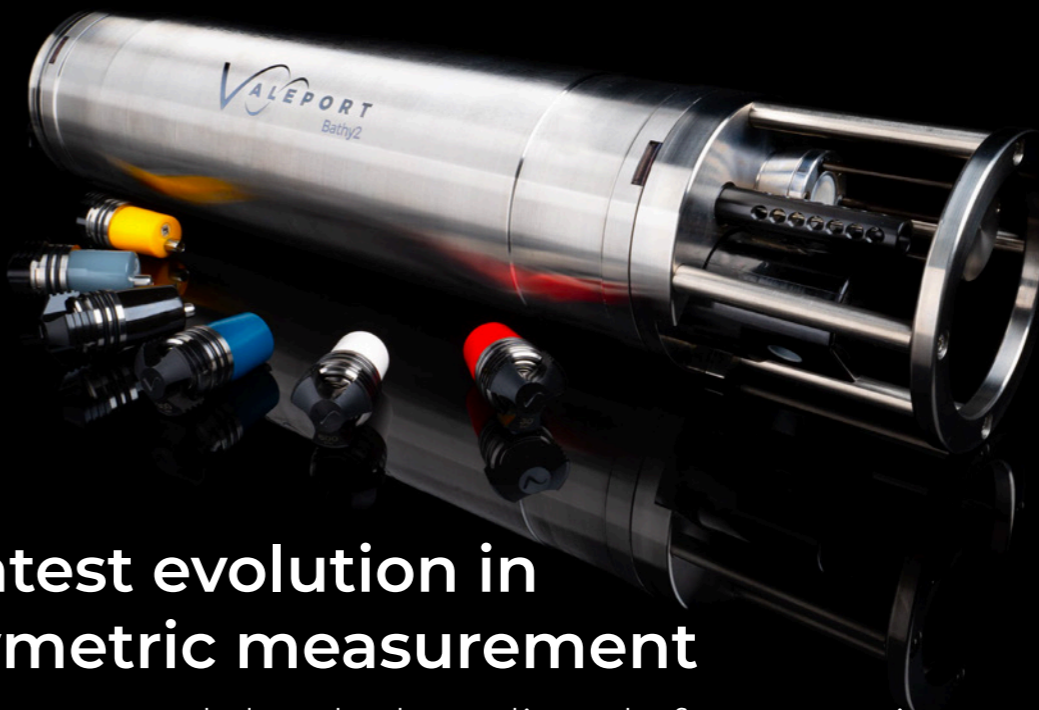
Petrobras technical representatives were able to watch the integrated ROV and Survey operations carried out from our OROC in Macaé and provided positive feedback to the Oceaneering team.

SMD

SMD has announced the sale of its first electric ROV to Jan De Nul Group. The Quantum EV will be integrated into Jan De Nul Group's new cable laying vessel, *Fleeming Jenkin*, and deployed to offshore energy projects globally. Once built, the *Fleeming Jenkin* will be the world's largest and cleanest cable-laying vessel

- Film-Ocean, has announced the expansion of its work-class ROV fleet with the purchase of a third hydraulic ROV from SMD. The company has also entered into a support agreement for services and spares.

Film-Ocean will take delivery of the ultra-compact Atom hydraulic vehicle (HV) this summer, where it will commence operations on a wide range of projects.



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Oceaneering Onshore Remote Operations Center in Macaé, Brazil

SULMARA AND ASSO.SUBSEA INCREASE MSA

Sulmara is increasing its presence in the cable market after signing a Master Service Agreement with leading international contractor Asso.subsea.

The agreement is structured around a multi-year commitment and will see the organisations collaborate on work globally.

Glasgow-headquartered Sulmara will support Asso.subsea during cable installation operations, with the company providing accurate survey and positioning of vessel and subsea assets.

With both companies growing substantially in recent years, Sulmara's Regional Director for the Western Hemisphere, Andy Nicol, believes signing the MSA can only enhance the quality of work delivered on projects.

- Sulmara has also been selected for site characterisation work at Scottish



Cable MSA agreement

floating offshore windfarm. The company has been awarded a contract to work on one of the world's largest proposed floating offshore developments.

The contract, which will see Sulmara conduct site

characterisation at the Stromar floating offshore windfarm in Scotland, will utilise the *Vos Gorgeous*, a 60m multi-purpose subsea vessel, to carry out geophysical investigation across the proposed windfarm site in water depths up to 100m.

OCEAN INFINITY GFA WITH SHELL



Ocean Infinity robotic and uncrewed vessel

Ocean Infinity, a leader in robotic and uncrewed vessel technology, has signed the signing a Global Framework Agreement (GFA) with Shell, marking a significant milestone in the provision of lean-crewed and robotic seabed geomatics, spanning geophysical and geotechnical services, within the offshore energy sector.

The GFA spans a 5-year period, encompassing all countries where Shell is currently active or plans to operate in the future. Services governed by the GFA include the Armada fleet of uncrewed and lean-crewed vessels.

Designed for today's tasks but with tomorrows in mind, the fleet of exceptionally fuel-efficient vessels only utilise a skeleton crew onboard,

with data processing and payload control conducted from onshore Operations Centres.

In due course they will be capable of working with no personnel offshore whilst also consuming solely renewable fuel such as ammonia.

With a history dating back to Ocean Infinity's inception, the partnership with Shell has evolved into a robust collaboration based on a shared vision for transformative ways of working.

The journey began with a groundbreaking project in Mauritania, simultaneously utilising a fleet of Unmanned Surface Vehicles (USVs), marking the inception of surface robotics working in the oil and gas sector.

"This agreement enables new, lean-crewed vessels into high-value field work. Using our robotic fleet to service global offshore energy activities will power the maritime industry's transformation into safer, more efficient new ways of working. It also solidifies a long-standing and valued collaboration between Shell and Ocean Infinity.

"Working through framework agreements like this allows us to achieve shorter lead-times, reduce risks, improve strategic alignment together with flexibility and scalability, work faster and ultimately supply our partners with their data more quickly," commented Katya Krylova, VP Business Development at Ocean Infinity.



EVOLOGICS DEBUTS ITS NEW DIVER NAVIGATION SYSTEM

EvoLogics has released its new acoustic navigation system for divers. This facilitates map-based navigation for divers on a mission, offering the flexibility of seamless two-way communication between divers and the dive supervision team, as well as pre-mission and real-time waypoint setup.

Much like texting on a smartphone, the system allows a team of divers to exchange short messages with each other and the surface, while also providing real-time tracking of each other's positions. Map waypoints can be added before or even during the mission to coordinate operations, and mark discovered objects or infrastructure for further investigation.

With the new system, EvoLogics aims to streamline complex underwater tasks such as search and rescue, salvage operations, recovery efforts, and cleanup operations. The Diver Navigation system enhances coordination,

improves task management, and promotes efficient information sharing, ultimately enhancing the effectiveness of diver operations.

The battery-powered diver tracker unit is compatible with all EvoLogics 18/34 modems and systems. It comes with mounts to attach it either on the diver's scuba tank or to most of the common underwater scooters. The molded unibody design of the tracker ensures broad compatibility with various diving equipment and facilitates straightforward installation.

The diver console is a compact wrist tablet that connects to the tracker modem by cable. It provides the diver access to the SiNAPS user interface - EvoLogics positioning software visualizing the map of the current operations area, the positions of all divers and the support vessel, and running the text chat tool.

At the surface, the USBL buoy acts as the acoustic node for operations. This device, a mono-unit with a USBL

antenna, an integrated PC running SiNAPS positioning software, a dual-antenna GNSS receiver, and a WiFi access point, is designed for mobile scenarios. The Buoy ensures rapid setup and fully supports bidirectional diver tracking and message exchange.

The USBL buoy calculates diver positions using acoustic signals and displays them in the SiNAPS interface for the support team. This capability allows the surface team to monitor diver positions, communicate messages, and adjust mission waypoints as needed. Bidirectional acoustic links ensure that all mission divers have access to tracker positions.

Acoustic navigation system



RTSM

Seiche has launched its Real-Time Sound Measurement Buoy, a remote monitoring system that can collect, measure, process and transmit noise monitoring data in real-time.

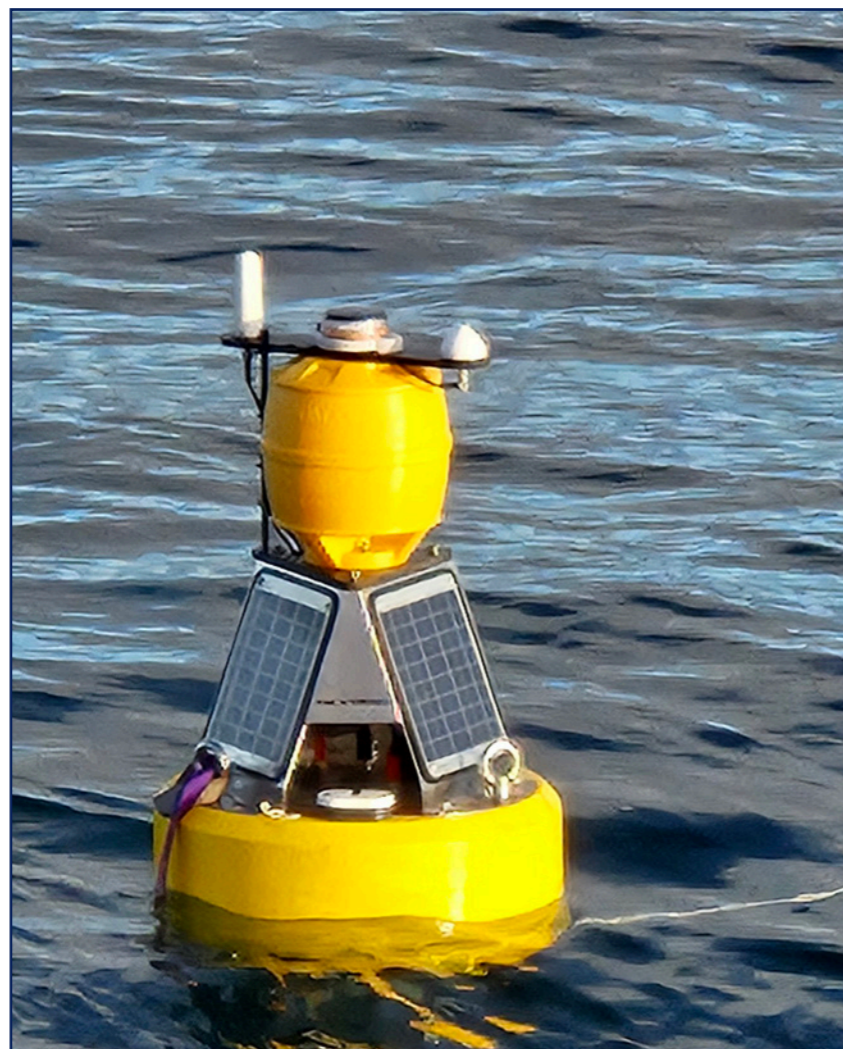
"We've always been focussed on underwater acoustics and its effects on marine life, especially mammals," said Rob Lee, Lead Marine Acoustician at the Devon-based environmental monitoring company Seiche. "In the past, we have not only designed a number of very effective passive acoustic tools, but we have also been instrumental in the development of a number of platforms from which to deploy them."

For some time, Seiche has been working on a new Real-Time Sound Measurement Buoy (RTSMB) system, a which represents a new approach to the monitoring of underwater sound with regulators needs being considered from the outset.

Pile driving is commonly used to install the large piles for wind turbines. These hammers produce acoustic vibrations that radiate from the site which have the potential to disturb, injure or even kill marine mammals.

Regulators and industry members have acting upon recommendations from the academic community to lower all marine noise pollution, including noise originating from offshore construction activities, such as piling.

"We wanted to develop a solution to monitor the sounds being



Real-Time Sound Measurement Buoy (RTSMB)

produced by piling, with onboard, smart technology processing the analogue signals received by the hydrophones," said Lee."

"Acoustic buoys are an ideal method for monitoring sound from piling; they can be deployed, often easily from small vessels, and left in place for an extended period of time, at a much lower cost than even a relatively small vessel, with no compromise on data quality."

"Previously, however, systems either recorded the sound for post processing, or transmitted the data a relatively short distance as an audio file, via, wi-fi or another range limited. With this in mind the RT-SMB has the ability to automatically

detect impulsive sound sources measure important metrics and wrap up the data into small packages for sending."

"This means, reduced bandwidth required, thus enabling the use of satellite communication, and effectively giving the RT-SMB a global effective range."

"The information is transmitted to the cloud where managers, regulators and everyone who has access to the data feed can see what's happening in real time.

"They can use this information to apply corrective measures to the Pile driving process to stop the acoustic emissions in the first place.

"This onboard processing of course does have its downsides, the power required to run a computer, and transmit the data is more than if we were to simply deploy an acoustic recorder.

"With our system however, we can put it in the water

and set it to 'standby', where the power consumption is minimal, and the solar panels can top up the batteries during daylight hours. Then, when required the device can be activated remotely, thus significantly extending its battery life, and the need for service visits.

"We tested it the entire system in March on the Moray West Wind Farm," continued Lee, "This milestone represented the final stage in what has been an extensive testing campaign meaning that the buoy is now ready to be used in anger and we're pleased to announce that it is about to be used to monitor the installation of new wind farm in the North Sea."

"There are many advantaged of real-time noise monitoring results, such as the ability to set thresholds and alert stakeholders should they be exceeded. This feedback enables a proactive approach to noise mitigation, and the ability to make adjustments during a pile installation. i.e. reduce hammer energy or adjust bubble curtains."

REAL-TIME SOUND MEASUREMENT BUOY

POWER

- 56Ah Internal batteries
- Solar assisted for longer deployments.
- IP67 Maritime Buoy

ACOUSTIC SPECIFICATIONS

- Single channel calibrated hydrophone (-210dB re 1V/uPA)
- 48 kHz sampling rate minimum (frequency range 5 Hz to 24 kHz)
- 24-bit resolution On-board audio recording to SD for post-processing and verification

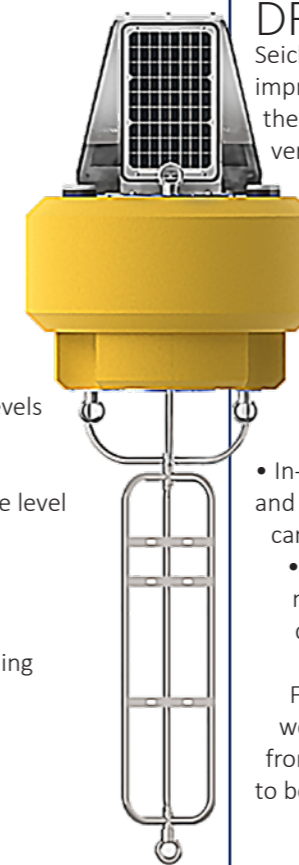
COMMUNICATIONS

- Iridium (global) or 4G GSM
- GPS

DATA PROCESSING

The following data points can be processed on the buoy and transmitted live for viewing in real time:

- Unweighted sound pressure level
- Third octave band sound exposure levels
- Weighted and unweighted sound exposure level
- Weighted cumulative sound exposure level
- Kurtosis
- T90 length
- Skewness
- Send real time alerts when approaching or exceeding a noise limit or threshold
- Ambient noise duty cycle
- System standby low-power states
- User settable threshold



DRIFT BUOYS

Seiche recently talked about its use of drift buoys to improve underwater noise monitoring. These compared the noise generated by three direct-drive tidal turbines versus three conventionally geared turbines.

A float with a hydrophone and high-resolution data logger was tethered to a drifting workboat, and the hydrophone was cabled to a PAM-Go data-acquisition system onboard the boat to enable the acoustic signal to be monitored in real time. This method had advantages over using an independent drift buoy, including:

- In-field adjustments: collection of data could be verified, and adjustments to negate clipping and low signal level can be made.
- Increased control: tethered hydrophones can be monitored for drift speed and location to meet target data collection zones.

Findings indicate that Shetland's tidal turbines operate well within acceptable noise limits. Underwater sound from both the direct-drive and geared turbines was found to be unlikely to result in injury to marine mammals.

NBOSI CTD

Neil Brown Ocean Sensors, Inc. (NBOSI) has launched a new integrated conductivity-temperature sensors (CTD) Sensor which the company says, promises to redefine underwater data collection by addressing an increasing demand for smaller, more capable unmanned underwater vehicles (UUVs) in various industries.

The UUV landscape is undergoing a transformative shift, driven by technological advancements, artificial intelligence (AI), and machine learning (ML). As vehicles are getting smaller, while growing in numbers and enhancing their capabilities, there is an increasing demand for compact, affordable, yet highly accurate sensors. This demand is unprecedented and continuously expanding.

The integrated CTD sensor represents a leap forward in UUV technology, offering a compact, palm-sized design that provides research-quality temperature, salinity, depth, and sound speed measurements. Dr. Dave Fratantoni, NBOSI's CEO, highlights the advantages of the new sensor, emphasising "simplified maintenance, faster recalibration, and superior data quality."

"Key advantages of NBOSI's integrated CTD sensor include streamlined installation and maintenance. By eliminating the internal electronics board, NBOSI has made sensor integration, routine calibration, spares management, and field replacement a breeze, reducing

operational complexities for UUV fleets. "Customers can get direct sound speed and ocean density data in real-time with the precision pressure sensor, ensuring accurate data without burdening the vehicle's CPU."

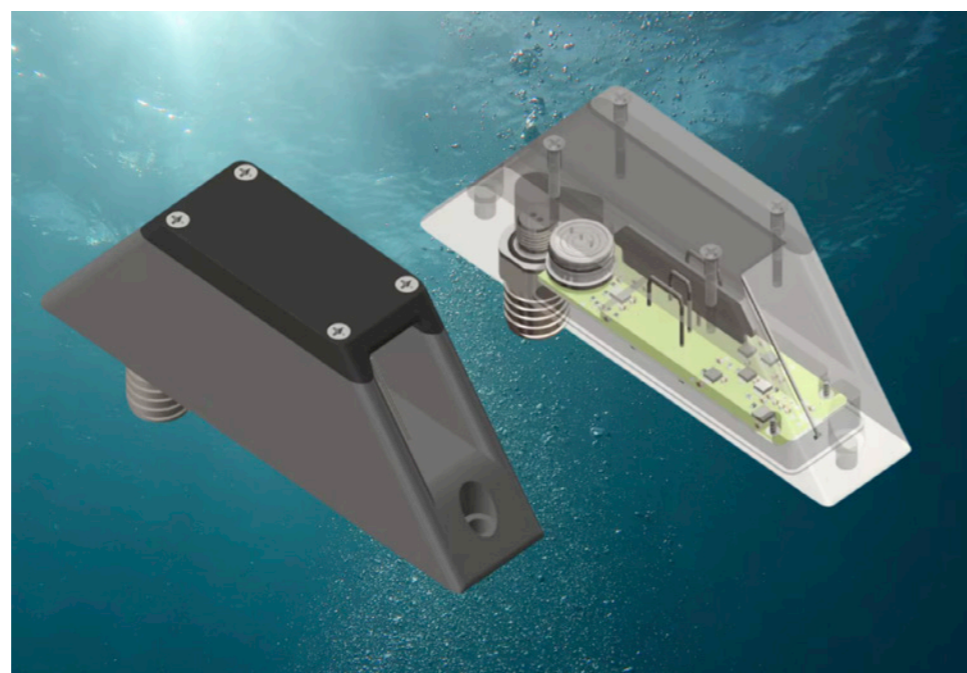
"The rugged and large-aperture flow-through design of the sensor not only offers class leading hydrodynamic performance, but also eliminates the need for an energy-consuming and noise-producing pump."

Design flexibility has been built in from the start with certain sensor variants featuring a bulkhead connector on the cell. This provides end-users with greater vehicle and systems design freedom, and operational flexibility, optimising UUV deployments for maximum efficiency.

"As a further bonus, the new integrated CTD sensor maintains identical form factors and dimensions to existing NBOSI CT sensors, ensuring backward-compatibility."

Over the past 18 months NBOSI has contributed to cutting-edge projects globally, from mine-hunting vehicles in Japan to deep brine pool studies in the Gulf of Mexico. The company's technology is a critical component of the HII REMUS 300, foundational for the US Navy's Lionfish SUUV program.

Looking ahead, Fratantoni expresses confidence in NBOSI's ability to adapt to the evolving needs of the industry: "As UUVs continue to shrink in size, NBOSI's compact sensors are poised to play a crucial role in meeting the industry's demands."



Integrated conductivity-temperature sensors (CTD)

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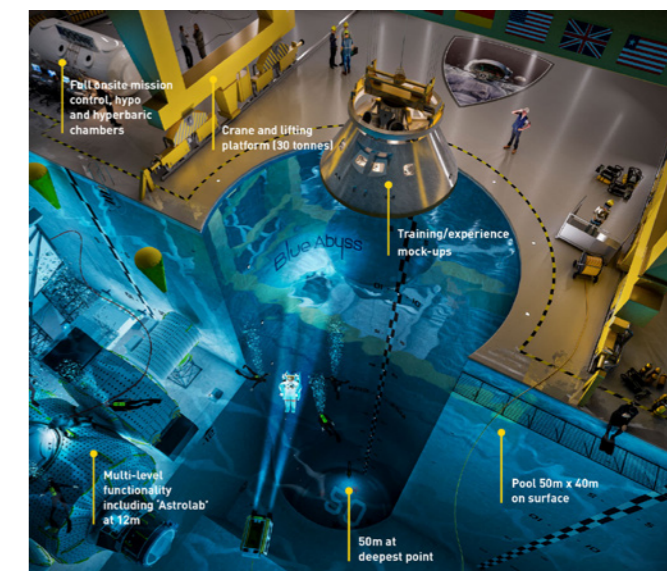
Earlier this year, the Blue Abyss extreme testing evaluation facility received a boost when the Cornwall-based company completed the purchase of 12 acres of land in the city of Brook Park, Ohio. The group anticipates building state-of-the-art extreme environment research, development, and training centre, and hotel.

The group hopes to follow this up with a similar purchase in Cornwall.

The facility will enable everything from training astronauts all the way to autonomous underwater vehicles, swarms, ROVs, divers, scuba diving, commercial diving, as well as free diving.

"The plan is for a 50m long and 40m wide, stepping down about every 10m, until a 16m diameter sinkhole to 50m," said Richard Tanner of Blue Abyss. It will contain 42,000m³ of water.

"It's got a wide spectrum applications, it's going to have currents, up to 4m/s or 6kt. It is aimed at testing to TRL 4-7, where there is a massive gap in the market,



Blue Abyss

"It will provide the ability to train people in repairing subsea cables, operate underwater vehicles, practicing decommissioning etc.

"We hope to have the facility in Newquay (Cornwall) built in parallel. With all the offshore wind being carried out in the Celtic Sea, there is a lot of testing that needs to be conducted."

SUBCONN NANO

Due to market demand, MacArtney says that it is excited to introduce the space and weight-saving $\varnothing 12.7$ mm SubConn Nano, which builds on the globally trusted SubConn design.

This new Nano connector offers a versatile and robust performance, making it suitable for multiple applications and the increasingly compact design of underwater instruments, equipment, and systems.

The underwater industry continues to exceed the limits of what remotely operated and autonomous vehicles can achieve from the surface to the seafloor. As a result, there is a growing demand for solutions and technological advancements that can bolster high performance while maintaining a small footprint.

MacArtney aims to provide a comprehensive range of connectivity solutions catering to the diverse needs of our customers – ranging from high to low pin count connectors.

The addition expands SubConn's product portfolio, offering a new dimension of connectivity options.

Despite its size, the market-driven SubConn Nano delivers powerful

performance across a range of applications. Whether it's sensors, AUVs, or other subsea devices, the SubConn Nano fits seamlessly.

The SubConn Nano connector draws upon the well-known and 45 years of field-proven design principles of the SubConn Circular and Micro Circular series.

It has been designed with enhanced sealing capability, ensuring reliable performance even in challenging underwater environments. Its meticulously designed uniform contact size and layout maintain consistency and dependability.

This splash and wet-mate connector is manufactured from high-grade titanium and neoprene to withstand deep ocean depths and open-face pressure ratings. The $2\frac{1}{2}$ -turn locking sleeve has been specially crafted for seamless mating and prevention of anti-seizing.

A legacy of reliability and innovation With over four decades of connectivity proficiency, the SubConn portfolio exemplifies precision engineering and seamless adaptation to the dynamic underwater technology market. From the larger $\varnothing 46.5$ mm (25-pin SubConn Circular) to the ultra-compact $\varnothing 12.7$ mm (6-pin SubConn Nano), SubConn's connectors offer reliability and innovation.

PISTON CORER

Feritech Global has completed a major design and build project for Oceaneering. The company has designed a next generation auto-drop piston corer which is expected to dramatically reduce the amount of time needed for subsea geotechnical surveying, increasing safety and efficiency, whilst reducing costs.

A piston corer is a long, heavy tube plunged into the seafloor to extract samples of soft sediment. Analysis of these samples provides vital information for developers who want to build installations out at sea, such as wind turbines, oil and gas pipelines, or undersea cables.

The new system includes a range of innovative features. Using sophisticated software, the auto-drop piston corer can be programmed, lowered to pre-set sea depth and then automatically released. This provides much greater precision and faster speeds than traditional piston corers, which are launched manually by a trigger mechanism. As well as improving efficiency, this system also enhances operator safety.

In addition, the Launch and Recovery System (LARS) and the winch can be operated remotely, through a control panel which is integrated into a lightweight wearable pack. This allows the operator to carry the control panel on the front of his body, making it portable and flexible.

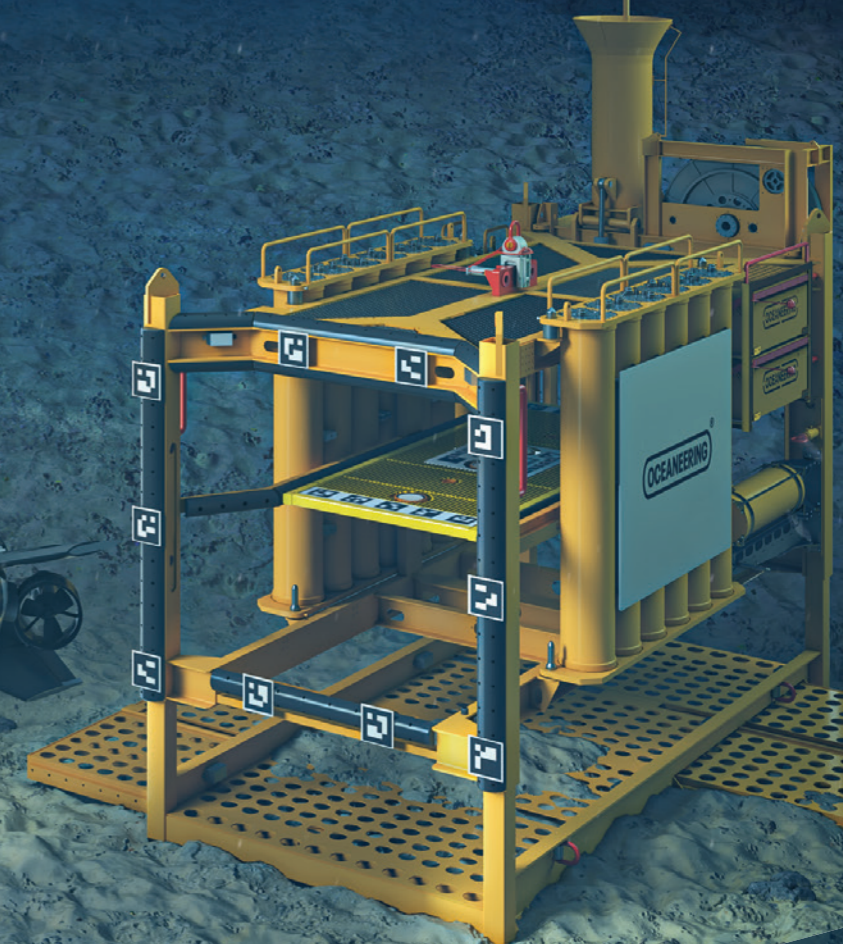
As a result, piston corer operations can be carried out safely by only one person, whereas previously at least two staff would have been needed to operate all the equipment required.

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New Nano connector



Connect with what's next at oceanengineering.com/rov

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SENTINEL

One way to advance human access and understanding of underwater environments is to live within for extended periods. So says the Deep Institute.

From its Wye valley base on the England/ Wales marches, the group has access to a 50acre site featuring an 80m-deep flooded quarry. Into this, it plans to install a subsea habitat called the Sentinel.

Subsea habitats themselves are not a particularly new phenomenon. Previous ventures such as the Conshelf 1, Conshelf 2, Seal III Tektite II, La Chalupa and Aquarius Reef Base have all been established as underwater habitats. The Sentinel system, however, is considerably larger.

The design is based on modular habitats around 16m in length and weighing around 450t. Inside, a crew of six can live in saturation for up to 27 days. From this, they can carry out dives and excursions on the seabed gathering data and samples.

Within the subsea base are hotel facilities, and work rooms such as a large wet and dry lab, dive centre, a machinery plant.

Divers can use the submerged base to explore the surrounding area. At the end of the time, the crew can transfer under pressure to the surface and decompress there, or alternatively, decompress within the subsea base.

"The habitat is rated to the full 200m," said Mike Taylor, Strategic Partnerships, "so the inhabitants can actually decompress at depth,

possibly spending the last few days of their mission decompressing on site so when they surface, they're already at one atmosphere."

The hull itself is made into three segments connected by spherical terminal ends to form a triangle.

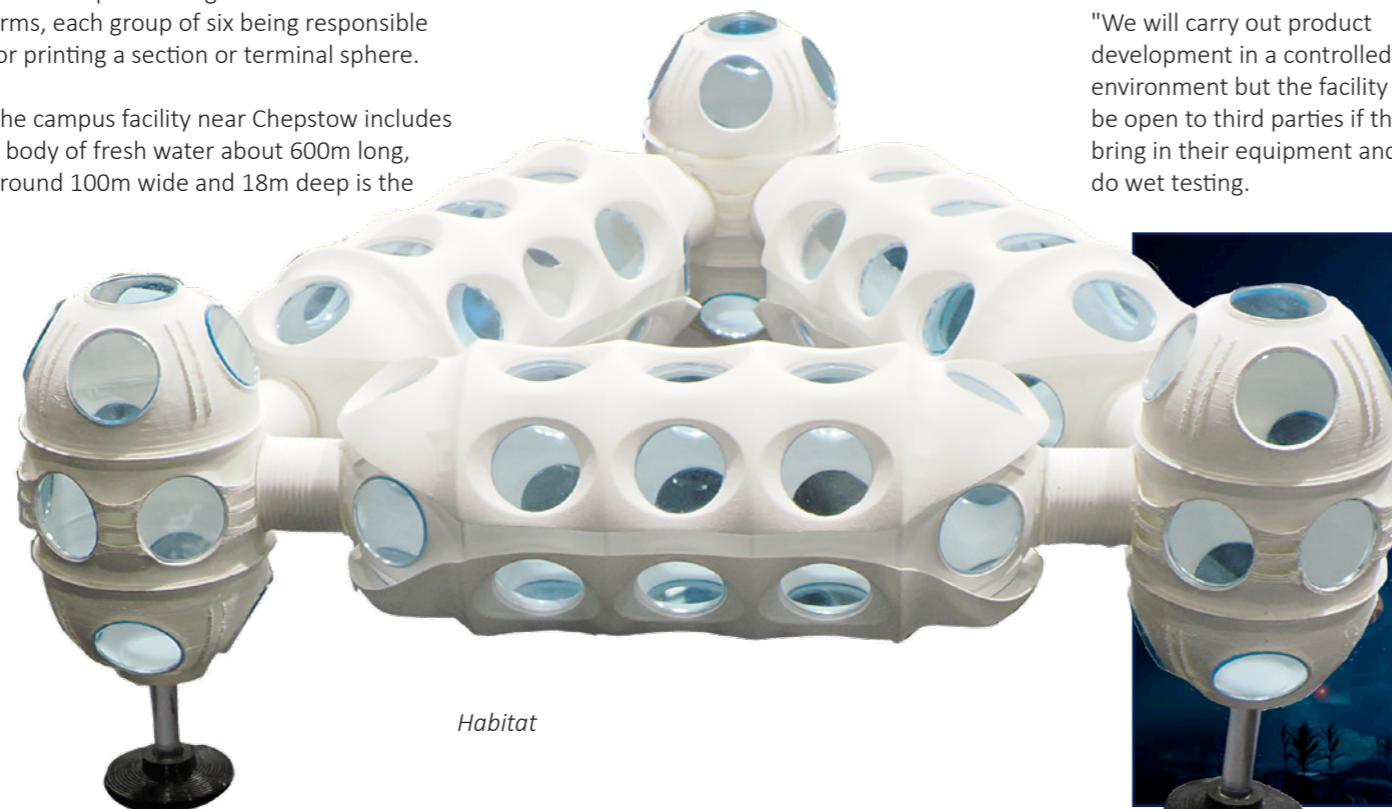
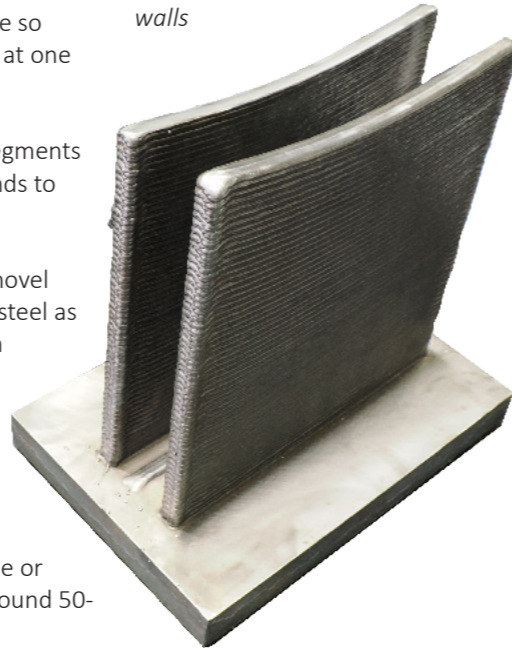
"The units are manufactured by a novel 3D--printer process that uses mild steel as the feedstock," said Taylor "We can also provide steel coating by applying an overlay of inconel on the surfaces if it is necessary for some areas to have a high resistance to corrosion.

A typical structure would be a single or double skin with the walls being around 50-100,mm thick.

"To enable this complex fabrication, we have set up an arrangement with 18 robotic arms, each group of six being responsible for printing a section or terminal sphere.

The campus facility near Chepstow includes a body of fresh water about 600m long, around 100m wide and 18m deep is the

3D Printed metal walls



Habitat

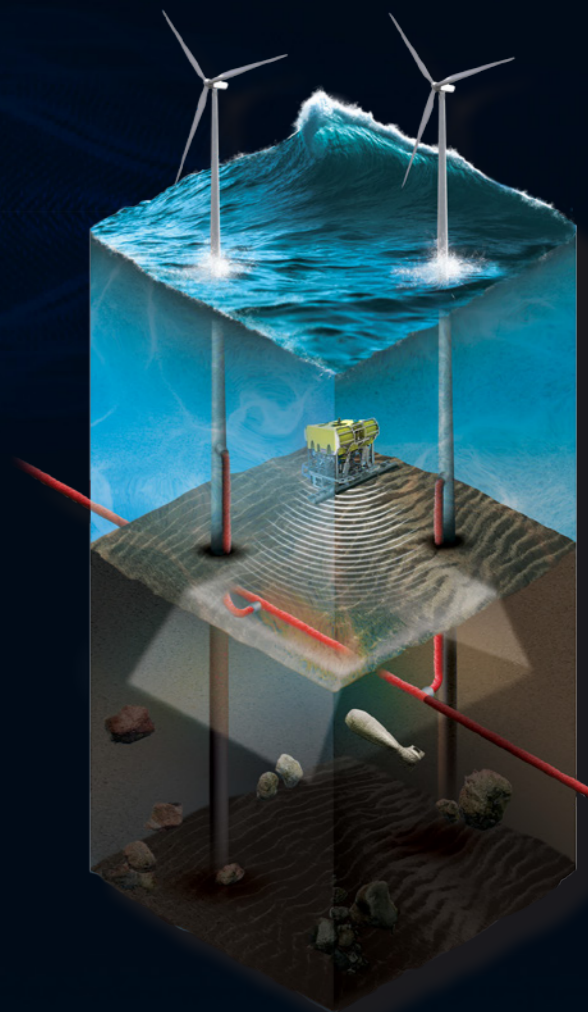
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deepest point. This was originally a quarry with the limestone removed for building materials.

"We will carry out product development in a controlled environment but the facility will also be open to third parties if they want to bring in their equipment and come and do wet testing.

"We will also develop training programmes for becoming like habitat diver as well as the delivering of courses. "We re not trying to do is replace submersibles or ROVs but to complement and to allow long-term observation.

"There are parallels between what we plan to do and the international

space station. With a permanent presence in an area, we hope to learn more and discover benefits that we many not even be able to predict at present. If we are going understand processes, we need to oceans be more connected.

The first ocean deployment we hope will be 2027.



In operation

PULSE 8X

The Pulse 8X has long been the “go-to” underwater metal detector for public safety dive teams, police departments, government agencies and other forensic teams across the globe who are tasked with locating missing evidence. This missing evidence can help solve crimes and provide families with closure.

This detector that has been awarded #1 by US Homeland Security as a commercial grade detector that will locate any metallic object; which is key component to finding disposed of weapons, cell phones and any other items that criminals don’t want found.

In the Spring of 2010, a woman named Shannon Gilbert made a hysterical phone call to 911. She had been at an individual’s home on Long Island and said she believed someone was after her.

She fled the known location on foot and told the 911 operator there were people trying to kill her. Then, Gilbert disappeared. Police began their search with metal detectors across a large search area of Gilga Beach, one detector being the Pulse 8X.

The teams were tasked with finding remains or any evidence of Ms. Gilbert. Many units were already owned by Suffolk County and were brought in to help the search across many of the marshes in Oak Beach, New York.

In December 2010, a police officer and his K-9 found human remains

near Gilgo Beach. It wasn't Gilbert, but the bodies of four other women were located.

What started as a search for one missing woman led to the discovery of multiple bodies (10 in all) along the Gilga Beach area.

This resulted in the capture of a serial killer who was ultimately charged with murder in January of 2024, more than a decade later.

The dedication of the entire team working on this high-profile case for more than ten years is a testament to all public safety and police departments across the globe that help the public when the call comes in.

In another part of the United States the SAR-1 underwater metal detector is in use by The Charles County Dive Rescue Team to search in zero visibility conditions. These detectors utilise the technology from the Pulse 8X and package it into a sleek, wireless design that vibrates upon location of metallic objects.

Chief Porter states the team got a “Request from military dependent on a lost phone with special information on it.”

The team went to work with their SAR-1 metal detectors and “found 18 phones, 2 fishing poles, knives, and other items.” The unit was able to locate the correct phone that they initially set out to find.



Pulse 8X

REDUCE COSTS WITH BALMORAL INTEGRATED BUOYANCY SYSTEM

Balmoral INTEGRAL MODULE PLUS™

Our integrally clamped buoyancy module, Type Approved to API 17L, removes the need for a separate clamping system by attaching directly onto flowlines, rigid risers, umbilicals, flexible risers, etc.

- Rapid installation
- Minimised deck space requirement
- Lower shipping costs
- No separate clamping operation
- Optimal load distribution
- Lower through-life cost of ownership



Innovative BUOYANCY, PROTECTION and INSULATION product solutions for the OFFSHORE ENERGY sector



HUISMAN MONOPILE GRIPPER

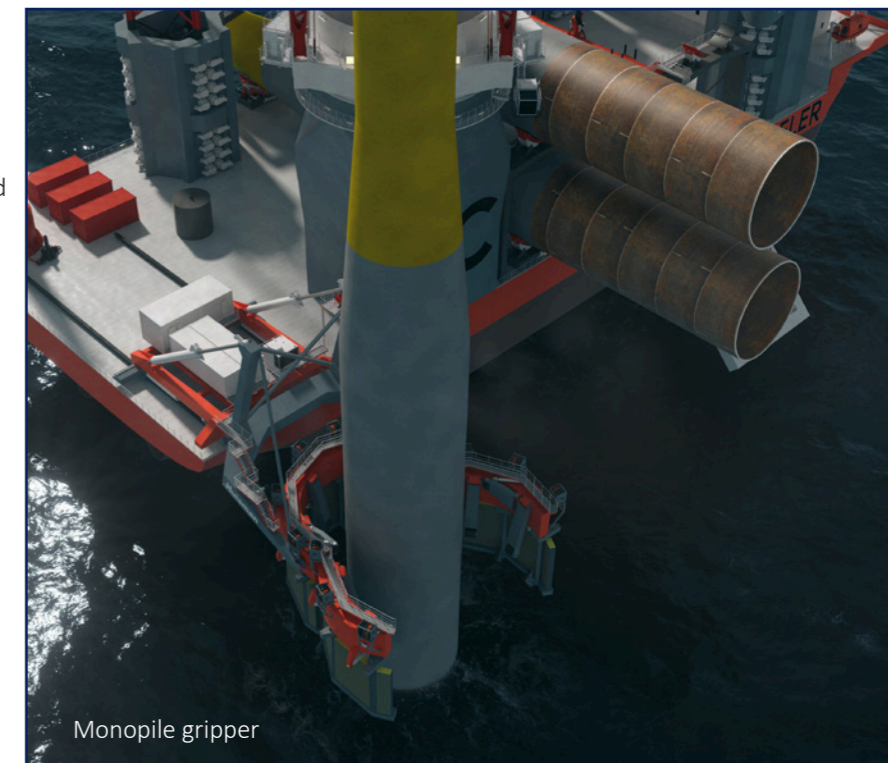
Huisman has signed a contract with Cadeler for the design and production of a Monopile Gripper. This marks the seventh gripper ordered at Huisman.

The Monopile Gripper, having a substantial 13m diameter, is engineered for the efficient and controlled installation of monopiles ranging from 80 to 120 meters in length, with a weight of up to 3000mt.

Notably, this gripper can be entirely stored on deck, facilitating future maintenance procedures and thus operational longevity.

The contract also includes an option for the integration of a noise mitigation system, designed to minimise the impact of noises on sea life, showcasing Cadeler and Huisman's commitment to environmentally responsible practices.

Production of the Monopile Gripper will take place at Huisman's production facility in China.



Monopile gripper

KRAKEN

Kraken is a leading producer of pressure-tolerant batteries for underwater use, revolutionizing the field with its SeaPower batteries. These batteries offer critical advantages in applications where space and weight are limited, allowing clients to double the Autonomous Underwater Vehicles (AUVs) dive times while reducing their overall weight compared to standard pressure-housed batteries.

"Our batteries are designed to be pressure-neutral, which is a significant benefit for subsea operations," said Patrick Paranhos, VP of Business Development for Battery Systems at Kraken.

"We use a polymer to encapsulate the battery cells and electronics, effectively protecting them from water ingress and allowing the pressure to equalise without needing heavy housings, oil, or compensators.

"Capable of functioning at depths up to 6000m, our SeaPower batteries boast the best energy-to-weight and volume ratios for rechargeable subsea batteries in the industry."

Traditional battery designs are encased in robust, pressure-resistant housings, typically made of aluminium or titanium. They

are filled with oil to neutralise the effects of water pressure—a method effective at any depth due to the oil's incompressibility. However, this design increases the overall weight since it includes the power cells and the considerable weight of the housing, oil, and compensators, which do not contribute to the available energy.

Kraken's battery modules, ranging from 5kWh to 23kWh and using Li-ion pouch cells, are customizable for voltages between 45V and 400V.

They are commonly arranged in series or parallel modular banks to meet specific capacity and voltage requirements. These batteries can form systems up to 1MW. Kraken enhances the utility of these power banks with smart power-comms rails equipped with RS485 communications, which facilitate the assembly of power banks and remote management of individual batteries.

Each SeaPower battery includes a Battery Management System (BMS) with solid-state relays that continuously monitor the battery's status. The design minimizes cables and connections, ensuring power transmission via rails and direct temperature and voltage monitoring for each cell through PCBs. It maintains dependable



Subsea Battery



Power system

communication through a CAN Bus. Rigorously tested for quality assurance, each battery undergoes over 100 cycles at 660 Bar, adheres to ISO 9001 production standards, and is UN 38.3 compliant.

The batteries also feature integrated cell heaters to facilitate quicker charging times, which is particularly beneficial in challenging environments. With Kraken's 15kW charger, a single 23kWh battery can be fully charged in four hours, with the option to charge four batteries simultaneously.

Kraken SeaPower's exceptional energy density and reliability make it the preferred choice for clients looking to maximize operational efficiency. Crafted with precision and quality in Germany, Kraken's products set a new industry standard.

SEAPOWER 1MW SYSTEM

In recent years, 1MW subsea battery modules have emerged as a novel solution in an expanding market.

"Wind energy is produced as turbine blades rotate, but the inconsistent nature of wind affects the power generated. Stabilizing this output is essential and can be achieved in two ways.

"One method is to integrate batteries

within the turbine structure. This approach, which uses dry batteries, presents logistical and weight challenges inherent to the turbine's design.

"The batteries take up considerable space within an area typically limited in size. Additionally, installing and replacing these batteries poses significant logistical challenges.

"An alternative is to establish a fully operational subsea power system. Such a system, designed for easy deployment and retrieval, avoids the issues associated with turbine-embedded solutions."

The 1MW power bank that Kraken developed provides significant weight and cost-efficiency advantages. The design capitalizes on the inherent efficiency of each battery in terms of power-to-weight and power-to-volume ratios. When combined to create a 1MW system, the resulting weight, size, and cost reduction is substantial.

Patrick Paranhos, Kraken's VP of Business Development for Battery Systems, discusses the benefits of this innovative product line. By eliminating the need for pressure housings, oil, and pressure compensators required for deep-sea conditions, these cost savings are passed on to the customer. Consequently, Kraken's power system is not only the smallest and lightest at this scale for subsea use but also the most cost-effective option available.

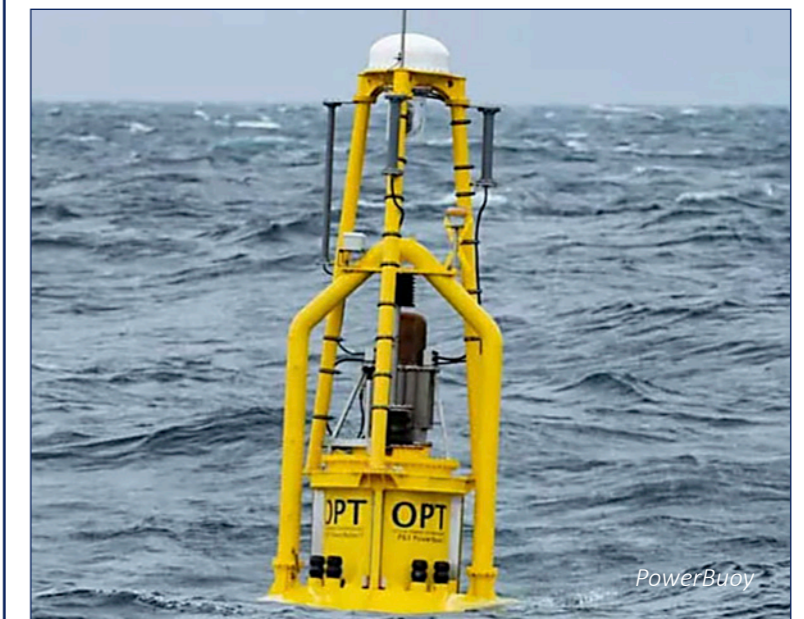
GREENSEA IQ AND OPT

Leveraging its versatile open architecture platform OPENSEA, Greensea IQ will continue to work with OPT to develop the next generation of OPT's Maritime Domain Awareness Solution (MDAS).

OPT is renowned for its over-the-horizon (OTH) MDAS-equipped PowerBuoy products. The OPT PowerBuoy serves as an innovative renewable energy solution, harnessing its power from a combination of solar, wind, and wave activity. MDAS is integrated with OPT PowerBuoys to monitor and collect data in marine protected areas, mitigate illegal fishing, provide automated vessel traffic data for ports, or support extended offshore monitoring and data collection capabilities for defense and security applications.

The new multi-year contract extension, which will run through to May 2025, will see Greensea IQ's advanced technologies, including OPENSEA and Safe C2, play a pivotal role in the evolution of OPT's MDAS, with Greensea IQ and OPT collaborating on all aspects of system and software design and development, including command and control, communications, and data transfer, including integration of OPT's unmanned surface vehicles (USVs) into the overall architecture.

Initially developed for specific defense purposes, the dual-purpose technologies, OPENSEA and Safe C2, are being reworked to adapt to and support OPT's objectives in maritime security and awareness and will enhance the efficiency and effectiveness of its ocean energy and defense solutions. This partnership will encompass integration of sensory data, user interface optimization, secure data transfer to the cloud, and integrating edge computing and storage solutions.



PowerBuoy

SYNAPSE H-GRAD

Marine Magnetics has developed the Synapse Transverse Horizontal Gradiometer, a new tool aimed at the underwater magnetic anomaly detection market. This highly versatile and ultralight gradiometer offers very fast sampling (up to 20Hz) while providing automatic configuration, coordination, synchronisation and self diagnosis.

At the system's heart is a Microcell Rubidium sensor which makes the system very power efficient, and small and light weight. At only 21.8kg (48 lbs), the combined frame and two nodes can be deployed by one person, allowing the use of smaller, greener vessels, and saving offshore costs.

The Lightweight anodized aluminium streamlined Gradiometer frame is neutrally buoyant and produces extremely low drag. This makes it ideal to tow behind Autonomous Underwater Vehicles, or lightweight

Autonomous Surface vehicles.

It can be installed on a heavier frame for traditional towing, or for reaching deeper depths.

All models can be equipped with an integrated pressure sensor and altimeter and an inertial measurement unit (IMU). The Altimeter is narrow beam 200kHz, with 0.01m resolution and 100m range. The IMU provides a full Euler-angle attitude solution with 0.01° resolution (pitch, roll, yaw).

Optional components include Side Scan Integration and Interface cables, and AUV communications tow cables. All this makes it one of the smallest and smartest sensors on the market. Synapse is designed to comfortably work as a single sensor, or as an array of up to 30 sensors, using a single data stream, and keeping itself time synchronized with no user intervention.

PERFORMANCE

Operating Zones	Worldwide.
Sensor Sensitivity	0 pT/rt-Hz
Resolution	1 pT
Dead Zone	1 Zone (+/- 6 degrees from center) Sensor can be easily rotated

PERFORMANCE

Sampling Rate	Up to 20hz
Sensor Type	Scalar (Rubidium optically-pumped)
Power Consumption	4.5 W per node
Range	18,000 nT –20,000 nT

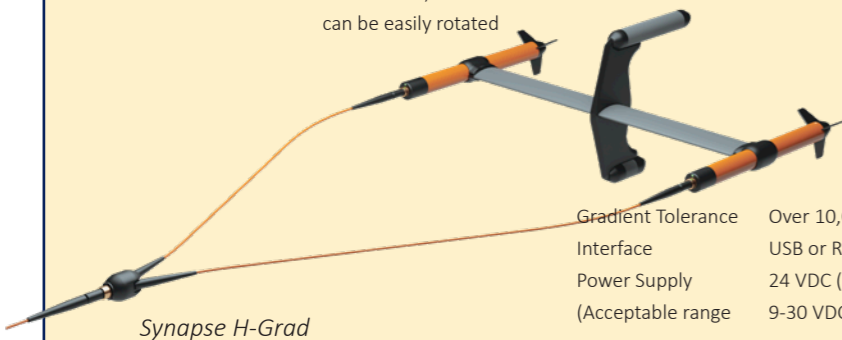
PHYSICAL MAGNETOMETER

Length	86 cm (33.75 in)
	94 cm (37 in) w/ altimeter
Diameter	7.6 cm (3 in)
Weight in Air	3.5 kg (7.7 lbs)
	4.7 kg (10.3 lbs) with altimeter
Weight in Water	Neutral
Depth Rating	1000 m (1420 psi)

GRADIOMETER SELF-RIGHTING FRAME

Span	1.5m (59 in)
Height	65 cm (26 in)
Weight in Air	12.4 kg (27.3 lbs)
Weight in Water	Neutral
Depth Rating	300 m (426 psi)

Gradient Tolerance	Over 10,000 nT/m
Interface	USB or RS232
Power Supply	24 VDC (120-240 VAC)
(Acceptable range)	9-30 VDC



Synapse H-Grad

GEOPULSE 2

GeoAcoustics has launched a new sub-bottom profiler.

Called the Geopulse 2, it is designed for diverse applications including pipeline detection, geological surveys, dredging surveys, environmental assessments, and buried object detection.

It replaces the original Geopulse analogue sub-bottom profiling system which was launched 30-35 years ago.

"Over the years, the company has sold many hundred," said Richard Dowdeswell, Chief Commercial Officer at Norfolk-based GeoAcoustics.

"The industry liked them because they were reliable and if they ever did go wrong, it was possible to open the enclosure and using a soldering iron, change a component.



GeoPulse 2

"We stopped making them about two years ago but last circuit boards still printed Ferranti ORE on them. We haven't been Ferranti ORE since 1991. "

NEW CHAPTER

The new Geopulse 2, is effectively a drop-in replacement for the original Geopulse transmitter. Because there's such a large installed base and it's still relied upon as a workhorse pinger survey system, customers can keep their existing transducers and cables, and just swap out the topside.

"While the old system only used a single frequency pinger to make the measurement, the new system is fully digital" said Dowdeswell.

"Not only does it use a pinger, but also chirp waveforms, and a Ricker (also known as a Mexican hat wavelet) centred upon a particular frequency.

The selection of which waveform to use depends on the geophysicist. But there are trade-offs between

penetration and resolution.

The GeoPulse 2 is available in 4, 9 or 16 transducer configurations giving an operational depth range down to 5000m. It can achieve resolutions up to 6cm and penetrate depths of up to 80 ms in fine clay and 20m in sand.

FIRST ORDERS

GeoAcoustics has secured the first major order for the GeoPulse 2.

GeoAcoustics' established Middle East channel partner MER-Subsea and will see the first 15 GeoPulse 2 systems exclusively delivered to end-customers across the region.

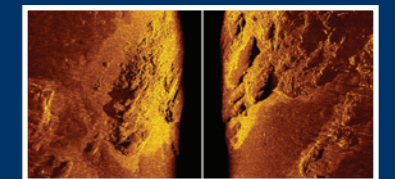
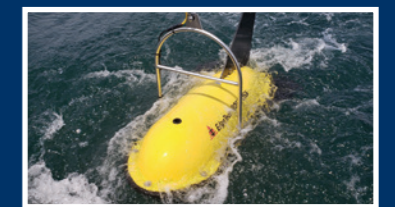
"We are confident that the new capabilities of GeoPulse 2 will unlock more flexibility and efficiencies for MER-Subsea customers," said Akram Ali, Managing Director of MER-Subsea



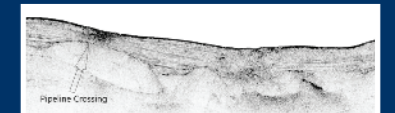
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- **Loaded:** Built-in pressure (depth), heave, pitch and roll sensors
- **Flexible:** Support for 3rd party sensors



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BOULDERS

NEW AI TOOL TO SOLVE BOULDER TROUBLES FOR OFFSHORE WIND DEVELOPERS

Renewable energy industry supplier Ocean Geophysics has introduced an AI-driven boulder identification tool that will significantly reduce development risk, time and cost for developers of offshore wind farms.

“We have successfully developed an AI-driven software that can automatically identify boulders down to 25 centimetres in height, with the power to remove duplicated boulders from seabed survey data.

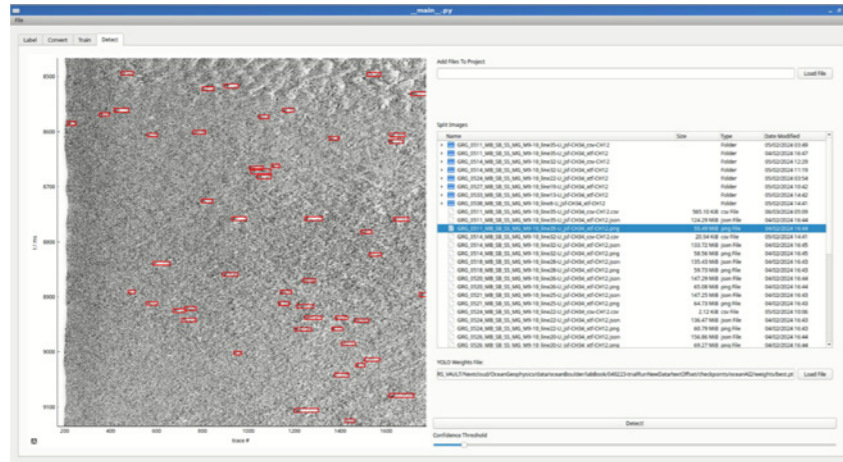
This will dramatically simplify and expedite the boulder identification process, with the associated time and cost savings for developers,” says Alison Wells, CEO of Ocean Geophysics.

Essential for wind farm developers Large, individual boulders as well as boulder fields with thousands, sometimes millions of smaller boulders pose a big challenge for the planning of offshore wind farms and cable routes. An analysis of the seabed is a prerequisite prior to any construction work.

Today, side-scan sonar – a system for detecting objects on the seafloor – is commonly used to identify boulders on the seabed. This analysis is then used to choose the ideal placement of wind turbines, substations or subsea cables for offshore wind farm developments.

Detecting big boulders is relatively straightforward. However, boulder fields with thousands or tens of thousands of boulders pose significant and costly obstacles to developers.

As developers must obtain both the



AI tool for boulders

amount and positioning of boulders to calculate the time and cost of boulder clearance. The cost of hiring offshore vessels to conduct boulder clearance is obviously substantial.

“There have been instances in our industry where millions of boulders have had to be identified manually one by one.

“It is tedious and prone to human error, a process we wanted to ameliorate in order to reduce the time and cost associated with boulder identification – and subsequent boulder clearance-work,” adds Alison Wells.

Seconds instead of months Ocean Geophysics’ new AI-driven boulder identification tool leverages a machine learning algorithm that allows for the automatic detection of boulders as small as 25 cm in size and automatically removes duplicates.

The software can process entire seabed survey areas quickly, taking around one second per side-scan line to detect all boulders.

“This means that boulder identification work, which previously took weeks or months to complete, can now be done in a few seconds,” says Alison Wells.

The company will integrate the tool with its specialist offering of processing, interpreting and reporting of marine geophysical data. The software will not be sold as a stand-alone product.

In just one year, Ocean Geophysics has grown from four to fifty-five employees. The company’s European and US clients datadrop seabed survey data in their evenings, Ocean Geophysics process it through the European and US night, returning the interpreted data to clients by their morning.

The company’s customers include seabed survey companies and indirectly their clients (developers and operators).

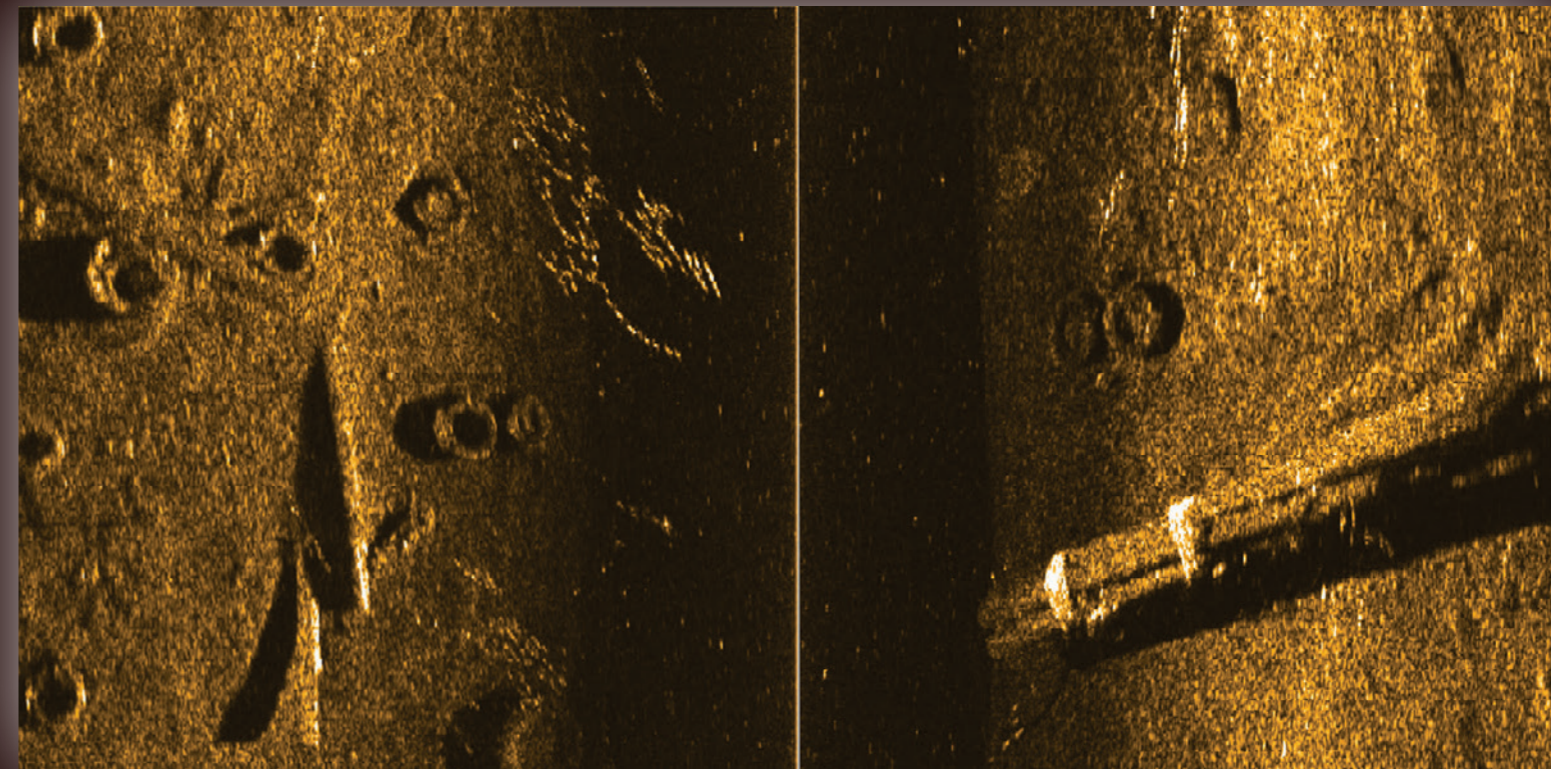
Ocean Geophysics is headquartered in the UK, and its high-capacity data processing centre is located in Chang Mai, Thailand.



Side Scan Sonar

Survey open water to identify environmental hazards such as tires and debris

- Simultaneous dual frequency operation
- Easily transported in included hard carry case
- Lightweight for one person deployment
- Economical with easy operation
- Fully digital



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DRIX MULTIBEAM

EXAIL'S DRIX USV EQUIPPED WITH SEAPIX-R MULTIBEAM ECHOSOUNDER CONDUCTS SURVEY IN U.S WINDFARM AREAS FOR NOAA FISHERIES

Exail's DriX Uncrewed Surface Vessel (USV) recently completed a first-of-its-kind fisheries research survey to assess the impact on biomass and fish stock before, during and after wind farm construction.

Equipped with a SeapiX-R 3D high resolution multibeam echosounder from Exail, two Kongsberg EK80 single beam echosounders and a Nortek ADCP, the DriX USV performed this survey off the coast of Massachusetts, Rhode Island, and New York for NOAA Fisheries Northeast Fisheries Research Science Center (NEFSC), in close collaboration with NOAA USxOC, as well as Kongsberg and Nortek.

Operating 24/7 in supervised autonomous mode, the DriX USV covered over 5000km of navigation lines, safely operating within 20m from the windfarm monopiles, detecting and avoiding ships, fishing nets and buoys. During the mission, the USV transmitted its data in real-time to a Remote Operation Center (ROC) set up at the University of Rhode Island's Inner Space Center in Narragansett, RI, as well as to Exail's Maritime Autonomy hub in La Ciotat, France.

Exail closely coordinated their efforts with the U.S. Coast Guard Sector Southeast New England, the windfarm developers, and local mariners to ensure safe autonomous operation in busy navigation channels and challenging windfarm construction areas.

With a 90% reduction in CO₂ emissions, compared to a conventional survey vessel, DriX helped contribute towards an environmentally friendly operation.



Seapix Multibeam

PHINS 9

Exail has announced the launch of its latest product, the Phins 9 Compact.

This new compact high-performance inertial navigation system (INS) is designed for all unmanned underwater vehicles and offers the market's highest blend of navigation performance, reliability, and Size, Weight, and Power (SWAP) efficiency.

The Phins 9 Compact is built around a high-performance Fibre-Optic Gyroscope (FOG)-based Inertial



Phins



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Measurement Unit (IMU) with advanced accelerometers, making it the most compact high-performance INS available in the market. With compact dimensions, a DVL-aided position accuracy of 0.1% TD, and a power consumption of less than 7 W, it is particularly suited for compact subsea vehicles operating in demanding applications with low power requirements.

"The Phins 9 Compact represents a significant advancement in subsea navigation technology, Stated Maxime Le Roy, Subsea INS Product Manager at Exail. With a heading accuracy of 0.07°, pitch & roll accuracy of 0.01°, it offers exceptional reliability and navigation precision, even in the most challenging environments.

- Exail has concluded its first sale of the Phins 9 to Bedrock, a leader in underwater data acquisition platforms. The Phins 9 Compact INS

will be integrated into Bedrock's new AUV, marking a significant advancement in navigational accuracy and operational efficiency.

Bedrock's AUV is a purpose-built, modular platform designed for swift deployment in geophysical surveys and monitoring. Equipped with Multibeam Echosounder (MBES), Side Scan Sonar (SSS), and Magnetometer (MAG), the AUV boasts a 300m depth rating and 12hr endurance surveying at 3kts with all systems operational.

The integration of Phins 9 Compact INS will empower Bedrock to achieve high navigational accuracy, address operational efficiencies, and mitigate Total Horizontal Uncertainty (THU) and Total Vertical Uncertainty (TVU).

"The INS was central to addressing uncertainties and performance challenges for our AUV. We sought

an INS solution that could overcome challenges in form factor, power, support, compactness, accuracy, and performance, and Exail's Phins 9 Compact INS seamlessly aligns with all these requirements", remarked Charles Chiau, CTO and co-founder at Bedrock.

"We are eager to witness the field performance of this INS during sea trials and explore its potential in enhancing our AUV's navigational capabilities."

Boasting compact dimensions of 88.9 x 130 mm, the Phins 9 Compact stands as the most compact high-performance INS available in the market. With a power consumption of less than 7 W and a DVL-aided position accuracy of 0.1% TD, it provides exceptional reliability and navigation precision for compact subsea vehicles operating in demanding applications with low power requirements.

BELUGA

Norwegian company Beluga Subsea has developed a novel self-contained underwater lifting system. It has been used recently in the North Sea as part of a decommissioning project and the company is looking at a range of other applications.

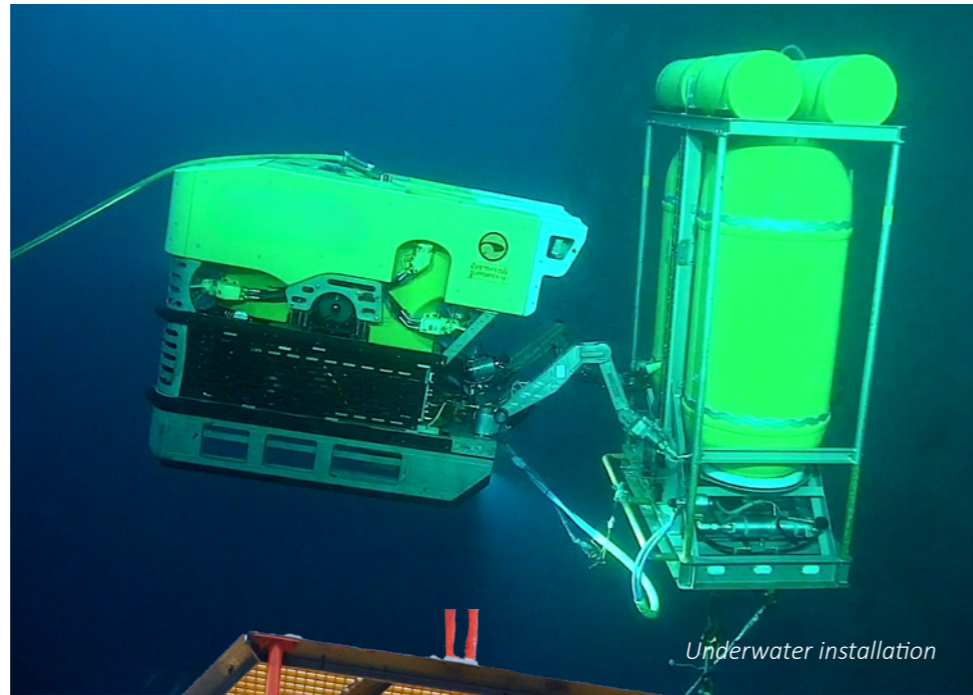
The technology is based on lowering a water-filled tank to the seabed and then evacuating it in a controlled manner using integrated pumps. The newly-created vacuum inside the tank changes the overall buoyancy which causes the tank to rise, taking with it anything attached to the structure.

"The basic structure consists of a pair of vertical tanks, support framework, tank shell and in-house designed pumps. The weight is offset by a fixed composite buoyancy system located at its top," said Beluga managing director Bjørn Kalland.

"At the commencement of the operation, we fill our tanks with water before deploying them into sea. The heavy weight allows the structure to easily enter through the high-energy splash zone and down through the water column.

"After it lands on the seabed, we pump the water out of the tanks to leave a vacuum. The pump is part of the system but the power is typically provided by a support ROV.

"The buoyancy cylinders are connected to a clump weight or dead man anchor by means of a lock system. This weight holds the unit securely into position on the seabed allowing object to be attached to it.



Underwater installation

Beluga tanks



"By evacuating all the water, the tank weight is decreased, the result being a net uplift. At any time, water can be introduced to lower the tank, resulting in a variable buoyancy.

TANKS

Beluga Subsea has developed have four basic models.

"Atypical basic tank has a capacity of nearly two cubic metres each, and this allows us to essentially lift around two tons with each tank. The VBS 4.2T model has a lifting capacity of 4200kg.

The company also has a VBS 2.5 which also contains twin cylinders but these are much smaller. at 1816m in length compared with the 2822 of the VBS 4.2.

For smaller applications, it offers a single-cylinder option with a 1.2t lifting capacity and the smallest is a 1.4m long device that can help an ROV lift medium/heavy objects up to 350kg.

In any water-filled tank, the ambient pressure on the outside is balanced by to the incompressible water on the inside. When the tank is evacuated, however, the internal support is removed and the structure needs to be able to withstand potentially considerable external pressures using its own strength. The tanks must therefore be reinforced to stop them buckling.

"For every 10s we go down on into the water column, the pressure is increased by 1 bar," said Kalland. "This is the equivalent 1kg of pressure on each cm². The tanks



Three from the Beluga family

are therefore subject to quite an extensive forces.

"The tanks we have today will start to buckle at 600m so we rate these at a water depth of 450m. Smaller tanks can be used in depth of 2000m but we can build tanks that can easily go to 3000m.

"The downside is that these are necessarily very thick walled and expensive to produce, and require a larger amount of solid buoyancy to compensate for the other own weight of the system.

"During the initial engineering phase when we first developed the original design, we decided that reinforced plastic would be a suitable material, although for smaller, lighter units, we would have to use carbon fibre. The maximum we can lift is around 2.5t, but a custom design combining three tanks would allow the device to lift 4.5t. The total lifting capacity, therefore, depends on how many tanks are included in the design.

"The concept is scalable depending on client requirements. We carried out a study to develop a system able to lift 50t. By using a modular design with tanks on the corners."

So what does 2.5 times of lifting capacity represent?

"A subsea manifold is typically around 20t which would be far too heavy for this sort of de ice but the latest generation of slim subsea trees are well within all lifting range.

"A more common application may be for the wet storage. Oil rigs and platforms are very weight sensitive, and during a construction phase, it is common to place materials that will be used in a development project, on the seabed.

"The equipment is often lowered down to the surface by floating cranes, however these vessels can be quite expensive. A more economic option may be to use a smaller boat, but these may not have the same, or indeed any, crane capacity.

"This is an ideal application for the Beluga VBS"

"We have used the system for gravel dumping and installing clamps. It is particularly applicable for decommissioning projects while pipeline removal or replacement is another potential application.

"We are currently in discussion with the company that are considering to use the system to remove explosive devices on the seabed in order to clear a route for the subsea pipe."

ROVAR

Smarter Subsea Handling is manoeuvring its novel ROVAR subsea lifting device to meet the demands of the decommissioning and offshore wind sectors with the release of two new versions. ROVAR is an acronym for Remotely Operated Vehicle for Assets Recovery.

Oil & Gas decommissioning and Offshore Wind construction necessitates a considerable amount of lifting work conventionally conducted by floating cranes but this always comes with a hefty price tag, especially in an ever tightening vessel market where oil & gas and offshore wind are competing for vessels.

The original ROVAR development dates back over 10 years when Phil Pritchard began to look for a solution to recover some of the millions of dollars' worth of salvageable material lying on the world's seabed, but quickly realised that his novel 'Underwater Forklift' design was eminently suitable for work in the underwater installation and decom market.

His idea was to develop a self-contained device that would essentially combine the manoeuvrability of a ROV with the lifting capacity of a buoyancy-lift device such as an air bag.

After receiving a grant from Innovate UK to develop the concept, and with support from the Universities of Southampton and Sheffield, he set about proving this novel idea.



ROVAR

The ROVAR is based on a small underwater vehicle consisting of three chambers. A central liquefied gas storage tank, or 'dewar', flanked by a pair of buoyancy caissons.

The liquid nitrogen in the Dewar is stored at around -196°C (-231°F).

As the vehicle and its load is lowered into the sea, dump valves are opened allowing seawater into the buoyancy caissons. As such, the assembly becomes negatively buoyant and causes the vehicle to sink slowly downwards.

As the vehicle and load approach the seabed, a dewar valve is opened allowing liquid nitrogen to flow through a pipe enveloped by the

surrounding seawater facilitating thermal exchange, vaporising the nitrogen and displacing seawater within the caisson, arresting descent and enabling the vehicle and load to hover.

The vehicle, using its vectored thrusters, may then manoeuvre horizontally before placing its load on the seabed, venting nitrogen vapour through its dump valves to compensate for the mass it is about to release, the load is then released allowing the ROVAR to ascend to the surface.

All of these operations are managed by the ROVARs control system. The reverse process enables the ROVAR to transport a load from seabed to surface. Numerous repeat operations

are possible without the need to replenish ROVARs internal liquid nitrogen storage.

Gaseous nitrogen occupies a volume around 690 times greater than liquid nitrogen at atmospheric pressure, exploitation of this physical property provides greater lift efficiency and repeatability compared to compressed gases.

Various real-time telemetry feeds data into the ROVARs control system enabling it to meter liquid nitrogen flow/vaporisation in concert with the venting of nitrogen vapour, hence precise levels of buoyancy are maintained throughout, irrespective of whether or not the ROVAR is carrying a load and whether it is

descending, hovering or ascending. The system is designed to operate down to 2000 msw using nitrogen and, potentially, 4000 msw using hydrogen.

"Thrusters enable the subsea infrastructure to be carried through the water column in all axes," said Phil Pritchard, "enabling loads to be delivered to, removed from and travel in between locations on the seabed and surface.

In the intervening years since the initial development, we have consulted with the oil & gas sector and the industry regulator (OPRED), as well as numerous offshore wind project developers".

As a result, Smarter Subsea Handling has developed two new products which, like its core ROVAR product, can be deployed independently from a conventional multi-use vessel as part of the backdeck equipment.

ROVAR-BB

The first is the ROVAR-BB, or Buoyancy Beam. This has been designed to provide dynamic buoyancy for handling elongated structures such as the removal of oil & gas pipeline bundles, and the handling (and repositioning) of cables, umbilicals and tubulars at any stage of a project lifecycle across all marine sectors.

ROVAR-BB has been designed with buoyant caissons along its beam to allow the controlled lifting of elongated structures with different longitudinal weight distributions.

Integrated with cutting and crimping tooling, ROVAR-BB can cut and lift

sections of pipeline bundles into, for example, 100m sections using multiple ROVAR units to spread the elongated load and recover the sections to surface.

Once at surface, the sections can "hand-off" to fixed buoyancy for wet-tow to recycling yards, while the ROVAR units can remain onsite to continue the sectioning operation.

ROVAR-WB

In circumstances when offloading sections of pipeline to a submersible barge is preferred over wet-tow, the ROVAR-WB or buoyant Wet Basket product, would be deployed alongside ROVAR-BB to collect sections of pipeline bundles (typically around 20m sections).

Once full, the ROVAR-WB's buoyancy would be activated for lift-to-surface and transfer to a submersible barge for eventual tow to recycling yards.

ROVAR-WB is an adapted subsea basket with integral buoyancy caissons for providing independent and controllable lift functionality without the need to use a conventional winch and crane.

ROVAR-WB can be designed to any practical length and weight bearing capacity, and can be deployed as a "seabed trailer", attached to a ROVAR master unit as a "seabed truck", to be shunted or towed into position.

ROVAR-WB is optimal in multiple scenarios where wet lay-down is needed, or preferred, to simplify and reduce the costs of subsea operations. The seabed "truck and trailer" is ideal where infrastructure needs to be deployed in a "pick and place" or be recovered in a "hunt and gather" mode.

PUMPABLE BUOYANCY

Around 15 years ago, Aberdeen based Aubin designed a novel underwater lift system (ULS) for the installation, remedial work and removal of seabed infrastructure. It was based on a low density incompressible liquid rendering objects neutrally buoyant. When Italmatch later acquired the company, it was keen to progress with the development. The company now offers two separate versions for shallower and deeper waters.

Many companies are looking to find ways of reducing costs offshore. One area of focus is vessel mounted cranes. These cannot only be expensive and not always available, but they are notoriously weather dependent. It is not uncommon for such vessels to spend considerable amounts of time waiting for conditions to change.

While the sea surface is energetic, water column conditions can be quite placid only 5-10 below. This has prompted many to look at the idea of a subsea crane. Independent from the surface, it would avoid vertical erratically accelerating hook movement.

In the past, the industry has solved this problem by the use of airbags which are cheap and versatile. Unfortunately, because the air changes volume as the bag rises and falls within the water column, these bags can be notoriously difficult to control.

The engineers at Aubin realised that liquid buoyancy would solve many of these shortcomings. As liquid is non-compressible, it retains the same density regardless of depth in the water column and, therefore, offers a more controlled lift with increased safety. Another advantage of liquid is that it can be pumped into a receptacle and immediately fills any void, regardless of shape.

"We envisaged a buoyancy unit that could be attached to an object on the seabed," said Callum Scullion, Global Technical Department Manager. "Pumping liquid would make the unit neutrally buoyant, and allow whatever it is attached to, to be easily and safely manoeuvred over the seabed by underwater vehicles or divers.

"Initially we envisaged with an inert liquid or oil-based fluid but progressed to a non hazardous environmentally responsible low-density gel made buoyant by dispersing millions of lightweight glass microspheres in suspension.

"The microspheres are gas (typically nitrogen)-filled and similar to those used within solid buoyancy foams. Different types of microspheres can be selected according to the required pressure/ depth rating. The gel matrix ensures that these spheres are evenly loaded and do not crush or collapse under pressure."

The company named this liquid gel lifting technology system Liquibuoy. In comparison to water, it creates a buoyant force of about 470 k/m³.

"A lot of the time, the engineer knows exactly how heavy the load is, but this isn't always the case," said Scullion. "With a load cell, it is possible to reliably measure how much material is required and this how solid buoyancy is calculated. With a liquid arrangement, however, if more buoyancy is required, the engineer continually adds material until sensors record movement.

TESTING

"In 2014, we conducted rigorous testing of the prototype gel lift system (GLS) at the underwater centre in Fort William. The aim was to prove its capabilities in a number of real-life operational scenarios. The aim of the trial was to prove how the lifting system handles in a real-world operational environment. Liquibuoy gel was pumped into tear-shaped lift bag and attached to a 1050kg clump weight. Soon, the lift bag perfectly balanced the mass in the water. Pumping small quantities in or out of the bag enabled the weight to be raised, lowered. In the tests, we examined aspects of mobilisation and set-up, deployment, operation, recovery and demob.

"As expected, the neutral buoyancy remained constant through the water column from 10-30m, and we experimented with tandem lifting of objects to simulate performing tie-ins, as well as lifting a dummy spool





Trials at Aberdeen university

piece which we manoeuvred and positioned on the sea bed.

"We followed these trials up with further work in the University of Aberdeen, to get an clear picture of what we needed to do to turn this concept into a practical subsea crane," continued Scullion.

"As part of a knowledge transfer partnership (KTP), we designed a prototype and developed a number of designs for applying these concepts at larger scales. We also filed some intellectual property (IP) documents on potential hybrid improvements.

"We concluded that the unit should be modular so that improvements can be developed and repairs can be made quickly and easily. As far as possible, the designs should also be simple to minimise cost. It should easily accept other items such as load

cells on the lifting unit, lights, cameras etc. "Importantly, the unit needs to be robust and, where possible, use existing proven subsea elements.

When operating, the user should take care to avoid spillage or discharge of chemicals. The system should be regarded as a sealed system where the customer rarely sees the chemicals.

"As we saw the results of the test, we started to recognise a number of potential applications, including the installation of manifolds, spools, pipeline terminations, jumper systems, etc. It could be use for supporting ROV tools or deepwater lifting operations, especially underneath a platform

"We calculated that it would be sufficient for lifting rigid spool up to 50t or Christmas trees up to 25t

LIQUID DENSITY

In addition to a liquid material that can add buoyancy to a structure, Italmatch have also developed a material That can increase the density. Called LiquiDense, It can be pumped into a system To make it less buoyant.

Pumping out this material while Simultaneously pumping in liquid buoyancy makes it transition considerably quicker.

"LiquiDense is a highly dense non-hazardous liquid that can be pumped into any structure or container to provide improved ballast weight. When compared to conventional solutions, this product can reduce the material volume required by over 50% for an equivalent ballast weight.

Unlike concrete-based ballast, LiquiDense does not form a solid material with compressive strength characteristics, which can be extremely beneficial in both the subsequent removal and control of structural trim/ballast.

LiquiDense can be supplied either as a concentrate for offshore requirements or a pre-manufactured liquid with a density of 3000 kg/m³. It can be mixed and pumped using readily available standard offshore equipment.

as well as 10t manifolds, 30t piles, 5t pipeline end manifolds and even ROV tools up to 2t.?

The designers say that its Deepbuoy product is capable of creating controllable buoyancy in water up to 3000m and can be used to manoeuvre heavy subsea structures of up to 2000t.





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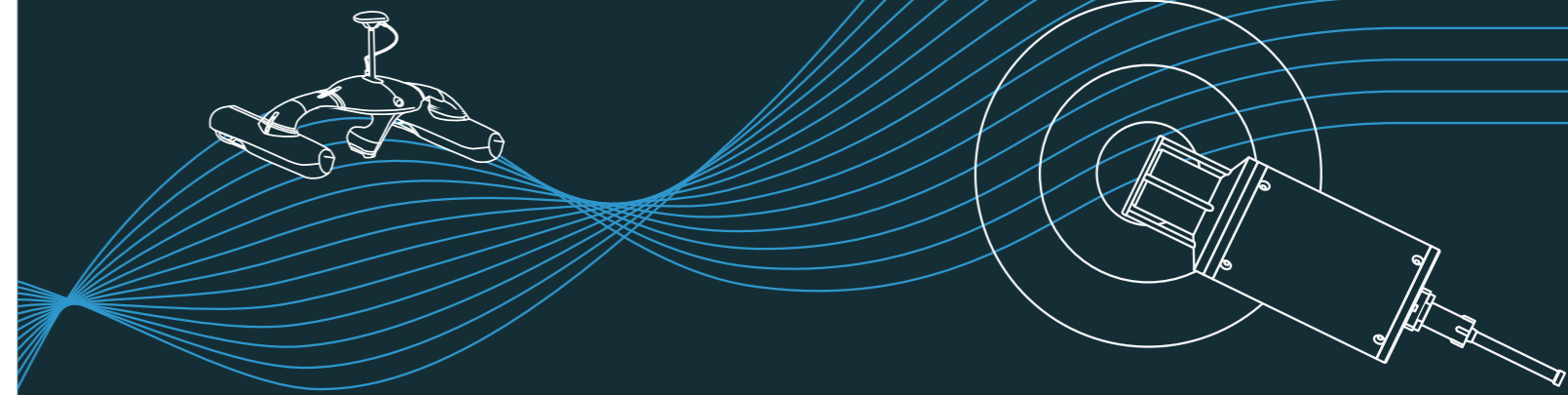
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