UNDERWATER ROBOTICS

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MTS marine technology society

Survey Arms

Vortex Subsea Solutions introduces their 4 function Vortex Full Reset (FR) survey arms.

Featuring 4 functions , the arms offer unprecedented flexibility for visual access, especially in scenarios like assessing pipeline free spans where zooming in the camera alone may not suffice.

Vortex strikes a balance between simplicity and practicality, providing pressure-compensated flow controls for the four arm functions. This allows ROV crews to independently control function speed with depth changes, enhancing the overall versatility of the arm

The extensive range of movement provided by these arms allows clients to push the boundaries in surveying pipelines, umbilicals, and power cables. To facilitate installation, hydraulic hoses from the arms to the host ROV come pre-assembled. Mobilisation is further simplified with sacrificial mounting plates included for easy attachment to the host ROV.

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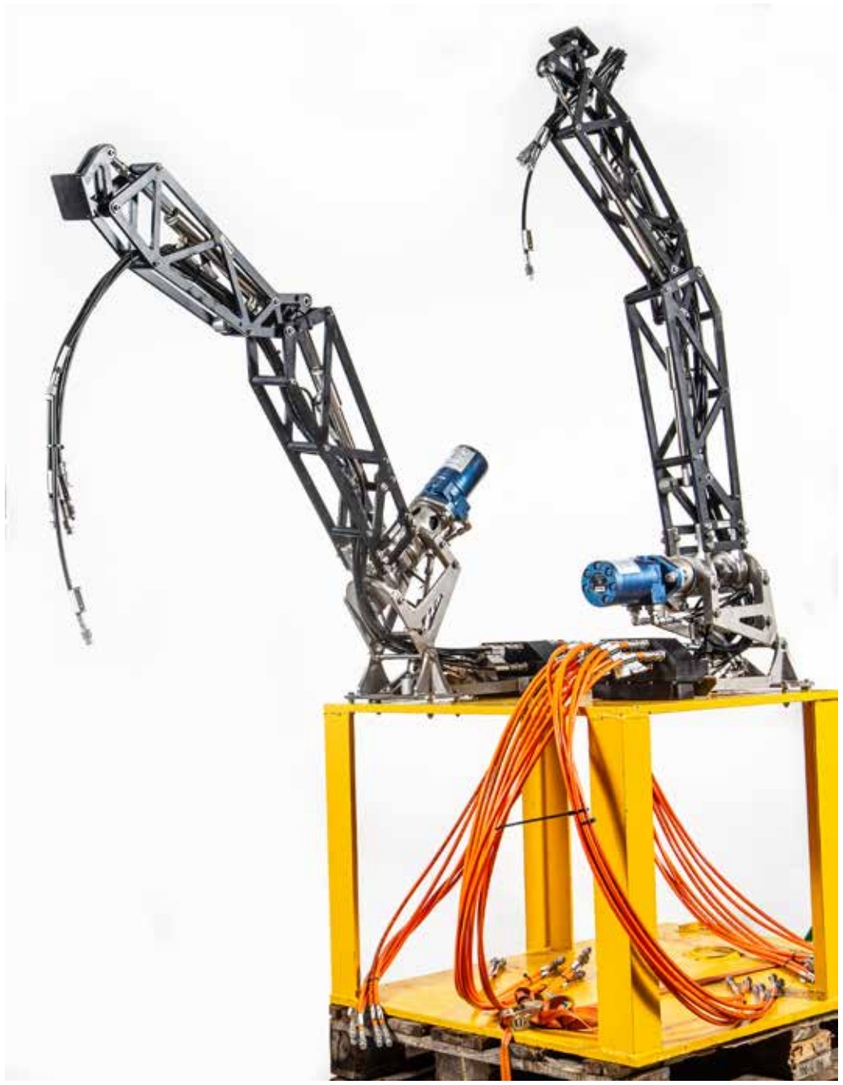
VORTEX FULL RESET

NEW-ZEALAND BASED VORTEX SUBSEA SOLUTIONS HAS UNVEILED ITS LATEST INNOVATION: THE 4-FUNCTION VORTEX FULL RESET

Vortex Subsea Solutions is a leading provider of innovative underwater technology solutions, specialising in ROV surveying, offshore equipment rental, and renewable energy support services. With a commitment to excellence and continuous innovation, Vortex is dedicated to shaping the future of underwater exploration and surveying.

Designed and built in New Zealand, these arms represent a significant advancement in ROV (remotely operated vehicle) surveying technology. Managing Director Joe Goodin expresses the company's commitment to meeting the demands of ROV operators for more robust and capable survey arms.

"Our clients constantly requested a more rugged and capable option for survey arms. We addressed this head-on by prioritising reliability and performance," he said.



"A key feature of the FR arms is their break-away friction clutch system. This unique design protects the arms and cameras from damage during impacts with rocks or other obstacles.

"In case of an impact, the arm harmlessly moves out of position upon impact to avoid the shoulder function damage typically seen with survey boom arms that are ridged in design, sustaining costly damage. The ceramic friction clutch design ensures resilience to water and depth-induced swelling. The design facilitates seamless operation events in challenging underwater conditions, minimising downtime and maximising productivity."

The FR survey arms boast an impressive array of functionalities, with a total of four individual functions (seven including Pan & Tilt). Goodin also highlighted the demand from clients for enhanced visual access into critical areas such as pipeline-free spans, necessitating advanced features beyond traditional camera zoom capabilities.

"A key consideration during the design process was ensuring compatibility and ease of use for ROV operators," he said. "The FR survey arms feature pressure-compensated flow controls for each function, enabling independent speed adjustments with depth changes. This versatility ensures optimal performance across varying operational conditions, without compromising on simplicity and practicality.

"The arms' exceptional range of movement empowers clients to push the boundaries of underwater surveying, including pipelines, umbilicals, and power cables. To facilitate swift mobilisation, hydraulic hoses are pre-

Vortex Subsea Solutions FR Survey Arms

assembled and sacrificial mounting plates are included for seamless integration with host ROVs.

"The slim side profile and mirror-image design of the arms minimise launch and recovery challenges, particularly in narrower LARS configurations.

"The arms are adaptable to accommodate various third-party hydraulic or electric Pan and Tilt systems, with meticulous attention to hydraulic hose routing and cable management for optimal functionality."

ASHTEAD TECHNOLOGY

With units already dispatched to Ashtead Technology regional offices in Aberdeen, Houston, and Singapore, Vortex Subsea Solutions is prepared to leverage its extensive development and testing efforts.

Ashtead Technology, entrusted with sales and rental of Vortex survey arms, will play a pivotal role in bringing this cutting-edge technology to market.

The introduction of the Vortex Full Reset survey arms underscores Vortex Subsea Solutions' commitment to innovation and excellence in the field of underwater survey technology, setting a new standard for reliability, performance and versatility.

In addition to the new FR survey arms, Vortex Subsea Solutions has expanded its rental pool with a wide range of innovative tools tailored to meet the evolving needs of the offshore industry.

Vortex Subsea Solutions Work Wheel

Low and high pressure gas sample tools for Inspection, Repair and Maintenance (IMR) and decommissioning work have been particularly well-receive, showcasing versatility by being able to sample gas and liquids from diverse locations such as oil wells, subsea volcano vents and municipal discharge sites.

Vortex has responded to the growing demand for renewable energy solutions by introducing electric and hydraulic winches designed specifically for offshore wind farms installations.

These winches, available in four different models, offer the largest range of subsea-capable, ROV-friendly, survey sensor winches on the market.

With a Safe Working Load (SWL) of 500kg, these winches are capable of lowering a wide variety of survey equipment into different work scopes, including capturing 3D data, visual imagery, and sonar data.

"Last year we saw the release of hydraulic-driven work-wheels to the Asia-Pacific, Gulf of Mexico, and North Sea regions," said Goodin. "These innovative tools safely lower a multitude of different tooling overboard, eliminating the need for manual handling of umbilicals and cables.

"Incorporating rubber insulators between a barrier between the operator, vessel, and deployed tooling, reducing the risk of Lost Time Incidents and associated downtime.

"Vortex has expanded its fleet to include seabed sample grabs for site survey and preparation for wind farms. Developed to operate of cranes in challenging conditions, these sample grabs gather samples of the seabed surface for biological analysis without the need for ROV and diver intervention.

"Increasing fleet stocks runs parallel with a heavy amount of research and development at Vortex Subsea Solutions. 2024 marks a significant focus on electric tooling, decommissioning and further wind farm developments, supporting global growth and innovation in collaboration with Ashtead Technology.

"As Vortex Subsea Solutions continues to push boundaries of underwater exploration and surveying, its commitment to innovation and excellence remains unwavering.

"The company looks forward to continuing to delivery cutting-edge solutions and driving positive change in the industry," he said.

Survey camera arms

SAILBUOY

NBOSI TO PROVIDE CT SENSORS

Neil Brown Ocean Sensors (NBOSI), has been selected by Offshore Sensing to provide a Conductivity-Temperature (CT) Sensor in order to enhance the capabilities of their latest SailBuoy unmanned surface vessels.

Field proven to stay for months at sea, the SailBuoy navigates the oceans autonomously- transmitting back data at regular intervals. It can be used for a wide variety of ocean applications.

From measuring ocean and atmospheric parameters to tracking oil spills or acting as a communication relay station for subsea instrumentation.

Founded in 2004, NBOSI has been at the forefront of designing and supplying CTD (Conductivity-Temperature-Depth) sensors to the global subsea market.

These sensors cater to the specific needs of autonomous underwater and surface ocean vehicles, serving a wide range of sectors including research, offshore operations, survey and defence.

Established in 2014 as a spin-off from Christian Michelsen Research, Offshore Sensing AS specializes in developing SailBuoys for various ocean applications including wave measurement and water quality monitoring.

The SailBuoy autonomously navigates the oceans, transmitting crucial data at regular intervals. Field-proven for extended periods at sea, including the first trans-Atlantic crossing by an unmanned surface vehicle, the SailBuoy is a solution for measuring ocean parameters, tracking oil spills, and acting as a communication relay station for subsea instrumentation.

Sailbuoy

AUV SERVICE

Teledyne Marine has announced the opening of a Service Centre for Autonomous Underwater Vehicles (AUVs) in Poland. Established in partnership with Enamor, this new centre reinforces the company's commitment to providing support and services to our valued customers in Poland and mainland Europe.

Enamor, based in Gdynia, Poland, is a research and production company with a strong focus on cutting-edge technology projects in navigation, communication, hydrography, and automation. Their collaboration with Teledyne Gavia spans over a decade since the initial delivery of Gavia AUVs for the Polish Navy EOD divers in 2012 and subsequent Gavia deliveries including for the Kormoran class MCMVs.

In the first half of 2023, Enamor's engineers and technicians underwent rigorous training at Teledyne Gavia to perform AUV maintenance routines in Poland. As a result, Enamor has now been officially appointed as a regional Service Center for AUVs in Europe, a testament to their dedication to quality service and support.

Gavia

VIETNAM SURVEY

On the 15th of June 1939, 1500T French submarine Phénix sank off the Vietnamese coast with 77 souls on board.

85 years later, a French Team ' La Voix du Souvenir' composed of avid technical divers, journalists and hydrographers travelled to Vietnam in an effort to find the location of the wreck and potentially unravel the events that led to the demise of the submarine and the loss of 77 lives in the dawn of World War II.

Through an extensive search in military and civil archives, the Team uncovered crucial details about the potential location of the wreck most likely located at a depth of about 100m below surface.

YUCO-SCAN Micro-AUV survey

The team will deploy a YUCO-SCAN Micro-AUV and survey the area at a depth of 100m to collect side scan data and video image, taking advantage of the GoPro option to pinpoint the location of the wreck prior to set up a diving expedition in the second phase of the project.

FREEDOM CONTRACT

Oceaneering International's Aerospace and Defense Technologies (ADTech) business segment has been awarded a contract by the Defense Innovation Unit (DIU), a U.S. Department of Defense organization, for the development and testing of the Freedom Autonomous Underwater Vehicle (AUV) as a potential Large Displacement Unmanned Undersea Vehicle (LDUUV) prototype for the U.S. Navy's Program Office for Advanced Undersea Systems.

The contract includes a Manufacturing Readiness Review to assess current production capacity and tradeoffs that could be performed to speed LDUUV capabilities to the fleet.

The Freedom AUV recently completed a five-year test and development program, culminating in commercial operations beginning in 2023.

Its design incorporates unique features that make it well suited for commercial and defence operations, including its multi-thruster design which provides six degrees of freedom in vehicle manoeuvrability.

With eight independent thrusters, Freedom supports mission success with its ability to conduct low altitude, precision operations in complex, critical subsea infrastructure environments.

Martin McDonald, Senior Vice President, Subsea Robotics, said: "Oceaneering is pleased to have been selected by the U.S. Navy and the DIU for this program supporting the development of LDUUV capabilities. The Freedom AUV offers the flexibility needed to support mission critical operations and we are delighted to be recognized for the flexibility Freedom offers and its suitability to support an LDUUV prototype."

As a worldwide leader in subsea robotic services, Oceaneering used its Remotely Operated Vehicle (ROV) database, encompassing over six million hours of operation, to identify several technology building blocks (thrusters, connectors, batteries, etc.) that are key to the performance and reliability of the Freedom AUV system.

These technology building blocks were designed and tested to provide Freedom with a prolonged maintenance-free operating period, which enables sustained subsea operations.

Long duration, reliable performance in subsea environments requires mature maintenance and logistics systems. The Freedom™ AUV uses the same maintenance and logistics systems used by Oceaneering's fleet of work class ROVs, the largest in the world, which last year performed over 450,000 hours of subsea robotic services.

HydroSurv USV, waterline view – Image: HydroSurv

ROBOTIC SEAGRASS SOLUTION TARGETS COMMERCIAL ADOPTION

HydroSurv, a provider of electric and hybrid uncrewed surface vessels (USVs), has secured Innovate UK funding to commercialise an end-to-end seagrass monitoring solution with support from the Department for Environment, Food and Rural Affairs (DEFRA).

The project aims to provide a rapidly scalable, low-impact and comprehensive answer to the numerous challenges of monitoring seagrass meadows by combining HydroSurv USV platforms with an automated data processing toolchain.

The robotic solution will be demonstrated over spring and summer 2024 at three designated worksites on the south west coast of England, conducting baseline and seasonal re-survey work and ultimately delivering some 40 days of on-water testing and data, showing seasonal variation over the project's 9-month duration.

Dubbed SONARS (Seagrass Observation using Novel Acoustic Remote Sensing), the project will see HydroSurv work with Coastal Marine Applied Research (CMAR) from the University of Plymouth, the Ocean Conservation Trust, Falmouth Harbour and the South Devon Area of Outstanding Natural Beauty.

The technology package has already significantly advanced seagrass mapping capabilities. HydroSurv started to develop the non-invasive solution, with Innovate UK support, in early 2022 in collaboration with the University of Plymouth and Valeport.

This previous work focused on refining acoustic ground discrimination techniques from the robotic vessel platforms and was successfully demonstrated in live trials over the past two years. The partners envisage that this next stage of technology development will propel the concept towards scale deployment and commercial viability.

"Working with partners and end-users, our focus has shifted from technology development towards the scale pilot of a whole-system solution.

The ability to demonstrate to service operator customers and channel partners that the solution has been extensively tested with engagement from survey commissioners, not only on small field trials, but also on multiple sites and seasonal resurveys, will build confidence in the solution." commented David Hull, CEO of HydroSurv.

"We've received a lot of interest from survey contractors who are interested in delivering these services, amongst others in environmental monitoring. Working together with them, I expect we could take this solution to market within the next 12 months across the UK and further afield in Europe."

HydroSurv's cloud-based data hosting and visualisation application, EasySurv, facilitates real-time decision making without the need for specialist GIS packages or interrogation skills. EasySurv hosts content-managed data deliverables, processed using machine learning algorithms, alongside the raw data collected from the company's USVs.

SULMARA AND ASSO SUBSEA AGREEMENT

Global subsea specialist 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's experts 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.

He said: "Asso.subsea and Sulmara have followed similar paths in terms of rapid growth in recent years, and we are delighted to collaborate with a like-minded organisation.

"The teams have increasingly worked together since Sulmara was founded in 2019, establishing a collaborative synergy across a spectrum of intricate projects over the last 18 months.

"There is a real sense of trust and confidence in each other to deliver, and that is something we will be able to pass on to our clients. In order to thrive, effective collaboration among stakeholders is imperative, and we are both certain this agreement will have a positive impact on the industry.

"Pushing for the use of more innovative solutions together will benefit not only individual projects, but will also allow a shift towards more sustainable operations."

With Sulmara's experience in subsea survey and seabed mapping, the team will also help Asso.subsea understand the seabed prior to installation as part of the burial assessment process.

Matt Dunlop, Sulmara's Operations Director, added: "Given the potential variety in ground conditions along a cable route, being able to understand any recent changes in the seabed before work begins is crucial to the success of a project.

The company also announced last autumn it had placed an order worth $1.6 million with Ocean Power Technologies for several Wave Adaptive Modular USVs

FORSSEA DEMOS

Forssea Robotics recently demonstrated the quick interfacing of world leading Teledyne Marine TSS660 cable tracking system onto its ARGOS smart ROV. Forssea Robotics expect to deploy the solution on first projects starting 2024.

- French consortium made of Ifremer , FinX (start-up specialised in bio-inspired underwater thrusters) and Forssea Robotics has been awarded a €3M grant to develop and qualify subsea resident patrol technologies.

Under the name RESIDENCE, the R&D project will focus on qualifying critical building blocks for long term immersion including navigation, positioning, communication and docking technologies.

Forssea's new generation hybrid ROV will be deployed as main demonstration platform.

POLISH NAVY ADDS NEW T20-S MODULE TO GAVIA AUV

Teledyne Gavia has announced that that the Polish Ministry of Defence (MOD) has bolstered its underwater survey capabilities by procuring the Teledyne RESON SeaBat T20-S Module for the group's GAVIA Autonomous Underwater Vehicles (AUVs).

These AUVs have been successfully employed by the Polish MOD for mine countermeasures (MCM) since 2014 and currently comprise a fleet of four (4) GAVIA AUVs, each equipped with extensive capabilities.

The SeaBat T20-S Multibeam Echo Sounder (MBES), operating at 400kHz, delivers high-resolution bathymetric data with remarkable positional accuracy, aligning with the IHO standards for hydrographic survey. The T20-S Module empowers the automated detection of pipelines, enabling tracking and inspection by the AUV. This capability will be instrumental in the Polish Navy's critical underwater infrastructure inspections, a crucial aspect of modern seabed warfare. Moreover, the T20-S Module offers valuable backscatter data for mine classification. It comes with the latest Teledyne PDS Cube software to streamline operations, facilitating raw data visualization, post-processing, mosaicking, and export directly into the onboard Command-and-Control system of the Kormoran Class MCMVs.

Since GAVIA AUVs have a modular design, these vehicles do not need to return to Teledyne Gavia for the T20 upgrades. Instead, the Polish MOD will receive new modules that can be user installed into their existing AUVs in Poland. The adaptability of GAVIA AUVs has made them a trusted choice for EOD/MCM operations.

With the addition of the Teledyne RESON SeaBat T20-S MBES Module, the GAVIA AUVs will excel at gathering extremely high-resolution bathymetric data, even during extended submerged missions at survey speeds ranging from two to five knots. Their sensor suite, including imaging sensors like EdgeTech 2205 side scan sonars with Teledyne BlueView MB2250 Microbathymetry Gapfilling Modules, ensures these AUVs are perfectly suited for mine countermeasures (MCM), bathymetric survey, and search and rescue (SAR) operations in continental-shelf waters and beyond.

GAVIA AUV

AS THE GLIDER COMMUNITY GROWS, SO DO GLIDERS

BY SHEA QUINN, SLOCUM GLIDER PRODUCT LINE MANAGER, TELEDYNE MARINE

Anyone familiar with glider autonomous underwater vehicles (AUVs) is certainly familiar with the popularity this type of platform has seen over the past two decades, growing from emerging technology to one of the most widely used tools for oceanographic monitoring.

In this time, the glider user community has also significantly grown, alongside the increasing number of use cases for which gliders provide a practical solution. Ocean monitoring – whether for environmental assessments, mammal monitoring, fisheries, physical oceanography, defence, or dozens of other missions – has driven advancements in glider technology to meet the modern demand for long-term data gathering of all kinds.

In response, Teledyne Webb Research has announced the launch of their newest product in the field of buoyancy engine driven underwater vehicles: the Slocum Sentinel Glider.

The Slocum Sentinel Glider builds on the technology of Teledyne Webb Research's Slocum G3 Glider by expanding the capabilities and endurance of the vehicle.

Teledyne Webb Research (TWR) was founded as Webb Research in 1982 by Doug Webb, an engineer at the Woods Hole Oceanographic Institution and pioneer of buoyancy engine driven underwater vehicles – unmanned platforms that use a pump to create changes in vehicle density to move through the water column and collect oceanographic data. TWR uses this technology on its APEX Profiling Float and Slocum Glider products.

Since its inception as the first-ever gliding autonomous underwater vehicle, the Slocum Glider has grown to be the most-used glider platform in the world. These vehicles have been designed to be very efficient and can persistently gather oceanographic data for months or even a year at a time, communicating and sending data shoreside during surfacing events to its operators via Iridium satellite connections. TWR has delivered over 1100 Slocum Gliders to scientific, academic, and defense customers in the past 25 years, with over 50 sensor and hardware options integrated for a broad range of missions.

"As the use of Slocum Gliders grew, so did demand for increased capability: longer missions, more sensors – especially high-energy

sensors – and the need to operate in more diverse water conditions. The Slocum Sentinel Glider answers that need," said Shea Quinn, Slocum Glider Product Line Manager at TWR.

The Slocum Sentinel Glider scales the standard Slocum Glider through an increased diameter to gain better volumetric efficiency and is 8 feet in length. This expanded size allows the Sentinel to hold over 3.5 times as many lithium primary batteries as the standard Slocum Glider, and to physically accommodate up to 8 different sensor or hardware integrations.

"The size of the Sentinel gives it the energy capacity to increase mission length to over 2 years; or users can fit more high-energy sensors like active or passive acoustics, sensors with on-board processing, and imaging, without seeing a significant decrease in their overall mission length," said Quinn.

The Slocum Sentinel Glider will be driven by the industry's largest buoyancy engine, with a volumetric capacity of 4 liters – more than double any other available glider buoyancy engine.

This affords the Sentinel a standard glide speed of 0.75 knots. It additionally features dual thrusters on the aft of the vehicle, which users can choose to activate for a sprint speed of up to 3 kts.

GLIDERS

"The Sentinel is the world's fastest glider – its buoyancy engine is large enough to deal with large density changes in the water column and its thrusters give it the ability to stay on track in strong currents or other difficult ocean conditions," said Quinn.

The Slocum Sentinel Glider uses the established piloting, flight control, and communications architecture of the Slocum Glider, and allows for the same sensor and hardware options as the standard-sized vehicle.

"We are excited to bring this new product and capability to our customers," said Dan Shropshire, Vice President Business Development and Program Execution, Marine Vehicles, "The Slocum Sentinel Glider represents the next generation in persistent ocean monitoring, and its features greatly expand operational opportunities for our customers."

The specifications of the Slocum Sentinel Glider open several new use cases for the glider community. With an increased need for environmental monitoring, especially to track the impact of offshore construction on the ocean ecosystem, the Sentinel can accommodate a greater number of environmental sensor options for longer mission periods.

For glider users working in fisheries and conservation, the Sentinel can run several high-energy passive and active acoustic sensors, on-board processing, and imaging hardware simultaneously for months at a time, extending deployments even in remote locations like the Antarctic.

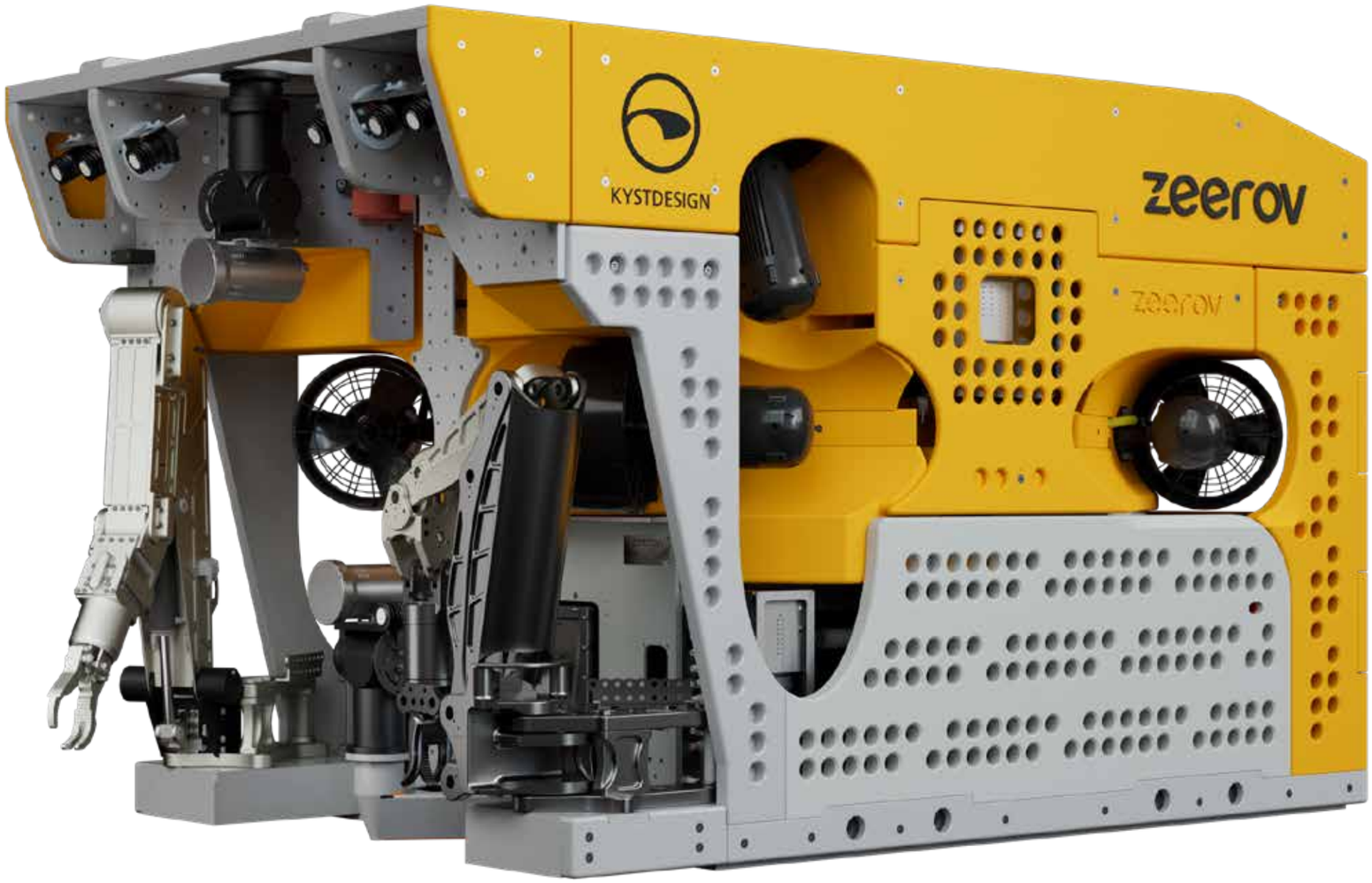
And for users who tend to operate in areas with drastic changes in water density, strong currents, and storm conditions – such as the Gulf of Mexico or the Indian Ocean – the Sentinel's large buoyancy engine and optional thruster capability will keep the glider on track.

It is expected that the Slocum Sentinel Glider will continue the upward trajectory of glider use in a variety of applications, including new, non-traditional fields for glider use, such as oceanographic mapping and surveying.

The glider user community and the diversity of their missions will continue to grow – and the Sentinel is big enough to take on the challenge.

Sentinel

ZEEROV



The industry in general has been looking towards moving between Hydraulic to Electric ROVs, especially when used in supporting clean renewable energy developments.

One such company adopting this ethos is Kystdesign, the Norwegian -based underwater vehicle and tooling designer and manufacturer.

"For many years, we contemplated the engineering ramifications of converting one of our ROV by retrofitting and electric motor in the place of the standard hydraulic thruster but it was not until 2022 that we got the opportunity to extend the dialogue," said Kystdesign Technical Manager, Frode Rabben

"Our business is traditionally based on the model of building systems to order and so it was not until 2022, when Reach Subsea inquired about two fully- electric system, that we could devote all our energies to the new design which was to be named 'Zeerov'. One of the most challenging parts of the parts of design, however, is that ROV we were to develop was to be capable of being used on new totally uncrewed vessels (USV). "

This would require it to operate for up to 30 days without intervention or maintenance.

"All-electric systems tend to be quite reliable but we discovered that biggest hurdle was getting its tether management system (TMS) down to a size that would fit their uncrewed vessel while still keeping the necessary tether length requirement,"continued Frode Rabben.

"We commenced the project by deliberating what functions the ROV might require in terms of available components, power distribution infrastructure, electro magnetic compatibility and electrical systems in general.

"In the beginning, the Zeerov will be mostly employed for survey and inspection work, including gravimetric imaging. This will require the ability to attach a skid slung under the ROV.

"We designed a system to be equal or better than our hydraulic Supporter ROV in terms of physical dimensions and available power, the vehicle is equipped with a 115 kW subsea transformer."

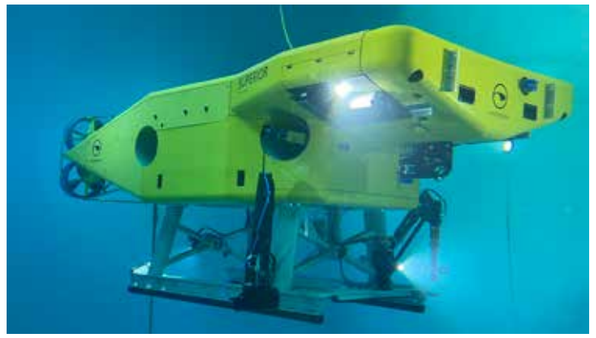
Only two years later the Zeerov is soon to be operational!

Kystdesign has fully accomplished the assembly of all the stages and earlier this year, it successfully

completed testing the sub components such as individual motors. This will soon be followed by the entire vehicle. In parallel, with the hardware, the engineers have been working on the software and control systems to handle both the vehicle and as an integrated machine with the management system.

"In ROVs, is not uncommon for rotary seals to leak with fluid escaping into the sea, especially in the high pressures associated with deep waters," said Frode Rabben. "Leakage equally means an ingress of water into the oil. Although this is much less of an occurrence than with hydraulic systems,it still happens in motors.

In our design, we have two rotary seals, one for the shaft seal and one for the motor. After extensive testing in our test pool, the sealing system looks very promising. As a contingency, the thruster is prepared to fit a remote operated shaft seal flushing system.



FUTURE WORK

"Once Reach Subsea have the system in operation and running offshore, we will study the lessons they will have learned," said Frode Rabben. "Looking to the future, we will probably start by looking into electric tooling and expanding the TMS range, because the model we have developed is fairly small, designed to carry 400m ø28 tether. We will probably expand this to 500m and 1000m of ø35 tether in the future.

"In the design, we started with a 15kW thruster which we considered was comparable output of the hydraulic thruster on our Supporter vehicle. When we tested it, however, we found that the motor actually balanced at 20kW, which was around one third more than we expected.

"The ROV system is essentially a prototype build to which we plan to make refinements in response to things that we discover during further testing and operation. We have received interest from other companies and will make it available for the general market when we have qualified the end product and are confident that we have got the quality we require.

"In addition, we also discovered that we could run the motor at 150% for about 15 minutes before it overheated. This means that for small durations, we can run it at 30 kilowatts. In our test pool, we have been able to generate up to 490kg thrust for a 300mm thruster.

“High power is a property very useful for pipeline surveys, where the vehicle needs to travel fairly straight lines at high speeds," continued Frode Rabben.

"We have already designed two hydraulic ROVs, the Surveyor Interceptor that we developed for Reach Subsea and MMT, and the Superior which we first designed for Deep Ocean, now also delivered to NextGeo.

These specialised designs were developed with a focus on high-speed, and high capacities for carrying Survey sensors. Following the Zeerov, we can see a great potential of making all electric versions of these niche vehicles.

Left, above: Superior *and left,* ***below****, the* Surveyor Interceptor

SAPURA ACQUIRES EXAIL ROVINS NANO

Sapura, a leading Brazilian provider of subsea services, has recently acquired eight units of Exail Rovins Nano Inertial Navigation Systems (INS).

Integrated into Sapura's fleet of remotely operated vehicles (ROV), Exail INS are intended to significantly enhance Sapura's ROVs capabilities in offshore installation of subsea equipment.

Ensuring highly accurate navigation down to 6000m, Rovins Nano INS will help Sapura to lay flex pipes and deploy subsea hardware onto the seabed, such as templates and manifolds, rigid jumper spools or tie-in-spools.

Rovins Nano, equipped with advanced sensors such as accelerometers and gyroscopes, will function as the central component in the ROV's navigation and positioning system. It will play a vital role in determining the ROV's position, orientation, and velocity with precision, which is essential for the accurate positioning and installation of subsea equipment.

This integration is set to optimise Sapura's overall high operational standards such as efficiency and accuracy.

Felipe Jesus, ROV Manager at Sapura, highlighted, "Our decision to collaborate with Exail for this upgrade was motivated by the goal to modernize our existing systems using cutting-edge technology.

The precision and reliability of Exail's INS align perfectly with our commitment to excellence in subsea operations.

BLUEYE X1

Blueye has announced the Blueye X1, mini-ROV designed.

Armed with a plug-and-play gripper port, the X1 is a good solution for simple underwater tasks from routine fish pen inspections to low-light recovery operations.

The Blueye X1 ROV is built on the same platform as the X3 model, with the minor difference that the X1 has one guest port for gripper connection, instead of three. The X1 still maintains the user-friendliness while offering a simple drone for those that only need a quality ROV and a gripper to get the job done.

With quick deployment in under 90 seconds, the X1 ensures no unnecessary delays. Paired with the Blueye High Capacity battery, it provides over 5 hours of operating time for full-day inspections.

The battery can also be changed in under 2 minutes while out in the field. It is possible to check the remaining dive time and battery status in the Blueye app during the dive.

Blueye X1 mini-ROV

PHOTON

DEEP TREKKER'S NEW MICRO ROV

Deep Trekker has entered the micro ROV market with its new Photon vehicle. Constructed from industrial-grade stainless steel carbon fibre, anodised aluminium and buoyancy foam, it is designed for applications such as ocean exploration, hull surveys, port security, hydroelectric inspection and examining infrastructure

The Photon is rated to work in 120m (400 FT) of water and has an operating temperature between-10°C to 50°C (14°F- 122°F). The vehicle measures 820.6 mm long, 332.2 mm in width and stands 228 mm high. It weighs 11.6 KG (25.6 lb) in air.

The very first models that Deep Trekker produced and the DTG3, featured a camera housed behind an acrylic window that could move up and down independent of the moving vehicle. This idea has been retained in the new Photon. The rotating high-definition camera provides an ultra-wide viewing range, complemented by an intuitive controller.

The Photon is powered by six vectored thrusters , magnetically coupled to the drive motors and sealed, to ensure, according to the manufacturer ‘precise vertical and lateral movements even in the most confined difficult to reach areas. With semi-autonomous navigation, advanced positioning and stabilisation systems, the Photon empowers teams with easy operability, requiring minimal training."

The vehicle has auto depth, auto editing and active yaw stabilisation which is enabled by a variety of standard sensors measuring depth, heading pitch roll turns count and temperature.

In addition to the standard package is the NAV package which additionally comes with a two-function grabber arm featuring a 32 kg locking force. It has USBL positioning and can track and log data with its GPS system. It's DVL improves position accuracy, stabilisation, and provides altitude/auto-altitude and hold.

The Photon

KYSTDESIGN AND OMEGA SUBSEA COOPERATION

Kystdesign has announced a significant expansion in cooperation with Omega Subsea Robotics (Omega Subsea Robotics, a JV between Solstad Offshore ASA and Omega Subsea) following the signing of the ROV manufacturer's largest ever contract. The delivery includes six complete ROV systems.-

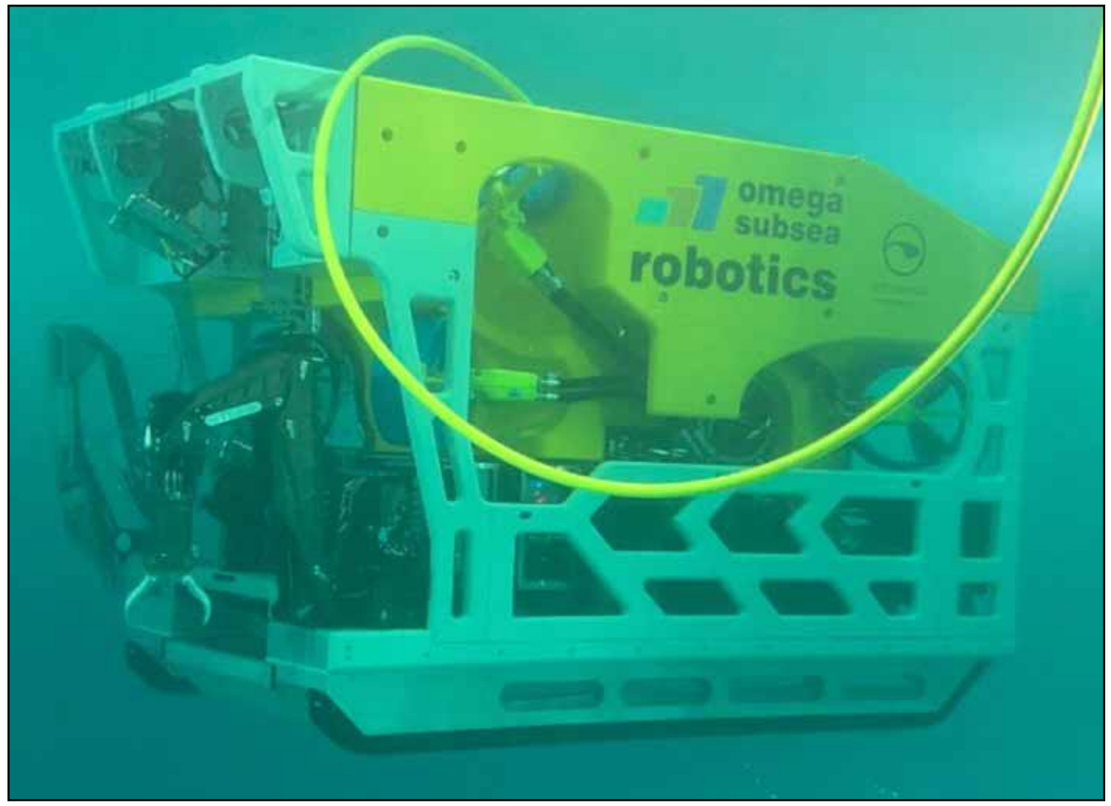
The contract award includes delivery of four standard Constructor ROV systems and two brand new compact Constructor ROV systems.

The systems will be delivered to Omega Subsea Robotics in three deliveries of two systems each, and all are to be completed by the end of the year.

The ROV systems will be installed on selected vessels in the Solstad fleet. Omega Subsea will be responsible for the administration, crewing and operation of the ROV systems.

The development of the new compact version is currently in progress at the design stage. It will be a considerably smaller version of Kystdesign's standard Constructor ROV, but with the same power and specifications. All ROV's included in this delivery are powered with 220 horsepower and designed to operate down to ocean depths of 3000m.

This new compact version can be operated from smaller scale vessels which in turn helps our clients reduce their emissions and cut costs.



Kystdesign ROV

NATO NAVY'S CAPABILITIES

L3Harris, Voyis and Wavefront have collaborated to deliver advanced technology to enhance NATO Navy's autonomous underwater vehicles (AUV) capabilities.

AUVs are designed to operate in harsh environments, including deep water and can be used for a range of missions, including search and rescue, surveillance, mine countermeasures and oceanography.

L3Harris is at the forefront of AUV development. To further improve its Iver4 900 AUV capabilities, the global defence company integrated a Voyis Recon LS and the Wavefront Solstice 3000 multiple-aperture sonar (MAS) Combined AUV payload onto the Iver4 900 platform to support defence missions.

The Voyis team, in collaboration with Wavefront Systems has now announced a successful factory acceptance test of the Recon LS/3000MAS AUV payload with L3Harris, to be delivered to a NATO Navy, further improving the IVER4 900 capabilities.

It consists of a single, integrated forward payload section housing Voyis' compact dynamic laser scanner, which captures high-resolution 3D point-cloud data, the Voyis' 4K imaging system with appropriate lighting which captures crisp, evenly illuminated still images with its edge-computed image enhancement feature, and finally, the Wavefront Systems' Solstice multi-aperture side-scan sonar that delivers 200m-wide swath coverage and bathymetry at high resolution.

The Voyis Recon LS/WaveFront Solstice Combined AUV payload offers a solution for autonomous underwater vehicles to covertly detect, classify, and identify mine-like objects (MLOs), reducing risk to divers. The system uses the multi-aperture side-scan sonar, 4K digital still-camera and high-resolution laser scanner to carry out this task. The L3Harris' Iver4 900 vehicle provides the payload with both stability and endurance to make the most of the payload.

MCM operations involve four stages: detection, classification, identification, and disposal/neutralisation.

Currently, side-scan sonar is used for mine detection and sometimes for classification. However, visual identification requires a clearance diver or remotely operated vehicles to enter the minefield, which is time-consuming and risky, especially in areas with complex seabed. This requires multiple resources to be deployed into a potentially hazardous environment to complete a successful operation, which is inefficient when relying on lower-quality sensor data and dangerous if humans are mobilizing the assets.

The Recon LS/WaveFront Solstice MAS Combined AUV payload is designed to rethink how mine countermeasure (MCM) operations are conducted today and enable single assets to complete complex missions without deploying additional resources within the minefield.

Voyis Recon LS

MSUBS

MSubs dates back to the late '80s, early '90s as Marlin Submarines, but it wasn't until the early 2000s when the company was acquired by its present owners, that it started to carry out more consistent underwater work, particularly for the United States Navy.

“One of our first ventures was a small, submarine that could be used employed as an asset for the development of future autonomous underwater vehicles," said Managing Director, Brett Phaneuf. "We commissioned the S201 in 2005.

“This 9.9t vehicle was designed for 48hr operation at depths up to 305m. It worked successfully for a decade, particularly for the US Navy, the Office Naval Research, NAVSEA and many other groups as a developmental platform. We used this to develop our first command and control system, user interface and software architecture that would later go into autonomous vehicles.

XLUUV/Manta/S201 / Specifications	
Length	9 m
Beam	2 m
Weight	9 tonnes
Operating depth	305 m
Submerged Duration	48 hrs
Submerged Speed	12 kts

"About five years ago, we received a request to build a demonstration/ training vehicle for the Royal Navy which would be indicative of what a large UUV could be. With DASA and additional follow-on funding, we reviewed the basic S201 and turned it into an autonomous vehicle to be called the Manta.

"In intervening 12 years, we built numerous uncrewed systems, with the new Manta being a test platform. It is still operational, and we plan to use it imminently to test a number of acoustic devices, it tests ISR sensors, imaging devices , communications and through-water autonomy systems under different types of complex software driving various behaviours and scenarios.

MUST Lab or Mobile UnderSea Test LABoratory

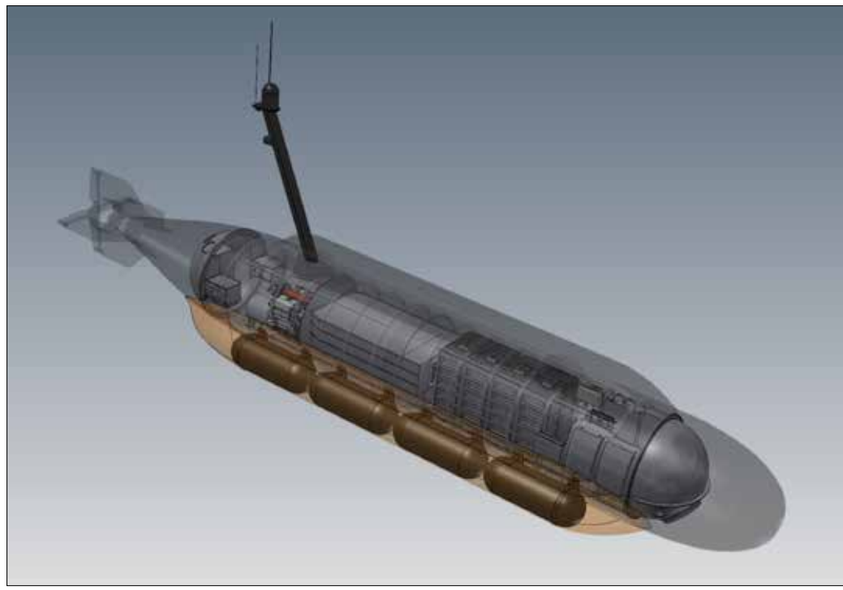
EXTRA LARGE AUVS

We see it as a pathfinder for future vehicles.

"At the same time, we began to look at a sister-ship- the 202. The project was delayed to conduct work for the US SOCOM building diver lockout submarines, but now the 202 project is back under construction. We are incorporating everything we've learnt over the decades with the 201 and plan to operate both in tandem. One of these may possibly go down to our new operating base in Australia next year.

DIVER LOCKOUT

“During this time, we built other vessels including a couple of diver lockout submarines. We discovered an old vehicle originally built in the late '80s by what was then Martin Marietta Corporation. It was sitting



XLUUV/Manta/S201

in the boneyard of what is now Lockheed Martin's facility in Revere Beach, Florida. Called the MUST Lab or Mobile UnderSea Test LABoratory, it was one of the first large UUVs ever to be built. Machined out Aluminium, it measured 10m long and was about 1.4m in diameter- the size of a C4 ballistic missile because at some point, the designers envisaged it being launched from a ballistic missile tube.

"We disassembled it, cleaned it up, added a hull section to make it a little longer, re-powered it, put our modern systems in, and started operating it for the Maritime Warfare Centre who employed it for anti-submarine warfare training. After a few years of operaation, the American corporation bought it back from us for use as a developmental asset.

"Another project started in 2010, when the U.S. Navy asked us to build a threat-representative minisub that would be sort of roughly the size of a North Korean midget sub. This resulted in MASTT, or Mobile Anti-Submarine Test Target. The MASTT was small enough to disassemble and ship in three containers but when reassembled it was 24m long and weighed about 65t.

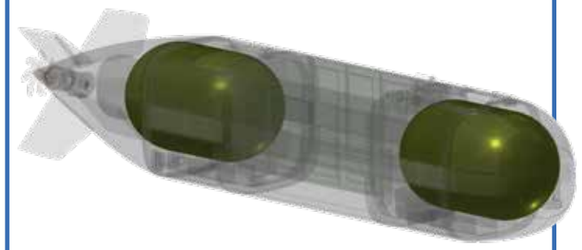
“It had to be able to operate in common water space with ships and submarines. We built that one from scratch, including all the software, in a year. It was operated successfully until the US Navy moved to its echo voyager programme.

Mobile Anti-Submarine Test Target

PROJECT CETUS

In 2022, the UK Ministry of defence awarded a £15.4m contract to build the first XLUUV (Extra Large Uncrewed Underwater Vehicle). MSubs will design and construct the new bespoke vessel at their Plymouth facility.

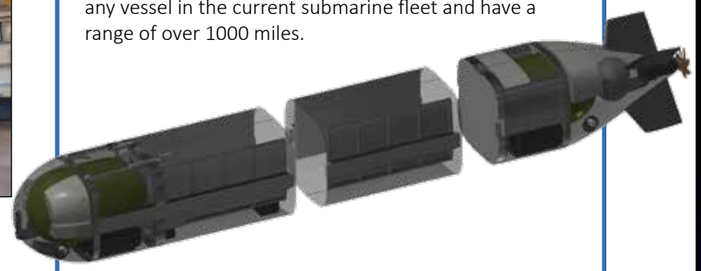
CETUS – named after a mythological sea monster – is funded as part of the Royal navy's Project Spearhead Anti-Submarine Warfare programme. The procurement will be managed by the Develop Directorate and the Submarine Delivery Agency.



CETUS is intended as a first step in developing an operational XL-AUV that could operate independently, or work alongside crewed systems as part of a hybrid Maritime Underwater Future Capability (MUFC). The XL-AUV – one of the largest and most complex crewless submersibles operated by a European navy, will be used as an experimental asset to reduce the risks associated with the acquisition of future large AUVs and their payloads.

The 17-tonne submarine will be 12m long and 2.2m in diameter. It is a modular design with an optional payload section that can be added to double the capacity of the vessel while range can be increased by installing additional batteries. The design features two pressure vessels separated by the central payload bay.

Importantly, the vessel will be able to dive deeper than any vessel in the current submarine fleet and have a range of over 1000 miles.



"One of our most interesting projects was the fully autonomous uncrewed surface vehicle Mayflower Autonomous Ship (MAS) which crossed the Atlantic in commemoration of its older namesake doing the same journey 400 years earlier. Built by MSubs, this grass roots initiative was led by marine research non-profit ProMare with support from IBM and a global consortium of partners.

" It uses AI and automation," said Phaneuf, "assimilating data from a number of sources to constantly assesses its route, status and mission in order to make decisions about what to do next.

Cameras and computer vision systems scan the horizon for hazards while streams of meteorological data were scanned to reveal potentially dangerous storms. Machine learning and automation software ensure that decisions were safe and everything in-line with collision regulations.

Inside, small, lightweight edge devices provide just enough local computer power for the ship to operate independently, even without connectivity or remote control. When a connection becomes available, the systems synchronised with the cloud, enabling updates and data uploading.

At present, Mayflower is operating at Woods Hole Oceanographic Institution and later this year, she'll be working up in all around the east coast of the United States carrying out climatological research.

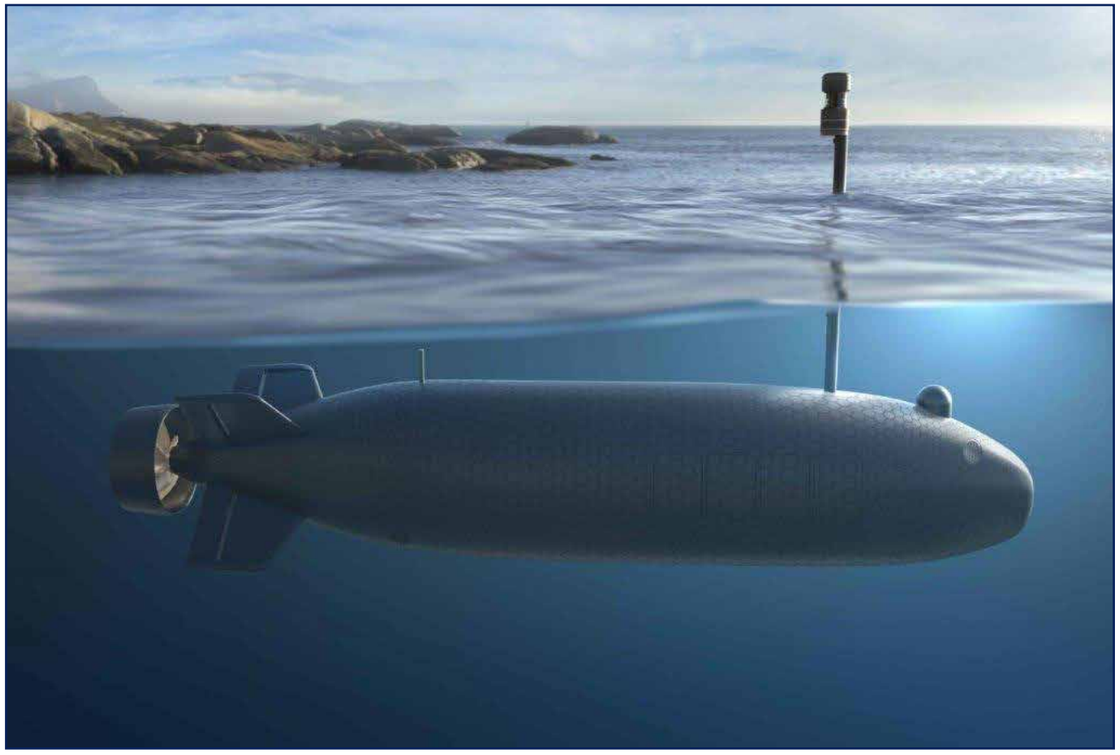
"Importantly, it also acts as test platform for the constantly developing autonomy system, " said Phaneuf. "To make any vessel properly autonomous is very challenging. Autonomy includes dynamic path planning and while this is not necessarily for hydrographic survey work underwater , it is certainly essential for more complex tasks such as anti-submarine warfare and mine countermeasures etc, which requires with innate decision making on the edge.

"The used if USVs on the market is expanding, but these are mostly much smaller vessels. We don't see ourselves, however, in that space. Instead, we see it as a command node or a processing centre. Even if we're employed near shore, we want to be able to operate for a couple thousand miles without refuelling.

"We of think of ourselves as the aircraft carrier, not the aircraft. We have successfully used it to deploy smaller autonomous vehicles underwater. When we crossed the Atlantic, we deployed Apex floats, from a launcher under the wings at predetermined longitudes."

Mayflower Autonomous Ship (MAS)

UNMANNED COMBAT UNDERWATER VEHICLE



UCUV_Crédits Naval Group

Last year, DGA awarded Naval Group a framework agreement for the design, production and testing of an Unmanned Combat Underwater Vehicle (UCUV) demonstrator. A first follow-on contract was also signed for the design and development of Naval Group's Autonomous Decision-Making Process (ADMP) and secure autonomous navigation.

This framework agreement follows on the contract awarded to Naval Group on May 4, 2023 for the study of the main use cases and system architecture of an UCUV.

The objective is to conduct studies and evaluate the technologies identified to meet the French Navy's main use cases, and thus design and develop the UCUV demonstrator. Aurore Neuschwander, Naval Group's Director of Drones, Autonomous Systems and Underwater Weapons, stated: "Naval Group is very proud to support the French Ministry of Armed Forces in the study of this innovative and disruptive naval capability.

"We will leverage the know-how we acquired in naval unmanned systems over the last ten years, and in particular our XL-UUV demonstrator, which will serve as a platform for technology integration and testing. This ambitious project will contribute to the creation of a French industry of excellence in naval unmanned systems, of which Naval Group will be one of the federators".

The first subsequent contract to this framework agreement will run for 24 months.

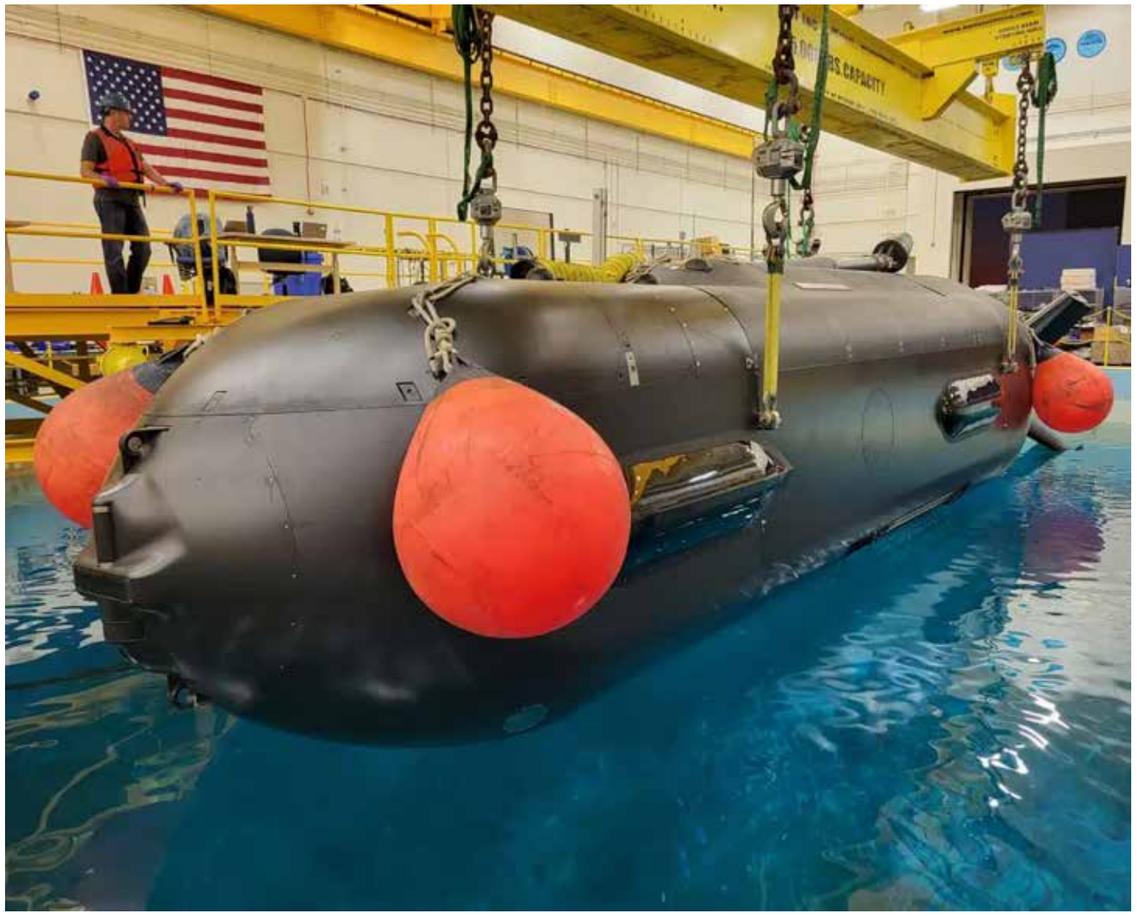
It will enable the development of a version of the Autonomous Decision-Making Process (ADMP or ADC in French, for Autonomie Décisionnelle contrôlée) designed to strengthen mission planning and monitoring, and secure surface and underwater navigation which are essential functions for an autonomous, enduring, multi-mission system.

Other follow-on contracts are planned in order to develop the technologies needed to meet the challenges of long endurance, underwater detection and sub-order implementation.

Naval Group XL UUV_c Giakoumopoulos

ORCA

BOEING RECENTLY DELIVERED THE FIRST ORCA EXTRA LARGE UNCREWED UNDERSEA VEHICLE (XLUUV) TO THE U.S. NAVY



Back in October 2017 the US Navy selected the pairing of Boeing and Lockheed Martin to participate in the design phase of its Extra Large Unmanned Undersea Vehicle design (XLUUV). By 2019 the project had moved to the next stage and the new Orca vehicle was Christened and ready to go into production.

"The original $43 million contract covered the fabrication, test, and delivery of four Orca vehicles and associated support elements. Later that week, Boeing announced that the work was to be carried out instead with Huntington Ingalls Industries and the contract was to cover five extra-large XLUUV prototypes. By 2022, the scope of work increased from 5 to 6 vehicles, all to be delivered within the original timeframe.

Last December the vehicle had successfully completed factory acceptance testing in-water trials at Huntington Beach, California, and the

XLUUV Test Asset System (XLE0) was formally handed over the Navy.

ECHO VOYAGER

"The design of the *Orca* was very broadly based on home-funded work on our proof of concept *Echo Voyager* project," said a source. "This in turn evolved from development work carried out on its *Echo Seeker* and *Echo Ranger* vehicles."

The *Echo Voyager* weighed 50t and measured 51ft long in its basic configuration. It had a range of around 6500 nautical miles(1 fuel module) allowing the vehicle to perform very long endurance operations. It reportedly had a maximum speed of about 7.8 kts underwater and could dive to 11 000 feet (3358m)below the surface.

Powered by a hybrid combination of battery technology and marine diesel generators, it was able to run on batteries alone at 2 kts for about 150 miles. In total, the vehicle had fuel capacity for up to six months of voyaging.

The vehicle was designed to incorporate a modular payload section for multiple uses. These modules were up to 34ft in length and 2000 ft^3 in volume, and the design considered include payloads extending outside of its envelope.

The *Echo Voyager* incorporated its own sonar-enabled obstacle avoidance system, as well as an inertial navigation.

ORCA

The Orca XLUUV is even larger. Weighing 80t, the Orca is too big to be launched or even carried by a submarine which was an early consideration and, therefore, it has to be deployed from a pier or even a surface ship.

The design focusses on a modular construction. At its core is the section involved in providing guidance and control, navigation, autonomy, situational awareness, core communications, power distribution, energy and power, propulsion and manoeuvring, and mission sensors.

The Orca XLUUV uses an open architecture for these systems.

"Communications are a perennial issue underwater," said a source. The Orca has a stowable mast designed to be raised when it is at or close to the surface to provide a number of functions, including satellite connectivity.

Sandwiched between that equipment, housed in an aft section with a shrouded propeller and a nose section housing sensors and space for modular payloads.

The 34ft modular mid-section has an eight-ton payload capacity. This is reconfigurable to carry payloads to suit a range of long-endurance missions, including undersea mines and synthetic aperture sonar for ocean-floor mapping. Navy requirements indicate the UUV will also perform underwater surveillance, electronic warfare, and minesweeping missions.

DIVE-LD

The US Navy has announced that Anduril and its Dive-LD autonomous underwater vehicles (AUVs) will prototype distributed, long-range, persistent underwater sensing and payload delivery in contested environments.

The Dive-LD is a modular and customizable commercial large displacement AUV that can be optimised for various defence and commercial mission types, such as bathymetric and geophysical surveys, long-range oceanographic sensing, undersea battlespace awareness, mine countermeasures, anti-submarine warfare, seabed mapping and infrastructure health monitoring.

Amid rising tensions in the Indo-Pacific region, particularly in the maritime environment, the US Department of Defense (DoD) has signalled its intent to invest in large quantities of autonomous systems to strengthen deterrence, project power, and achieve affordable mass. Mass is a critical element of undersea deterrence.

Insufficient fielding of unmanned undersea vehicles with long endurance and large payload capabilities at scale has created a significant gap. In July last year, the Defense Innovation Unit (DIU) sought proposals for commercial solutions to fill that gap.

As part of the selection process, Dive-LD carried out government-defined missions in a “swim-off” competition that rigorously evaluated vehicle capabilities at the Naval Undersea Warfare Center in Newport, Rhode Island.

During this event, Anduril engineers successfully tracked and shared the location of the Dive-LD asset with operators around the world in real-time by leveraging Lattice, Anduril’s AI-powered software platform for command-and-control (C2) of autonomous vehicles. After the successful demonstration, Dive-LD was down-selected for a contract under DIU’s Commercial Solutions Opening process.

DIVE

Anduril Industries acquired Boston-based start-up Dive Technologies, in early 2022 and in doing so, gained access to the modular and customizable AUV DIVE-LD This extra large vehicle was designed to be optimised for a variety of defence and commercial mission types such as long-range oceanographic sensing, undersea battlespace awareness, mine countermeasures, anti-submarine warfare, seabed mapping and infrastructure health monitoring.

Anduril was able to integrate its autonomy software, **Lattice OS**, into the vehicle to improve its capabilities.

An important feature of the DIVE -LD was the use of Large Format Additive Manufacturing (LFAM) techniques and a novel system architecture to rapidly produce the DIVE-LD at a fraction of the time and cost of existing AUVs.

At the time, Dive Technologies co-founder and CEO Bill Lebo said ‘We built Dive to make undersea exploration safer, smarter, and cheaper, and to offer customers the highest level of customisation.

GHOST SHARK

One of the first customers was the US Defence technology and the Australian Defence Force who back in 2022, entered into commercial negotiations for a US$100m co-funded design, development and manufacturing program for Extra Large Autonomous Undersea Vehicles (XL-AUVs) for the Royal Australian Navy. This was renamed *Ghost Shark*.

"They have the capacity to remain at sea undetected for very long periods, carry various military payloads and cover very long distances,” said Rear Admiral Quinn of the Royal Australian Navy.

"Joining other autonomous systems, as Navy invested in smart AI-enabled technologies, Ghost Shark would be a game-changer."

They said that a three-year XL-AUV development programme will involve capability assessment and prototyping using Anduril’s agile capability development systems. There will be three prototypes delivered to the Royal Australian Navy over these three years.

Last year, Anduril Industries, announced a partnership with the National Offshore Wind Research and Development Consortium (NOWRDC) to autonomously inspect undersea power infrastructure.

Under this partnership, the Dive-LD, was to inspect an existing export power cable from Block Island to Point Judith, Rhode Island.

Using Metron’s executive mission autonomy, advanced autonomous target recognition algorithms and data quality analysis, the Dive-LD would survey the existing export power cable, autonomously identify potential problem areas, and dynamically re-task to perform additional higher-fidelity inspections of any abnormalities.

“The capabilities demonstrated in the NOWRDC partnership are also transferrable to other underwater applications, including telecommunication cables, oil and gas pipelines, and national security assets,” said Sam Russo, Senior Director of Business Development at Anduril.

DIVE-LD

The DIVE-LD is 5.8m long, 1.2m diameter underwater vehicle and was specifically designed to carry out low cost, long range operations in waters up to 6000m. The company was founded by three ex-Bluefin employees in August 2018 who recognised that at the time, most AUV companies were concentrating on smaller vehicles between 4ins–21ins diameter and this portion of market was becoming heavily saturated.

Conversely, they perceived a real gap in the larger, more powerful end which resulted in the design of the new Dive large displacement (LD) AUV, subsequenly known as the DIVE-LD.

The logic behind this initial size was it allowed them to pack in what they considered to be a meaningful amount of energy while also allowing for a generous payload volume of over 1m³.

At the time, Russo said the DIVE-LD was powered by Kraken Robotics lithium battery which gives us 93kWh of energy that translates to up to as much as 10 days in the ocean on a single charge. The latest vehicle has a range of up to 900 km although that is really dependent on speed and the sensors onboard.

"The strength of many AUVs come from the exoskeleton – the outer skin or shell. This makes it easy to add sections or modules," said Russo.

"The DIVE-LD, however, has a novel load bearing internal marine grade aluminium strongback or spine that features a single point lift.

"Another novel, perhaps unique part of the design, is that the external skin of the vehicle is all 3D printed.

SUNFISH

SUNFISH hovering autonomous underwater vehicle (HAUV) can explore complex underwater terrain like the submerged caves the team is searching for as part of NOAA's 'Our Submerged Past' project.
Image courtesy of Jason Gulley

Sunfish is an underwater inspection and exploration company that primarily focuses on developing vehicles able to operate in difficult-to-access environments such as tunnels or underwater caves. NOAA recently used the vehicle as part of the "Our Submerged Past" project to map the Late Pleistocene caves off the coast of Southeast Alaska, conducting high-resolution multibeam surveys of potential targets and processing the data into maps.

Sunfish was born in 2019 as a spin-off from the niche technology group Stone Aerospace. Stone specialises in developing vehicles and systems, primarily for NASA , to support future exploratory missions to moons with liquids on the surface, such as the Jovian moon Europa.

Many believe that if building blocks of life exist, they will likely be found in aquatic environments and these will require a robotic underwater explorer that can go where no other vehicle can.

Commercialising some of this technology, Sunfish have developed a vehicle (called SUNFISH) that is capable of finding its way through complex 3D underwater environments such as reefs, caves, and tunnels. To do so requires a highly agile vehicle with precise six-degree-of-freedom (6-DOF) manoeuvrability.

"When operating in enclosed environments, it is beneficial to use as small a vehicle as possible. Without affecting the reliability, we have been working hard to shrink the footprint of the system and especially the core technology that Stone originally developed," said CEO Alberto Lopez.

SUNFISH is 1.61 m in length, 0.47m in width and 0.2m in height with a flattened shape helping it progress long distances in confined spaces.

“The vehicle is fabricated from aluminium and carbon fibre. The original version was around 40 kg, but since then, we have increased the endurance by adding a new battery pack, and this has increased

the weight by 8 to 10kg. The upside is that it can now work in the water for 12 hours as opposed to the original four and it can traverse up to 12km.

"SUNFISH has been designed to be neutrally buoyant. Within the external sealed panels, runs a long carbon fibre cylinder that contains the control system and everything it needs to operate the vehicle apart from the propulsion system which is located externally. This design means that different sensors can be easily added.

“Key to the technology is the very high levels of autonomy. Powered by sophisticated artificial intelligence algorithms, it can navigate through and explore unknown environments without direct human control."

"The AUVs onboard sensors include a high-precision inertial measurement unit, Doppler velocity log,multibeam sonar and high-resolution camera, providing a comprehensive 3D view of the environment.

"An important feature of the design is the Simultaneous Localization and Mapping (SLAM) Technology developed by Stone. It combines all the data from the sensors into a real-time map of the area it is exploring. It then uses this map to find its way around.

"After returning from a mission, these real-time maps can be post-processed to provide high-resolution 3D models of the places the robot went, providing valuable context and insight for scientists."

The SUNFISH can also trail a fibre-optic thread for high-bandwidth communications to the surface, allowing scientists to understand the vehicle’s environment as it is being explored, providing the human observer with high-level guidance, situational understanding, and expertise the robot cannot understand. Working together, humans and the robot ensure optimal exploration and data collection.

PROJECTS

“Many of the projects that we are working on are for the water industry," said Lopez.

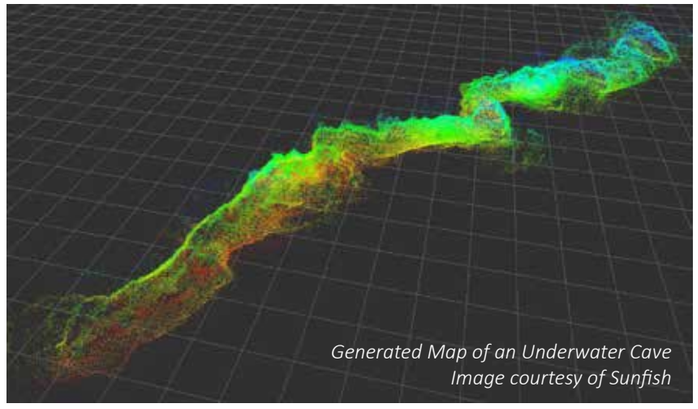
"Typical operations include sending the vehicle inside the conduit tunnels that transport water to cities. Armed with the correct sensors, SUNFISH is used to perform visual or non-destructive inspection. These inspections provide the foundation

Collecting Sediment Samples
Image NOAA

of a high-quality asset management plan by supplying the information necessary to make informed decisions. Such assessments provide insight into the nature and timing of possible failures, and guide maintenance/repair planning and funding allocation.

“A customer can come to us with a challenge, and we can tailor-make a sensor package and integrate it to SUNFISH to meet this requirement. We leverage 3D printing to develop the fittings and make integration easier and cost-effective.

"In parallel to water infrastructure inspection, we are putting together a number of standard sensor packages with new configurations that will service different sets of clients. For example, we recently are working on a new configuration capable of detecting nitrate pollution using water quality sensors for water resource management clients. SUNFISH is a great tool for enhancing water resource management at accessible sites by providing comprehensive, accurate data to inform conservation and restoration efforts.



Generated Map of an Underwater Cave
Image courtesy of Sunfish

By adding water quality sensors to the AUV – such as a nitrate sensor or water sampling – pollutant loads to groundwater systems such as karst aquifers can be quantified and located. The AUV provides knowledge of these complex aquifer dynamics in order to properly mitigate water quality and quantity problems from the surface.”

IMPACT SUBSEA NEW HQ

Impact Subsea recently opened a new chapter in its growth trajectory with the move to larger headquarters in The Aberdeen Energy Park, United Kingdom.

The company's headquarters, located at Silverfield House, provide ample space to support the company's sustained growth. Silverfield House provides 12,000 sq ft of modern office, production, training, calibration and demonstration space.

With its previous base situated in Ellon, Aberdeenshire, the move to Aberdeen will serve as a more centralised hub to streamline the company's operations.

Managing Director Ben Grant was pleased with the move, saying; "To support the continued growth of Impact Subsea, we are delighted to announce the acquisition of larger premises. Our new premises not only enable continued support to users of our sensors but provide a strong base to take on new employees and launch further innovative underwater sensors."

New HQ

FET ENERGY TRANSITION

Forum Energy Technologies (FET) has appointed its first ever energy transition business development manager within its subsea business, reinforcing the company's commitment to helping operators achieve greater carbon emission improvements.

Martin Thomson, who will be based at the company's Aberdeen office, brings with him a wealth of experience in both the subsea and offshore wind sectors as the firm seeks to bolster its influence in the market. Martin

Martin Thomson

has previously held senior sales positions at Subsea7, GE Oil & Gas, KCA Deutag and Oerlikon Surface Solutions. He joins FET from Dril-Quip where he was director of sales – Europe and Africa.

His appointment marks an exciting milestone for FET as it intensifies its commitment to supporting the transition of the energy landscape, particularly in offshore wind energy. Martin will report directly to FET's Houston headquarters.

DIRECTOR OF APPLICATIONS ENGINEERING, INTEGRATION AND TESTING

Jeff Snyder

VideoRay has appointed Jeff Snyder as the new Director of Applications Engineering, Integration and Testing.

Snyder began his career with a degree from Duke University before serving as a special operations officer for the US Navy. After his service with the US Navy, he earned a graduate degree from the Massachusetts Institute of Technology (MIT).

Snyder brings to VideoRay over two decades of expertise garnered from leadership and field positions at robotics and technology organizations such as SeaVision Underwater Solutions, L3 Harris-Oceanserver, and Terradepth.

With VideoRay's defence sales and the recent acquisition of Blue Ring Imaging, system integration and testing are becoming increasingly important to keep pace with advanced innovation and product development.

C-KORE SALES TEAM EXPANDING IN 2024

C-Kore Systems, a UK based company specializing in subsea testing tools, has rounded off an excellent 2023. With a healthy order book for 2024, C-Kore is looking to expand their Sales Team, basing the new staff in Aberdeen, UK.

C-Kore Systems has a range of subsea testing tools used globally by operators and contractors on de-commissioning, fault-finding operations and new installation campaigns. The tools are easy to deploy and are operated without the need for C-Kore personnel being present, providing rapid and accurate feedback. This combination of simplicity, accuracy and reliability introduces significant operational savings to testing campaigns.

Cynthia Pikaar, Sales & Marketing Director at C-Kore commented, "We have had a very busy 2023 and our order book for 2024 is looking to be very good also. We are very excited to be expanding our Sales Team to meet the increased demand. With Aberdeen being the heart of the UK's Oil & Gas industry, it was a natural choice to base our new staff here."

Greg Smith, Operations Director at C-Kore commented further, "It is great to see our cost saving technology being adopted by more operators and installation contractors around the globe. As we continue to develop our subsea testing tools further, also expanding our Sales Team allows us to reach out to even more customers, helping them simplify their subsea testing needs."

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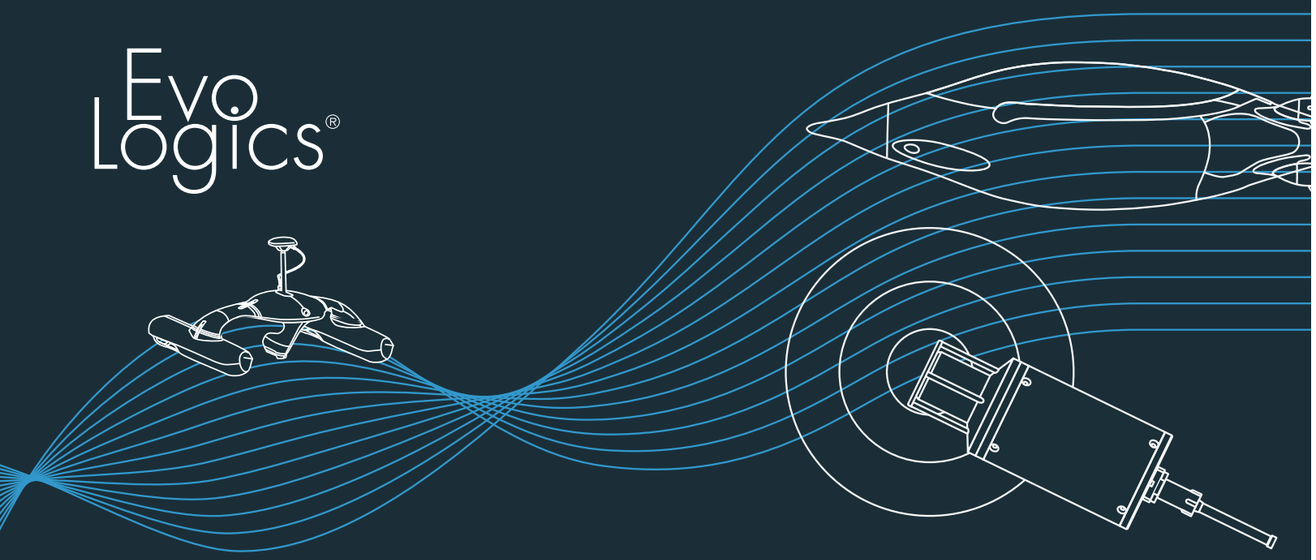

SMART SUBSEA SOLUTIONS

- Delivering data in most adverse conditions: underwater acoustic modems with advanced communication technology and networking
- Accurate USBL, LBL and hybrid positioning of underwater assets, navigation for divers
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