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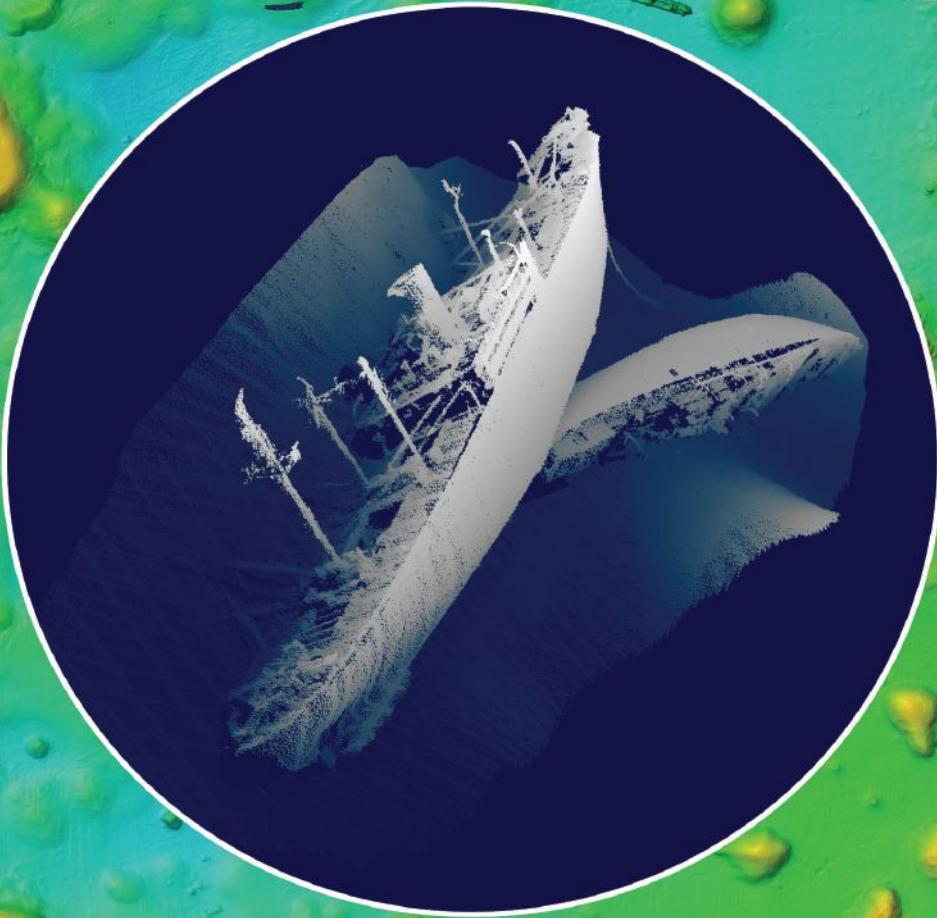


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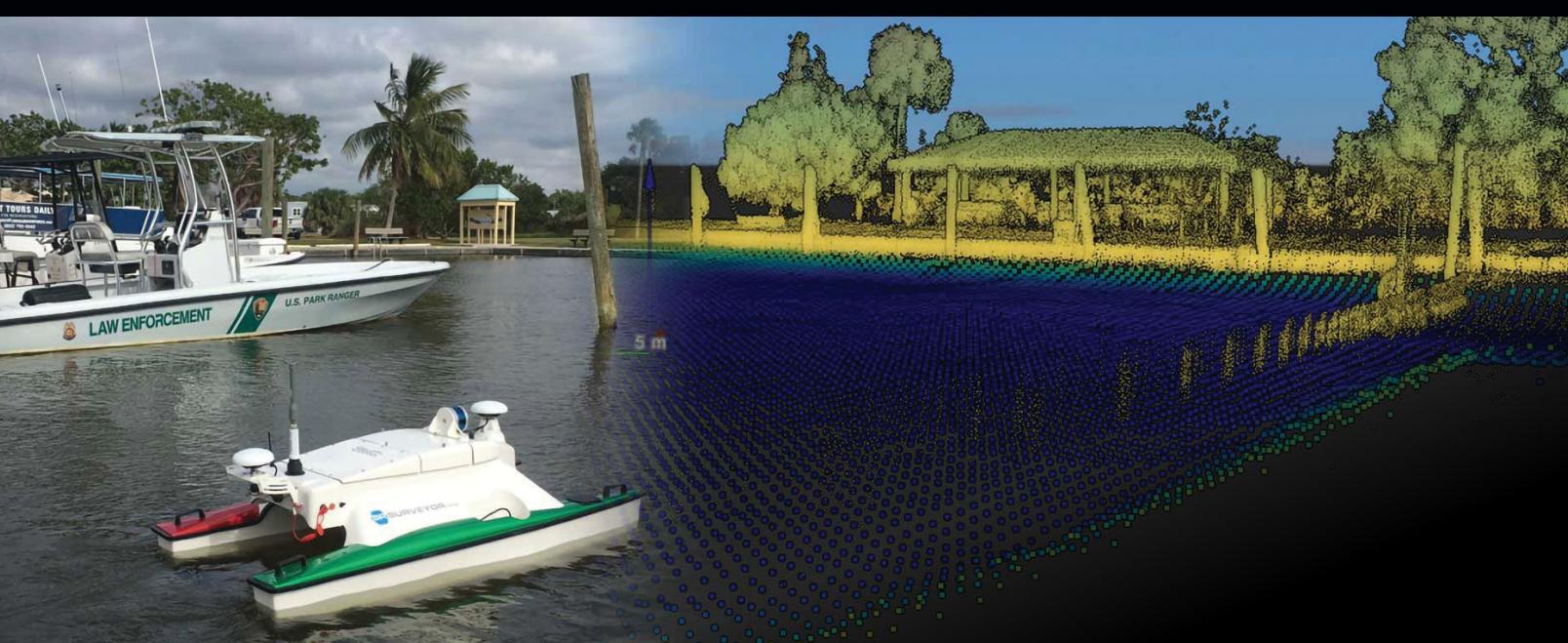
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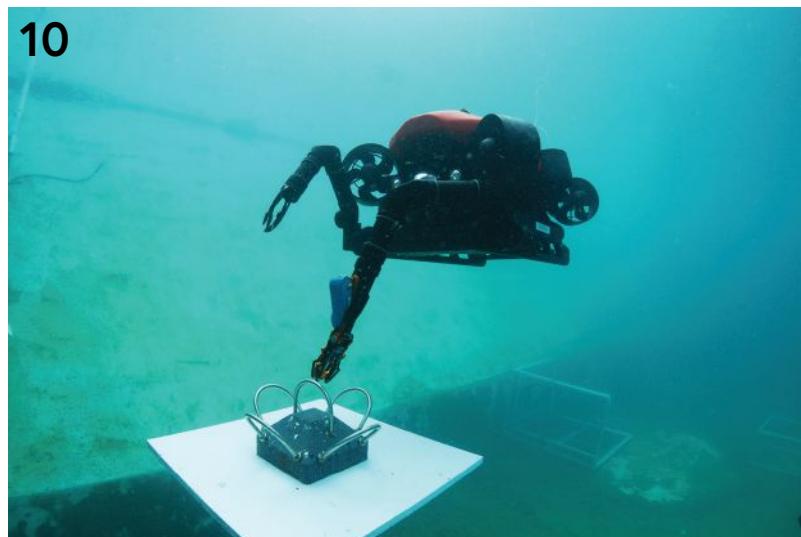
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ON THE COVER:
A new paradigm for expeditionary subsea operations: The FUSION™ Hybrid Underwater Vehicle equips warfighters with mission-critical capabilities under remote, diver, or autonomous control. (Image credit: SRS)

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[WITH THANKS - Ed.]

Ongoing investments in ocean technologies, whether deployed for shorter tactical missions or longer-range surveillance campaigns, continue to expand our naval defense and security capabilities.

As marine domain stakeholders consider the shifting dynamics of in-field operations amid an increasingly combustible geopolitical climate, the facility and readiness to conceive, develop, and field game-changing technical innovations presents a sustainable competitive advantage for any nation.

In this edition of ON&T we get an exclusive look at some of the brilliant products and systems transforming how operators investigate, monitor, and ultimately safeguard targeted waters. Our special thanks go to Strategic Robotic Systems, RTsys, MARTAC, General Dynamics Mission Systems, and Ocius.

Happy reading!
editor@oceannews.com

Ed Freeman



Integrated Solutions for Defense Challenges

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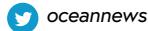
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MEETING UUV DEMAND FOR DEFENSE & SECURITY

**By Michael Guay***Director of Autonomous Undersea Systems***GENERAL DYNAMICS**

Mission Systems

As world events continue to evolve in dramatic fashion, the undersea domain is ever more a focal point for potential conflict. The United States and its allies continuously look to leverage unmanned systems like unmanned underwater vehicles (UUVs) as a force multiplier in greater and greater numbers. So much so that the US Navy Chief of Naval Operations, Admiral Michael M. Gilday, has said that some forty percent of the US Navy's future fleet will be unmanned. The composition of this future unmanned fleet will matter greatly, particularly with space on key platforms like attack submarines coming at a steep premium.

General Dynamics Mission Systems is celebrating the 25th anniversary of the Bluefin Robotics product line this year. Over those 25 years, we have seen tremendous advancements in maritime autonomy, subsea power, sensing, processing, and communications. When we designed the new Bluefin-9 and Bluefin-12 UUVs in 2017, it was with an eye toward packaging as much capability as we could into those smaller nine- and twelve-inch diameter form factors in support of expeditionary operations. The Royal Australian Navy is leveraging several of those systems for that exact purpose on the SEA 1778 mine countermeasures program.

EXPANDING THE RANGE OF UUVs

While Bluefin-9 and Bluefin-12 are very adept in that expeditionary context, they and other small UUVs simply lack the physical volume to practically address the requirements of larger scale operations—requirements like endurance, operating depth, payload capacity, etc. Conversely, larger diameter UUVs come with incredible capability afforded by their size, but also bring a host of complex logistics challenges, much higher upfront acquisition costs, and are trickier to integrate into platforms like a submarine if desired.

The 21-inch medium diameter Bluefin-21 UUV seeks to offer a third choice in today's increasingly contested maritime environment. The Bluefin-21 has been our flagship system for more than two decades, serving as the basis for the revolutionary US Navy Knifefish Surface Mine Countermeasures (SMCM) UUV and countless other novel adaptations. It strikes an optimal balance between size, speed, endurance, payload capacity, and price.

OPTIMIZING UTILITY IN THE FIELD

Its modular design enables rapid turn-around operations and allows it to be broken down quickly into transit cases, air shippable to hotspots across the globe in a matter of hours. Add in its full-ocean-depth operating capability and you have a truly worldwide asset, deployable from any number of vessels of opportunity.

Tomorrow's pacing threats require UUVs that maximize operational agility while simultaneously delivering the mission performance of larger platforms. Utility UUVs like the Bluefin-21 are essential to meeting the increasingly complex demands of modern naval applications.

The performance of a single Bluefin-21 obviates the need for several smaller systems, and one or two Bluefin-21s can accomplish similar missions as some larger platforms, but with less complexity and at a lower price. The range of options available to today's and tomorrow's naval forces is far greater with a robust complement of utility UUVs such as the Bluefin-21.

General Dynamics Mission Systems is eager to support our customers in this endeavor and look forward to the next 25 years of applied UUV research and development.



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» *FUSION* in Diver Mode providing navigation and propulsion. (Image credit: SRS)

| EDITORIAL FOCUS |

HYBRID UNDERWATER VEHICLES OPTIMIZED FOR EXPEDITIONARY MISSIONS



By Omer Poroy
CEO, Strategic Robotic Systems



Expeditionary maritime operations remain a critical aspect of naval operations across the globe. The dynamic geo-political landscape, coupled with the pace of technological advancement, and a growing set of budgetary challenges are driving naval leaders to develop novel concepts of operations to tackle increasingly complex undersea operations with fewer resources. This austere environment is precisely where

the full value proposition of the *FUSION*™ Hybrid Underwater Vehicle, developed by Strategic Robotic Systems, Inc., comes to life.

Founded in 2015, Strategic Robotic Systems set out to develop a compact, tightly integrated multi-mode undersea robot with a highly intuitive user interface that is optimized for expeditionary missions. The company delivered on that vision through the introduction of its *FUSION*

platform in 2017, seamlessly integrating a high-resolution camera, lights, forward looking sonar, side scan sonar, Doppler Velocity Log, Ultra-Short Base Line (USBL) navigation pinger with integrated acoustic communications, GPS receiver, and an attitude and heading reference system—along with all the necessary electronics and onboard energy storage—into an underwater robot that weighs less than 28 kgs, or 62 lbs.

In addition to its single-person deployable weight profile, the team behind FUSION minimized the system's deployment footprint to align with expeditionary requirements; eliminating the need for a topside power generator, employing a compact tether management system (TMS), and developing a tablet based human machine interface (HMI).

Today, the FUSION system can be deployed in three primary modes of operation—via a small (< 3 mm diameter) fiber or copper tether to conduct undersea inspection and intervention tasks in Remotely Operated Vehicle (ROV) Mode, without a tether to conduct seabed surveys or gather intelligence, surveillance, and reconnaissance (ISR) data in Autonomous Underwater Vehicle (AUV) Mode, or in support of military dive operations by simultaneously providing a diver subsea navigation capabilities as well as augmented propulsion for increased range efficiency in Diver Mode.

ROV MODE

Designing a battery powered ROV system was foundational to ensuring the tactical utility of the system for expeditionary missions, however the design team at Strategic Robotic Systems also recognized the need to significantly reduce the cognitive burden levied on an operator under stress.

The team set out to develop an intuitive HMI and delivered a real-time vehicle control paradigm that is highly augmented by automation. Unlike traditional ROV systems, FUSION flight control algorithms are incorporated in every vehicle, allowing users to simply command a desired motion and supervise as the machine executes the task. Strategic Robotic Systems continues to pursue advancements in autonomy-augmented supervisory control to extend beyond traditional vehicle and manipulator controls in partnership with Reach Robotics based in Sydney, Australia.

AUV MODE

With all the necessary sensors for autonomous operation already incorporated into the vehicle to enable the ROV control paradigm described earlier, the team at Strategic Robotic Systems went on to



» FUSION ROV Mode deployment footprint—Vehicle, TMS & Tablet HMI. (Image credit: SRS)

further refine the autonomy algorithms, mission planning and post-mission analysis capabilities of the FUSION system to ultimately enable the robot to conduct fully autonomous, tether-less operations—all managed from the same intuitive HMI.

In this mode, the integrated USBL is leveraged to limit any navigational drift in the system and the acoustic communication capabilities are leveraged to provide in-

stride mission adjustment, command ROV-like behaviors such as orbiting around a target of interest, or even drop a payload. FUSION systems outfitted with a payload delivery system (PDS), incorporated into the under-belly of the vehicle, can be programmed to drop a payload at pre-determined positions, or acoustically triggered to release by a human supervisor. Undersea autonomy is an area of increasing interest for Strategic Robotic Systems,

and the company continues to develop new behaviors to meet emerging mission needs in collaboration with its customers and industry partners.

DIVER MODE

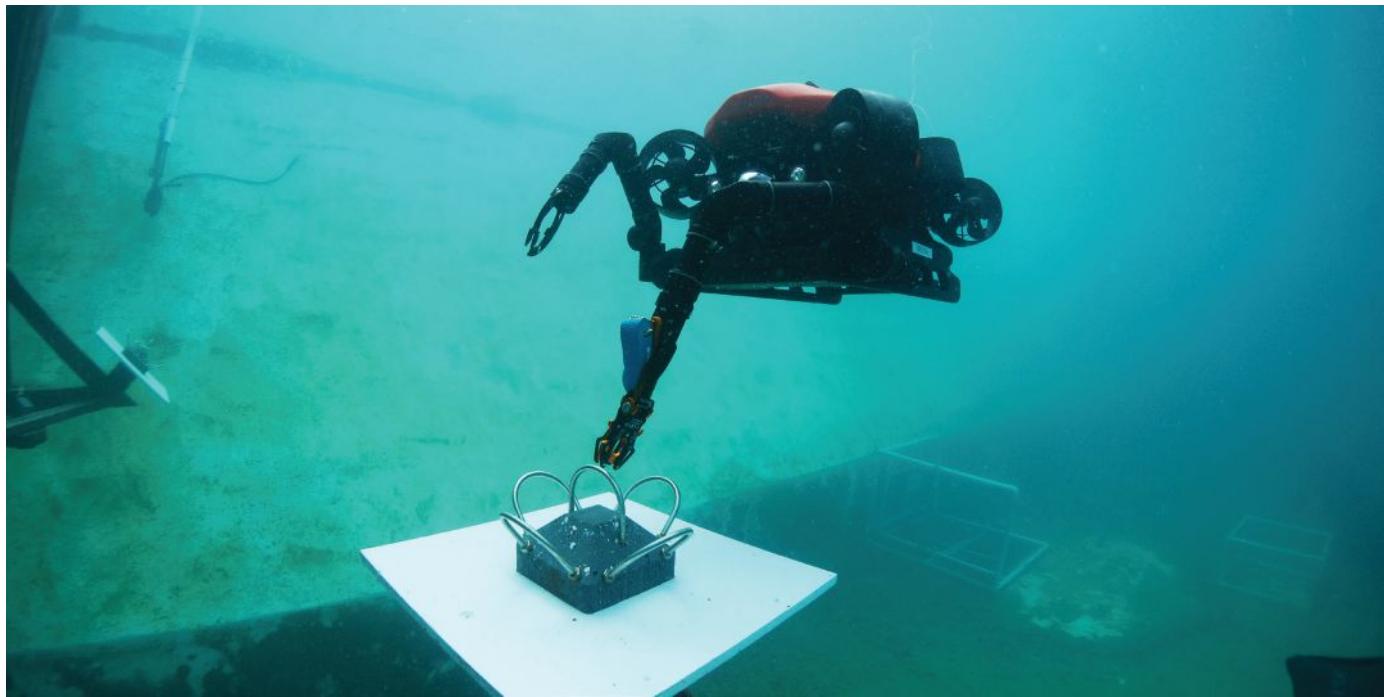
The FUSION system is transformed into its Diver Mode with the addition of a diver interface module (DIM) which is affixed directly onto the vehicle, as depicted on the cover of this issue of Ocean News & Technology. The DIM allows the diver to control the vehicle in real time and visualize the live stream sonar, camera, position,

navigation, and status information on a large format screen.

Utilizing the DIM, an operator can use the vehicle to navigate underwater and gain efficiency in swim range by using the vehicle's integrated thrusters. In addition to topside communications, the DIM also allows other users of the FUSION in Diver Mode that are within acoustic range to exchange text messages with each other to enable coordinated undersea action. The FUSION battery management system is designed to enable hot-swap of batteries while underway, providing divers the ability to extend the range and duration of their missions.

» ArtemisELITE and FUSION in transit to an area of operation. (Image credit: SRS)





» FUSION with Dual 5-Function Reach Robotics manipulators. (Image credit: SRS)

INDUSTRY COLLABORATION

This unique combination of capabilities in a single vehicle allows expeditionary teams the flexibility they need to adjust to operational needs in real time while reducing the number of assets they must carry into a theater of operations.

Today, the FUSION platform is employed globally with a broad range of defense forces including the US Department of Defense, US Homeland Security, and numerous allied nations; yet the team at Strategic Robotic Systems continues to push the art of the possible in expeditionary undersea robotics.

Strategic Robotic Systems has been working with its strategic collaborators, Blueprint Subsea of the UK and SUEX of Italy, to enable an undersea "system of systems" concept wherein the FUSION extends the reach of tactical dive operations by enabling deployment and control of the FUSION system by a diver while remaining submerged.

In this new concept of operations, an ArtemisELITE system comprised of a long-range SUEX diver propulsion vehicle (DPV) fitted with a Blueprint Subsea Artemis Diver Navigation System is employed for transit into an area of operation. The FUSION is then deployed, either in AUV or ROV Mode, by the dive team to ingress further into harm's way to conduct operations, allowing the warfighter to maintain their stealth and stand-off distance. The ArtemisELITE and the FUSION are designed to seamlessly communicate with one another, sharing position, mission, and status information, in addition to acoustic messaging, command, and control functionality.

These industry leading features offered exclusively by the FUSION platform have positioned the company well for continued growth within the defense industry. At Oceanology International Americas in February, Strategic Robotic Systems announced that we would be relocating the business to San Diego, CA to better serve the men and women in uniform who deploy into harm's way with our products and to gain access to an ocean-tech savvy talent pool as we continue to innovate in the realm of expeditionary maritime robotics. We are excited to embark on this next chapter and invite you to reach out and schedule a visit the next time you are in the area.

For more information visit: www.srsfusion.com.



» FUSION outfitted with a payload delivery system operating in AUV Mode. (Image credit: SRS)

NOC LEADS INTERNATIONAL OCEAN SCIENCE RESEARCH EXPEDITIONS



» A view of the A76a iceberg from RRS Discovery. (Image credit: NOC)

The National Oceanography Centre (NOC), home to RRS *James Cook* and RRS *Discovery*, is managing 31 global research missions in 2023, providing a wealth of support for international research institutions.

This will include missions to the Bay of Biscay where NOC's Marine Autonomous Robotic Systems team will be trialing its fleet of AUVs and gliders to test autonomous ocean research capabilities, an expedition to quantify deep sea ecosystem resilience in the Pacific, and a research mission to Norway to study the role nitrogen plays in Arctic biogeochemistry.

These include the DY158 expedition which took place earlier this year and circumnavigated the A76a megaberg and last year where the team sailed out to the Thwaites Glacier in Antarctica with renowned autonomous underwater vehicle, *Boaty McBoatface*.

The DY158 expedition to the Southern Ocean with British Antarctic Survey (BAS), saw the NOC supply 22 NOC crew plus 6 NOC technicians to provide underwater sensor technology and facilitate data gathering, whilst BAS provided the scientific expertise to understand the long-term variability in krill biomass and the influences from climate variability, fishing pressure and predation.

NOC is world renowned for its research ships the RRS *Discovery* and RRS *James Cook*, providing first class facilities to global research institutions. Onboard the ships at any time the NOC provide up to 17 technicians and 22 crew members to support the delivery of science.

NOC undertakes extensive work to supply equipment to fulfil the objectives of science institutions across the globe, assigning fully trained technicians to ensure that vessels are operated by appropriately trained and experienced personnel—from the Captain to the Chef.

Jon Short, Senior Project Manager at the National Oceanography Centre, said: "We ensure that the vessels are capable of performing the science operations required for all research missions, alongside certifying the required equipment and operating state of the art technology safely, efficiently and optimally."

"NOC's involvement in circumnavigating the A76a iceberg highlights the key role the National Oceanography Centre's technicians, alongside the captain and crew on board the RRS *Discovery*, play in providing data to support important scientific research expeditions."

NOC's pioneering technological equipment supports ocean research missions, including sampling instruments which provide real time data from the sea surface, collating data relating to temperature, salinity, and fluorescence, which are used to validate weather and climate models. Alongside this, NOC provide real time atmospheric data, such as air temperature, wind speed and direction, and light measurements.

Short continued: "This kind of data collection is the fundamental backbone of all science research and forms the basis of the vast majority of papers that will come out of this or any other research cruise."

» RRS *Discovery*. (Image credit: NOC)



VALEPORT UNVEILS SWIFT DEEP CTD



Valeport's popular range of SWiFT profilers has been extended with the launch of a new addition for those requiring CTD measurements to depths of 6000 m.

Offering increased versatility and absolutely no compromise on accuracy, the new SWiFT Deep CTD has been designed with the intention of a seamless workflow and offers the highest quality CTD profiles in a compact, robust and portable package.

The new profiler provides survey-grade sensor technology coupled with the convenience of Bluetooth wireless technology, a rechargeable battery and an integral GNSS module to geo-locate each profile.

Using Valeport's world-leading high accuracy sensor technology to combine sensors for multiple profiles in a single drop, the SWiFT Deep CTD can operate to 6000 m, delivering directly measured conductivity, temperature and depth. In addition, the SWiFT Deep CTD will provide computed salinity, density and sound velocity, calculated using the UNESCO international standard algorithm and Chen and Millero equation. Data can be quickly and easily downloaded wirelessly, and instantly shared in industry standard data formats.

With an operational battery life of up to five days and the convenience of charge via USB, the SWiFT Deep CTD is designed to cope with the harshest conditions and intended for offshore, coastal, harbor and inland environmental and hydrographic survey use.

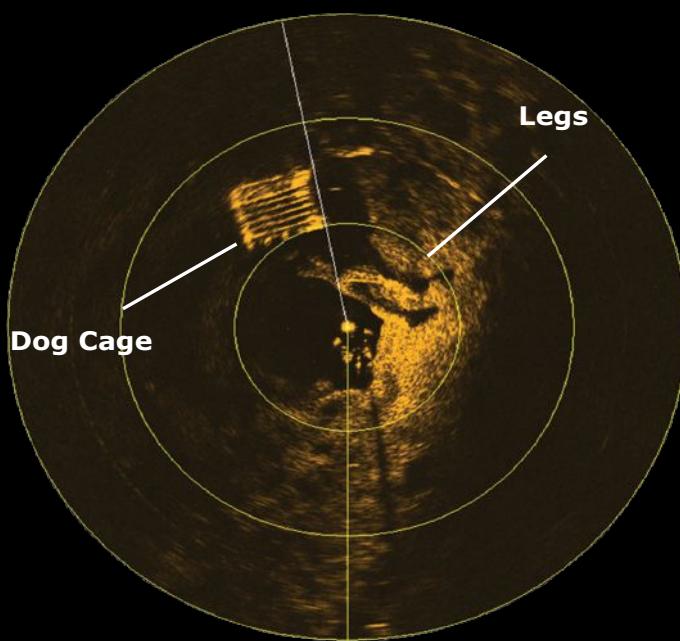
Providing unmatched durability, the SWiFT Deep CTD is constructed from titanium and the CTD sensors are housed in a strong acetal sensor guard.



» SWIFT Deep CTD, intended for hydrographic and offshore use to 6000 m. (Image credit: Valeport)

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MANNED-UNMANNED TEAMING: THE USE OF MICRO AUV BY EOD DIVERS

By



» NemoSens fitted with DVL and 900 kHz Side Scan Sonar is the most requested configuration for SOF and EOD divers. (Image credit: RTsys)

Manned-Unmanned Teaming is the collaborative use of both manned and unmanned systems to achieve a common objective. In the context of explosive ordnance disposal (EOD) diving operations, Manned-Unmanned Teaming can be a valuable solution to enhance safety and efficiency.

Autonomous underwater vehicles (AUVs) were originally designed to carry out various subsea missions without the need for human intervention. And they have proven, especially among defense sector users, to be an invaluable tool. Equipped with different configurations of sensors, sonars, cameras, and other intelligence-gathering instrumentation, AUVs offer the most efficient way to collect critical information about enemy activity, seabed terrain, and potential threats. Today, unmanned systems are commonly used to perform tasks that deemed too risky for human divers, such as searching for explosive devices in murky waters or in hazardous environments.

However, there are limitations. Manned EOD operations (i.e., divers) ensure the often necessary *in situ* human interpretation and real-time decision-making capabilities in situations where automated systems may prove lacking. EOD divers are also able to provide unmanned systems with physical assistance if required, such as the need to classify a detected mine or attach/remove an explosive device. In short, the presence of a human brings a second tier of intervention and assurance to complex operations.

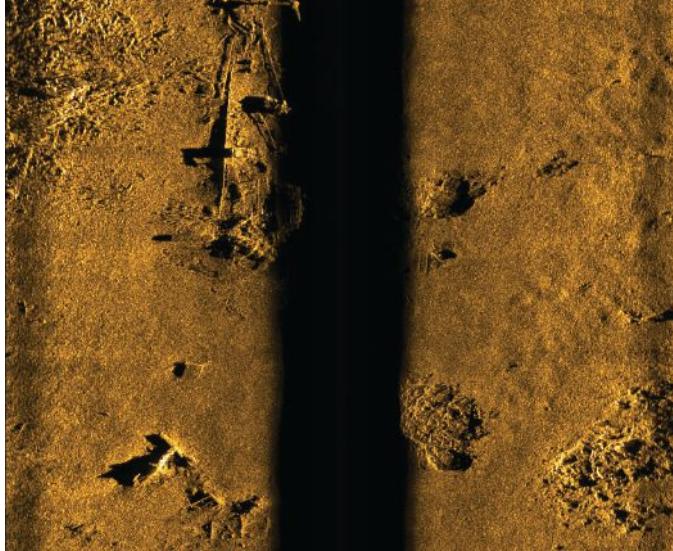
AUV-ASSISTED DIVING OPS

By combining the strengths of trained divers and underwater robotic systems, Manned-Unmanned Teaming helps optimize the overall effectiveness of EOD diving operations while minimizing the associated risks to personnel in the water. It can also increase the speed of operations and reduce the overall cost of EOD missions.

Such has been the rate of development of specialized AUVs, we have now reached a point where AUVs have become the most efficient tool for EOD divers to perform their operations more safely and effectively.

Where once AUVs would work independently, deployed from a support vessel, and programmed to run a mission, they now offer a more complementary role to critical EOD operations.

This realization inspired the team at RTsys, a French producer of specialist AUVs and handheld sonars, to design and manufacture NemoSens, a micro AUV developed specifically for EOD ops and other deployments by Special Operations Forces (SOF).



» Shipwreck detection at 3 m altitude. (Image credit: RTsys)

MINI BUT MIGHTY

NemoSens is a 300 m depth rated micro (less than 1 m in length) and highly portable (less than 10 kg in weight) AUV. Lightweight and modular, its open LINUX architecture allows users to develop their own navigation algorithm for greater flexibility and maximal use. Engineered for the precise identification and localization of underwater mines across large search areas, the AUV delivers ultrahigh accuracy positioning thanks to its acoustic communication system. This bundle of features makes NemoSens the ideal tool to provide specialist diving units with the necessary data to inform accurate and timely decision making in high pressured situations.

This "unmanned" part of the said "teaming" allows SOF and EOD diver units to extend their traditional scope of operations to include:

- Mine Countermeasure Missions (MCM)
- Very Shallow Water missions (VSW)
- Rapid Environmental Assessment (REA)
- Search And Locate (SAL)
- Search And Rescue (SAR)
- Amphibious and Beaching operations
- Harbor protection
- Intelligence, Surveillance, and Reconnaissance (ISR)

A key consideration surrounding the development of NemoSens was the AUV's operational synchronization with SonaDive, RTsys' diver-held sonar. This critical compatibility acts as a technical bridge in the Manned-Unmanned Teaming solution, resulting in a comprehensive and seamless network of equipment to safeguard and inform work carried out by SOF and EOD teams.



MCM ECOSYSTEM

The modularity and versatility of the RTsys MCM Ecosystem means that operators can use each device in the network as either a standalone piece of equipment or integral to the Manned-Unmanned Teaming system, with no need for recalibration at any time thanks to the embedded acoustic communication and repositioning of every module at sea.

Mission planning of this teaming solution (hand-held sonar and AUVs) is managed by one light and ruggedized programming and post-processing module, affording the operator maximum flexibility from projects anywhere around the world.

Real-time monitoring of the mission (including live underwater tracking of every asset) is available thanks to a Surface Communication Module and supported by a compact but robust waterproof touch pad.



» All elements of the RTsys Ecosystem—the COMET-MCM AUV (the bigger AUV), SONADIVE handheld sonar, the NEMOSENS micro AUV, and the NEMOBUOY autonomous acoustic extender and repositioning AUV—share the same SCM surface communication module. (Image credit: RTsys)

To ensure positioning accuracy of the micro AUV NemoSens, as well as that of the EOD divers with the SonaDive, RTsys has developed a unique underwater acoustic protocol called RACAM® (Repositioning And Communication Acoustic Module).

RACAM® is a lightweight and compact acoustic modem natively installed on every RTsys device. It allows for a coverage distance through Sparse-LBL over 2 km point to point and up to 5 km with relay beacon (underwater or surface buoy) and provides real-time information data points on equipment status, position, speed, heading, payload, depth, altitude, and distance from the Rhib.

This comprehensive RTsys Ecosystem offers the widest capability range possible, allowing operatives from navies around the world to leverage the operational benefits of using a Manned-Unmanned Teaming network.

For more information, visit: www.rtsys.eu.

» The SonaDive handheld sonar. (Image credit: RTsys)

NOKIA WIRELESS CONNECTIVITY SUPPORTING THE OCEAN CLEANUP

Nokia has announced it will deploy private wireless connectivity, network edge equipment and analytics for The Ocean Cleanup, the international non-profit project working to develop and scale technologies to rid the world's oceans of plastic. The collaboration is in line with Nokia's enhanced Environmental, Social and Governance (ESG) strategy, as well as a broader longstanding commitment to advancing the role of technology in combatting climate change and minimizing environmental impacts.

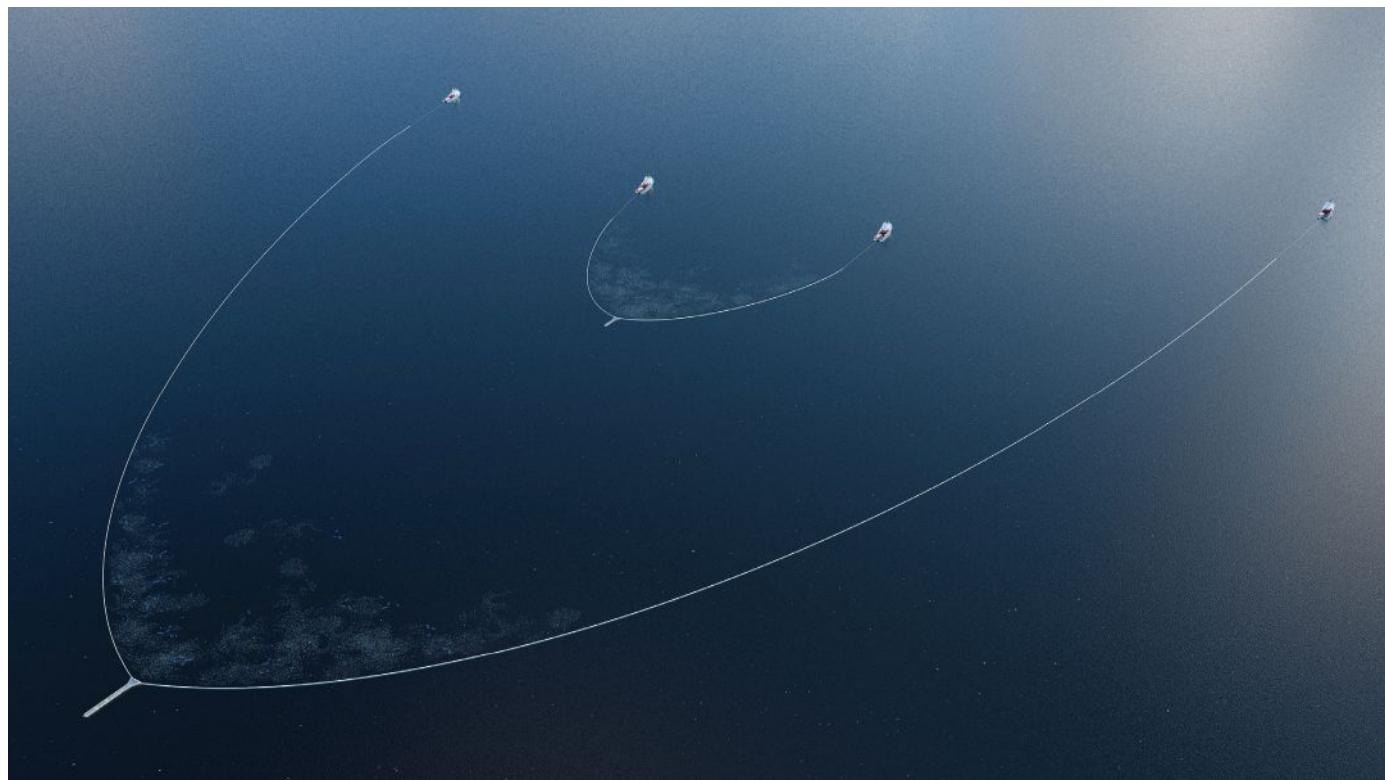
Nokia is focused on the role its products play in solving some of the world's most pressing challenges, using connectivity and digitalization to restore stalled productivity, provide inclusive access to opportunity and relieve pressure on the environment and natural ecosystems. According to UNESCO, plastic waste makes up 80% of all marine pollution and around 8 to 10 million metric tons of plastic end up in the ocean each year.

Nokia and MCS, Nokia's partner for Nokia Digital Automation Cloud (DAC) distribution in the Benelux, have already successfully deployed the first Nokia DAC private wireless solution for The Ocean Cleanup's operations in the North Pacific, and will deploy further systems at a later stage. Nokia DAC is a high-performance, end-to-end private wireless networking and edge computing platform. The Nokia connectivity, Nokia MX Industrial Edge (MXIE) and analytics will be used for applications such as high-end video connectivity over 4G technology, to help navigate The Ocean Cleanup's operations while harvesting plastic in the Great Pacific Garbage Patch.

5G, private wireless, edge compute, sensors, AI-based analytics, drones and other advanced technologies will play an increasingly critical role in supporting the conservation and sustainability of our natural environment by providing immediate up-to-date and constant information on the status of the environment, whether on land or in the sea. Working with The Ocean Cleanup provides the opportunity to explore that role further.

Subho Mukherjee, Head of Sustainability at Nokia, said: "Through our subsea optical fiber networks, innovations such as acoustic sensing technology, remote environmental monitoring, or private wireless, Nokia can—and will—continue to play an important role in the marine environment. We are proud to support and collaborate with The Ocean Cleanup, and look forward to see how our technology can genuinely drive sustainable change and help protect critical natural resources and habitats."

Stephan Litjens, Vice President of Enterprise Campus Edge Solutions at Nokia, added: "At Nokia we believe that there is no green without digital, and that we have our greatest positive impact on people's lives and the planet through our products and solutions. This project truly exemplifies that. Our Nokia DAC private wireless network and Nokia MXIE edge computing system will ensure reliable, cost-effective voice and data communication between the two ships involved in the clean-up operation. With secure coverage on open sea also enabling video and analytics, this solution improves worker safety and provides high visibility and scouting of target clean-up areas."



» System 03 is three times the size of System 002. (Image credit: The Ocean Cleanup)

OPENSEA EDGE DELIVERS UNTETHERED AUTONOMOUS OPERATION TO ROVs



Greensea Systems, the industry leader in marine robotic software solutions, recently demonstrated untethered autonomy for ROVs.

Using a commercially available Defender ROV from VideoRay, outfitted with batteries, acoustic modem, and the new OPENSEA Edge system, Greensea has successfully proven untethered operation of an ROV at sea.

OPENSEA Edge puts a tremendous amount of processing power at the edge, right on the robot, where it can work directly with sensors to process that data

onboard, eliminating the need for a topside computer via the tether. This dual, parallel NVIDIA edge platform runs Greensea's open architecture software, OPENSEA, and handles the sonar and video perception feeds while providing autonomy, navigation, communications, and task management for the robot.

Once the need to send constantly send all of the data to a topside computer was no longer necessary, data could reside on the vehicle, sending only the most crucial pieces of information for a human operator to supervise. Reducing the amount and frequency of data being transmitted means that a lower bandwidth/higher latency communication method, such as acoustic modems, could be used.

During recent operations conducted at sea, Greensea was able to demonstrate that a VideoRay Defender outfitted with OPENSEA Edge was able to search, classify, map, and inspect during a mock EOD

mission while being untethered. Operators supervised the autonomous ROV through Greensea's EOD Workspace user interface for defense applications.

Greensea also utilized their proven Safe C2 (standoff command and control) technology to provide seafloor to over-the-horizon communications. This enabled the supervision of the ROV over very low bandwidth and very high latency-sparse data connections by an operator using a tablet.



» VideoRay Defender (also top left) with OPENSEA Edge. (Image credit: VideoRay/Greensea)

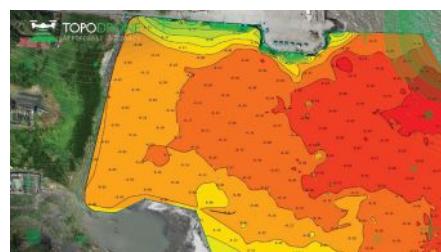
SURVEYING PARTNERSHIP BETWEEN TOPODRONE AND RASA AUGMENTS COASTAL MAPPING

TOPODRONE, a Swiss based designer and manufacturer of high-precision surveying equipment, and RASA Surveying, an integrated surveying company, have entered a technological partnership to advance airborne surveying approaches and accommodate coastal management and monitoring demands in the Philippines. RASA Surveying will adapt Swiss hardware and software for data collection and processing to overcome local operational limitations for coastal mapping.

RASA Surveying's new approach synchronizes current photogrammetry and LiDAR practices with the bathymetric data collection capabilities of TOPODRONE AQUAMAPPER. The join between orthophotos, above and below waterline point clouds and bathymetric data is expected to better support authorities to manage coastlines and enhance the resilience of coastal communities.



» Test flight of TOPODRONE AQUAMAPPER the Philippines. (Image credit: TOPODRONE)



» Coastal bathymetric data collected with TOPODRONE AQUAMAPPER in the Philippines. (Image credit: TOPODRONE)

"Coastal cities in the Philippines are vulnerable to the effects of climate change and climate-related disaster events. However, coastal areas are expensive and challenging to map using conventional technologies. UAV-based surveying of coastal environments allows quickly and accurately to collect shallow water data and details on the land-sea interface," said TOPODRONE CEO Maxim Baklykov.

"TOPODRONE AQUAMAPPER will provide RASA the much-needed efficiency in doing bathymetric survey. We will be able to conduct our bathymetric surveys with ease since the equipment involves only two people to operate. Furthermore, it can quickly cover a large survey area within a short span of time without sacrificing data accuracy," added RASA Surveying President Raymund Arnold S. Alberto.

KONGSBERG DIGITAL IMPROVES MARITIME NAVIGATION TRAINING WITH CLOUD-BASED SIMULATION

K-Sim Navigation CLOUD is based on Kongsberg's well-reputed simulation technology. (Image credit: Kongsberg Digital)

Kongsberg Digital continues to enhance simulation training by launching its new cloud-based navigation simulation solution. The solution is another advanced simulation technology that Kongsberg Digital offers as an online training application on their digital platform.

K-Sim Navigation CLOUD is based on Kongsberg's well-reputed simulation technology and was developed in the SkyNav project funded by Innovation Norway. It enables schools and training centers to provide high-quality simulation training in navigation and ship handling, including ECDIS and radar.

The solution is designed to provide basic navigation training in compliance with the DNV's Class D requirements. For training institutes with onsite simulators, K-Sim Navigation CLOUD is perfect for blended learning and an excellent supplement to classroom or full-mission simulator training. The training application can also be used as a stand-alone offer by other training providers that do not need to invest in hardware to provide their students with simulation exercises.

Thanks to an advanced physics engine and state-of-the-art hydrodynamic modelling, it provides students with highly realistic training using vessels, objects, and equipment that behave and interact as in real life. A sophisticated new visual system powered by Unreal Engine brings vessels, geographical areas, and all possible weather to life.



» K-Sim Navigation CLOUD is based on Kongsberg's well-reputed simulation technology. (Image credit: Kongsberg Digital)

Consolidating its position as a leading adopter of the new digital technology, The Maritime Academy of Asia and the Pacific (MAAP) started using Kongsberg Digital's K-Sim Connect platform in 2019 for cloud-based simulation training to complement classroom education, and they will be the first training center in the world to offer K-Sim Navigation CLOUD to their students.

SAFE BOATS INTERNATIONAL INTRODUCES 23-METER MONOHULL AUTONOMOUS SURVEY VESSEL

SAFE Boats International has announced the introduction of a revolutionary, autonomous hydrographic survey vessel: *Merlin*. This innovative, 23-meter semi-displacement monohull design was developed in collaboration with Mythos AI, Echo81, and World Marine Design.

Merlin will be a Jones Act-compliant all-aluminum hull powered by a twin Volvo Penta D13 Hybrid-ready System with IPS. For a zero-emission power package, the *Merlin* can accommodate forward-thinking hydrogen technology supplied by Zero Emission Industries (ZEI). Both power options offer lower emissions and extended

range to perform site assessment surveys at offshore wind energy areas.

Three deck levels offer crew and technicians sleeping berths, full bathroom, galley, survey workstation, and a marine mammal observer post on the flybridge. The generous aft working deck is equipped with an A-Frame, dual winches, moonpool, and outboard seismic booms. The hull was specifically designed to incorporate the industry's most advanced sonars with minimal interference while collecting data at a highly efficient pace. A Seakeeper gyro provides active ride control, greatly enhancing stability and crew comfort. A shallow draft of 1.6 m allows *Merlin* to perform various survey missions and make port in small or large harbors across the US.

Hydrographic systems provider, Echo81 will provide a single source for sensor service and support, drastically reducing the cost burdens associated with owning and operating survey vessels. Mythos AI's advanced driver assist systems (ADAS) will automate geophysical workflows so that skilled onboard hydrographers and crew are not required. As Mythos AI's technology advances, it will be capable of providing a push-button, long endurance, dock-to-dock, self-driving, and self-surveying solution for offshore wind.



» Merlin delivers autonomous hydrographic survey capabilities to the offshore wind market. (Image credit: SAFE Boats International)

ARMACH ROBOTICS ANNOUNCES LAUNCH OF EVERCLEAN

Armach Robotics, Inc. has reached another milestone in its mission to deliver a sustainable and scalable solution in managing biofouling for the global shipping industry. Following a successful period of demonstrating the effectiveness of its hull cleaning robots with commercial shipping operators, Armach has announced the launch of EverClean—a new service delivering always clean hulls for ship owners and operators, with the added value of perpetual hull condition monitoring.

Currently, the additional focus and pressure on ship operators to work more intensively towards decarbonizing and managing biofouling, has led to heightened demand for a cost-effective, and sustainable solution. EverClean enters the market at the right time to meet this need, with demonstrable success in maintaining a ship in an always clean state.

Managing biofouling on ships has long been a challenge, with associated problems, including vessel scheduling, maintenance, increased hull deterioration, and reduced efficiency, affecting commercial interests, as well as the environmental impacts, including higher emissions through drag, and the transportation of invasive species.

Thanks to its sophisticated navigation technology, the hull service robot navigates its way over the hull intelligently, and, similar to georeferencing, maps the hull condition to its appropriate on-hull location. This ensures the cleaning of each section of the hull without accidental repeat, giving EverClean its competitive advantage, and ship owners and operators a proven, cost-effective way to ensure a clean hull at all times, with the addition of an accurate hull condition survey after each clean.



» Hull Service Robot testing. (Image credit: Armach Robotics)



The top half of the slide features the Metron Defense Solutions logo, which includes the company name in large white letters and "Defense Solutions" in smaller white letters below it. To the left of the logo are several client logos: ONR (Office of Naval Research), NAVSEA (Naval Sea Systems Command), US Naval Research Laboratory, Department of Defense, NAVWAR, DARPA, AFRL, AFRL (Air Force Research Laboratory), GovCon WINNER 2023, and U.S. AIR FORCE. The background of this section is dark blue.

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The bottom half of the slide features the Metron Defense Solutions logo again, along with the tagline "YOUR MISSION. METRON TRUSTED SOLUTIONS." in yellow. The background of this section is dark blue with a wireframe mountain graphic at the bottom.

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YOUR MISSION. METRON TRUSTED SOLUTIONS.

SCHMIDT OCEAN INSTITUTE LAUNCHES NEW RESEARCH VESSEL



» The newly refitted R/V Falkor (too). (Image credit: Schmidt Ocean Institute)

Schmidt Ocean Institute launched its newly refitted 110-meter global-class research vessel, early March, for use by scientists worldwide to dramatically advance marine science and push the frontiers of deep-sea expedition.

Funded by Schmidt Ocean Institute founders Eric and Wendy Schmidt, the research ship, *Falkor* (too), will embark on a series of expeditions and be available to scientists and technologists globally at no cost in exchange for making their research and discoveries publicly available. The ship replaces Schmidt Ocean Institute's previous research vessel, which was in service for a decade and hosted more than 1,100 scientists, discovered over 50 new marine species and underwater formations and mapped over half a million square miles of the seafloor.

The ship's inaugural science expedition will explore one of the world's most extensive underwater mountain chains—the Mid-Atlantic Ridge. More than 20 scientists will study hydrothermal vents—hot springs on the ocean floor made by underwater volcanoes. The scientists will search for lost city vents—older hydrothermal towers made of limestone—that have a chemical makeup thought to be most similar to when life began on earth. The microbes living on these vents could provide insight into the conditions that facilitated life's origin.

An impressive seven-deck vessel, *Falkor* (too) will offer scientists a modular platform to conduct almost any research at sea, with a 105-square-meter main laboratory in addition to seven other at-sea laboratories. The ship also features a 150-ton crane, two moonpools, equipment



» (L – R) Dr. Jyotika Virmani (Executive Director of Schmidt Ocean Institute) and Wendy Schmidt (President and Co-Founder of Schmidt Ocean Institute).

for high-resolution ocean depth mapping—which will contribute to a global effort to map the entire ocean floor by 2030—a microplastic water flow-through system, and 900-square meters of aft deck space for interdisciplinary ocean research and exploration.

The ship refit was performed at Freire Shipyard in Vigo, Spain, with sea trials taking place off Puerto Rico. In addition to the scientific and technical capabilities, the vessel is also outfitted with 98 berths, allowing for even more participation in expeditions by scientists, technologists, students, media, artists, and community leaders.

» The ROV control room onboard. (Image credit: Schmidt Ocean Institute)



VERIPOS INTRODUCES APEX PRO CORRECTION SERVICES FOR PRECISE POINT POSITIONING

Veripos has launched the Apex PRO Correction Services with breakthrough RTK From the Sky technology. Hexagon's Autonomy & Positioning division's RTK From the Sky enables global, centimeter-level precise point positioning (PPP) accuracy in as fast as 3 minutes—without compromising on high reliability. Now, this technology comes to the offshore marine market through Apex PRO corrections to support safer operations and increased efficiency, resulting in higher productivity and minimized downtime.

With RTK From the Sky, Apex PRO becomes the world's first high-accuracy, quad-frequency and quad-constellation correction service for offshore positioning with RTK-level vertical and horizontal accuracy, 99.999% service uptime and near-instant reconvergence. With the ability to layer multiple Veripos solutions combined

with their 24/7/365 customer support and global coverage through L-Band and IP delivery, they provide a total solution for the most demanding offshore applications.

"Offshore positioning is a very challenging environment requiring the best positioning possible with built-in redundancy, resiliency and accuracy to maintain continuous and safe operations," said David Russell, Marine Segment Manager at Hexagon's Autonomy & Positioning division. "Apex PRO is the latest service to integrate RTK From the Sky technology, and we are excited for the continued safety of operations and reduced environmental impacts the service enables."

Apex PRO is compatible with existing Veripos hardware and software, including the LD8, LD900 and Quantum visualization software. The new PPP solution builds upon

Veripos' proven track record of delivering innovation in reliable and robust positioning solutions for the offshore marine market.



» Apex PRO offers higher accuracy and convergence for offshore applications. (Image credit: Veripos)

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AN EXCLUSIVE INTERVIEW WITH MARTAC SYSTEMS



Jack Rowley, USN (Ret.)
Chief Technology Officer

MARTAC
Beyond Human Capability



Ed Freeman
Managing Editor, ON&T

ON&T

MARTAC (Maritime Tactical Systems, Inc.) is a leading manufacturer of unmanned surface vehicles (USVs). ON&T recently sat down with LCDR U.H. (Jack) Rowley, USN (Ret.), MARTAC's Chief Technology Officer (CTO), at the company's Florida-based headquarters and production plant to get his take on this rapidly expanding market.

ON&T: For any readers not familiar with MARTAC, could you give us a brief overview of the company and how you came to work as its Chief Technology Officer?

JR: MARTAC was incorporated in 2012 with a singular focus: to challenge the technical boundaries associated with working in dangerous and often unpredictable marine environments by developing and delivering reliable and innovative uncrewed systems for military, security, commercial, and scientific applications. Initially, MARTAC concentrated efforts on developing a suite of rapidly deployable, fully integrated USVs before reaching a key company milestone

in 2018 with the commercial launch of the T-12 (12 ft) MANTAS™ USV, the success of which has gone on to inspire a broader, and larger, portfolio of high performing multi-mission USVs.

I joined MARTAC in 2016 having previously served 22 years in the US Navy where, among other duties, I managed the \$1.2 billion Landing Craft Air Cushion (LCAC) program before working for SAIC as an engineering technical director and the lead architect integrator for the DARPA ASW Continuous Trail Unmanned Vessel (ACTUV)—better known today as the *Sea Hunter* USV. My time working on

these unmanned systems afforded me a unique understanding of both underwater autonomous vessels (UAVs) and USVs, and how they can—whether working together or independently—bring real-world operational advantages to personnel in the field.

ON&T: Could you elaborate on some of the operational advantages associated with USV deployment?

JR: Our USV models are engineered with one common objective: to optimize Maritime Domain Awareness in the most cost-effective, safe, and accurate manner possible.

Whether USVs are used for tactical marine ops in contested waters or acquiring geospatial datasets for subsea infrastructure planning, the shared goal is to execute the mission efficiently, reliably, and without putting people in harm's way.

» A T-12 underway during a demo. (Image credit: MARTAC)





» T-12 production at MARTAC's manufacturing facility in Melbourne, FL. (Image credit: MARTAC)

Our job as a USV designer/manufacturer is to align what's needed with what's possible. In a rapidly evolving market, that means defining fit-for-purpose USV platforms that deliver at-sea competitive advantages to our customers in their respective markets.

ON&T: How has the shifting nature of these markets shaped MARTAC's current USV portfolio?

JR: In short, plenty. All MARTAC base models have been developed to bridge the broadening challenges of operating in maritime environments where manned—or other unmanned systems—may not suffice. But the breakneck speed at which USV technology is advancing, exemplified by the phenomenal diversification of COTS models in recent years, means that companies like MARTAC need to stay ahead of the development curve by actively partnering with clients seeking to incorporate uncrewed systems into their standard operating procedures. This also includes working closely with sensor and communication technology developers.

MARTAC's ongoing investment in the latest control systems and power sources (we build our own battery packs) has been equally instrumental. Early on, MARTAC mostly produced 3-, 6- and 8-foot USVs, mostly designed to support hydrographic survey campaigns. While operationally on point, once customers saw the USVs in action—true proof of concept, if you

like—they quickly began to demand more: more endurance, more speed, more payload capacity. The result was our all-electric T-12 MANTAS, the dimensions of which hit the desired balance of payload (up to 140 lbs. or 64 kg), speed (8–12 kts cruise, 20 kts burst speed), and endurance (cruising range 60 nm). With the base boat weighing just 380 lbs., MANTAS can also be easily launched from a ship, small craft, pier, or shore.

ON&T: How has MARTAC worked with the naval defense and security markets in recent years?

JR: The proven agility and versatility of MANTAS immediately sparked an interest

from the naval security and defense community and triggered the expansion of our USV portfolio. Today, alongside MANTAS, MARTAC offers a family of larger models: the 24-foot T-24, the 38-foot T-38, and the 50-foot T-50, all under our DEVIL RAY branding.

Again, striking the right balance of speed and operational capacity for specific tasks was paramount. The T-24 was conceived for streamlining harbor security and surveillance operations, whereas the T-38, with a top speed of 80 kts and a payload capacity of up to 2,050 kg, is designed for more expansive operations, including missions that require the launch and recovery of ancillary assets, such as other USVs, AUVs, remotely operated vehicles (ROVs), and unmanned aerial vehicles (UAVs).

Interest in our T-50, which is in the design phase right now, is indicative of how naval forces see the long-term integration of USVs for tactical gain. Larger USVs mean heavier payloads and bigger fuel tanks; that means increased utility and range on the water. There is no limit, in theory, to the scaling of size and function of a USV. But there are limits to naval budget, so USVs pose an interesting quandary for those allocating funds for future investments: what dollar percentage should be appropriated to the construction of traditional 500-crew vessels when there are safer, emission light, and ultimately more efficient solutions at hand? With a target production time of a T-38 down to approximately 6 months—as opposed to several years for a fully staffed US Navy

» The T-38 has a top speed of 80 kts and a 2,050 kg. payload capacity. (Image credit: MARTAC)





vessel—the lead time from concept to acceptance only strengthens the case for USV adoption.

ON&T: Tell us more about the operating procedures involved with MARTAC USVs?

JR: Just like the T-12, the T-24 and the T-38 are remarkably easy to control. Once a customer is trained to operate one MARTAC USV, the switch to another is relatively intuitive. This makes force multiplication—running multiple units at the same time under one control—a real gamechanger. The standard T-24 and T-38 come equipped with a launch and recovery bay specifically designed to support T-12 deployment.

There are three control modes: *Manual Control*, by which operators can pilot the USV using a standard joystick; *Semi-automatic Control*, by which the USV will navigate to a set of coordinates and execute assigned tasks within a programmed proximity, say 100 yards, of that waypoint; and *Full Autonomy*, whereby the USV will leave port and follow a full mission plan, carrying out multiple tasks at multiple waypoints, before safely returning to its recovery point.

At any point, the operator can take full navigational control and/or instruct the USV to reprioritize its sequencing (e.g., inspect something unexpected) or upload an entirely new set of directives (sent to the USV's mission control system). We recently piloted one of our USVs taking

part a naval exercise in Bahrain from our Florida location.

ON&T: How do you see the USV ecosystem developing in coming years?

JR: We can expect to see more diversification of the USV market, servicing two broad end-users in the near term: marine survey needs and defense and security requirements. Are there units that can cross over, like the T-12? Yes, but I see naval forces around the world as the key driver for USV advancement. Whether for logistics or ISR (Intelligence, Surveillance, and Reconnaissance) ops, navies will deepen their investment in versatile USVs capable of greater interoperability with less and less supervision. The last point is something of a red herring, though. Will AI fully remove the need for supervision? I am doubtful. We celebrate the capacity of so-called uncrewed operations, but there must be—for now, at least—manpower behind every deployment. So, we are really talking about reskilling and re-tasking technicians in the name of increasingly lean, green, and safe operations at sea. The strict degree of supervision will be determined by regulatory reform, but this shift in operator mindset is critical. This is an important and complementary aspect of the many unmanned naval exercises taking place around the globe.

How the sensor and camera industries progress will also determine the rate of USV acceptance. Camera technology developments significantly broaden the

» The T-24 and T38 have a launch and recovery bay specifically designed to support T-12 deployment. (Image credit: MARTAC)

applications for USVs like MARTAC'S (our USVs are sensor and camera agnostic), so we can see units like the T-24 and T-38 (which also has a moon pool option) as becoming suitable for a range of intervention activities, from marine mammal observation to countertrafficking measures to offshore oil spill detection and mitigation.

ON&T: Tell us more about these unmanned naval exercises you mentioned...

JR: These provide MARTAC, alongside other USV manufacturers, with the opportunities to fully demonstrate the latest USV developments to critical influencers and decision makers in the defense sector. In short, they allow us to connect our products with the right customers.

Last December, alongside 16 other developers, one of our T-38's took part in Task Force 59's Digital Horizon exercise, a three-week event profiling the latest unmanned and artificial intelligence naval technologies in Bahrain. We followed this up more recently, in March, with a full demo of both the T-12 and the T-38's as part of the International Maritime Exercise (IMX'23), with one T-38 in Bahrain and a second in Jordan. Having these events take place in regional hubs allows USV manufacturers to station the right vehicles. We have now demoed our platforms across the globe, but the unmanned exercises in the Middle East and out of San Diego, CA are central to our ongoing marketing plans.

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



» T-24 and T-38 in production. (Image credit: MARTAC)

ASHTead TECHNOLOGY LAUNCHES NEW DROP CAMERA SYSTEM FOR SUBSEA INSPECTION

Ashtead Technology has launched its new standard drop camera system, part of a range of systems designed for high-resolution seabed visual inspection, in water depths down to 4000 m.

The company's standard system is depth rated to 1,000 m, increasing to 4,000 m utilizing sonar coaxial cable. It has been fitted with a high-specification digital camera which streams uninterrupted real-time HD 720P video during the survey, and records 16.6MP digital stills and 4K video for download at the end of the survey for live interpretation.

Equipped with a digital video recorder, the topside system records real time HD video and incorporates Ashtead Technology's drop camera system control software. Lights, camera position and orientation can be adjusted within the frame, and light

intensity, which can produce 4 x 9,000 lumens, is controlled using the topside software for optimal imagery.

Ashtead Technology is also currently developing a range of advanced drop camera solutions for shallow and deepwater use to go with its established work class ROV deployed winched borehole drop camera.

Ross MacLeod, Integrated Projects Director, said: "The first commercially available DSL telemetry-based drop camera system was developed by members of the Ashtead Technology engineering team back in 2005, and since then we have continued to evolve the systems using more advanced telemetry technology, camera systems and oceanographic sensors to optimize the system's capability.

"Based on its specification, we believe this to be one of the most advanced drop camera systems in the market and we look forward to launching the full series throughout 2023 to support our customers' subsea visualization requirements."



» Real-time HD 720P video to 4,000 m. (Image credit: Ashtead Technology)



Ocean Sensor Systems

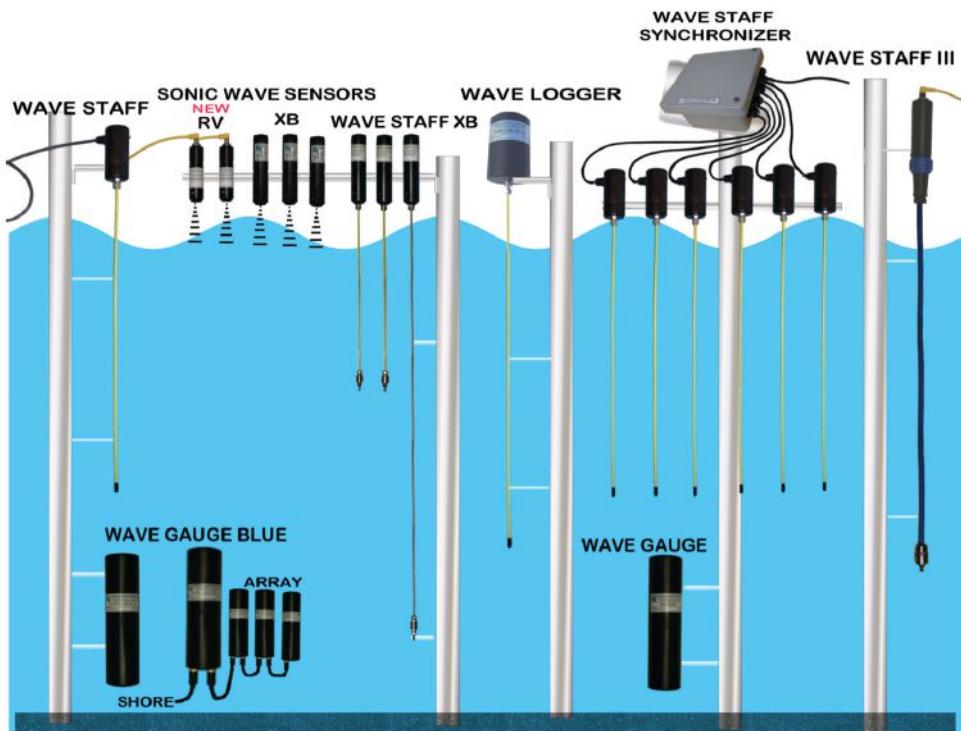
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DNV REPORT SHOWS DEMAND FOR OCEAN SPACE WILL GROW FIVE-FOLD BY 2050

The collaboration between ocean industries will need to intensify for the rapid buildout of offshore wind and aquaculture to coexist sustainably with other industries and the ecosystem.

According to DNV's Spatial Competition Forecast, the amount of ocean space occupied by installations will grow five-fold by 2050. This will be driven by offshore wind, which will account for 80% of stationary infrastructure at sea by midcentury, followed by aquaculture (13%), and oil and gas (5%).

Whilst ocean space is plentiful, industrial activity will be located primarily close to shore which will heighten the need for ocean coexistence. To enable stakeholders to gauge the demand for ocean space DNV has developed the Spatial Competition

Index. According to this index, the North Sea is the area in Europe which will see greatest competition due to the large number of shipping lanes and ports, as well as the strong presences of the fishing, aquaculture, oil and gas and wind industries. Installations for offshore energy and food production will cover 23% of the area between 2–50 km from shore in water depths less than 50 m.

Greater China's emergence as the powerhouse of the blue economy is reflected in offshore construction. It will account for a third of all global infrastructure built at sea by 2050, mainly due to the sharp increase in offshore wind, which will make up 13% of the region's electricity production. The Indian Subcontinent sees the strongest growth in area covered by stationary infrastructure,

as the region experiences fast offshore wind development requiring vast areas, whereas historically, offshore oil and gas and marine aquaculture are negligible in this region.

Globally, the area occupied by fixed offshore wind will grow from about 9,000 km² today to about 242,000 km² by mid-century. Floating offshore wind will grow from a low 15 km² today to more than 33,000 km² by 2050. Compared with bottom-grounded installations, floating offshore wind can potentially ease some of the tensions between offshore wind and fisheries, as it takes renewable energy production out of the way of the fishing fleet operating on shallow banks.

"The ocean is crucial for the production of sustainable food and energy, but at the same time we must tread carefully as many ocean ecosystems are already under huge stress," said Bente Pretlove, Ocean Space program director at DNV. "This report underscores the urgent need to balance protection, productivity, and social development objectives for a sustainable Blue Economy. Those developers that are most adept at early stakeholder engagement, spatial efficiency, flexible coexistence, and pursuit of sustainability are likely to be most competitive. Coexistence is essential for the sustainable growth of the Blue Economy."

DNV's Spatial Competition Forecast builds on the findings of the previously published *Ocean's Future to 2050*. The results are based on what DNV forecasts to be the most likely energy mix in 2050 and not what is required to reach net zero. To limit global warming to two degrees the amount of offshore wind in Europe, for example, would need to double.

FIGURE 3.13

Distribution of marine space on LMEs in North America in 2050

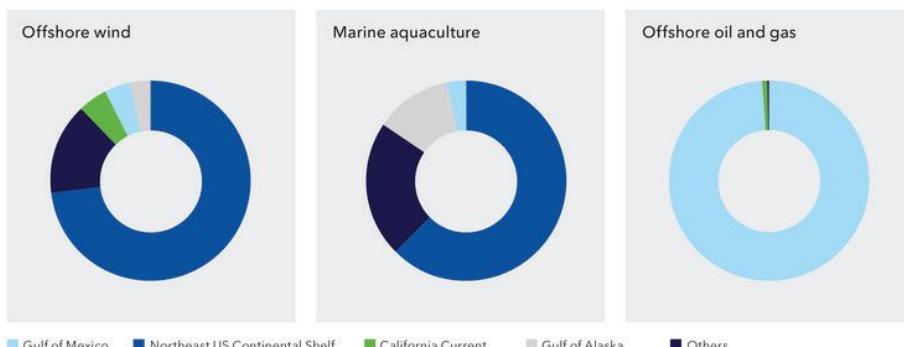
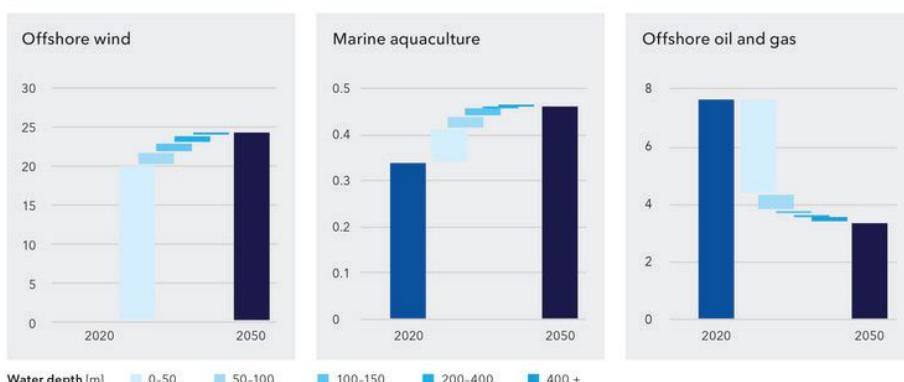


FIGURE 3.14

Changes in water depth distribution for ocean industries in North America from 2020 to 2050 [Units: 1,000 km²]

DNV

AKER BP BRINGS THE FROSK FIELD DEVELOPMENT ON STREAM IN THE NORTH SEA

Aker BP recently announced that the Frosk field development in the Alvheim area has been successfully completed and production has started on schedule and within budget, only 18 months after the Plan for Development and Operation (PDO) was submitted. Frosk is operated by Aker BP, with Vår Energi as partner.

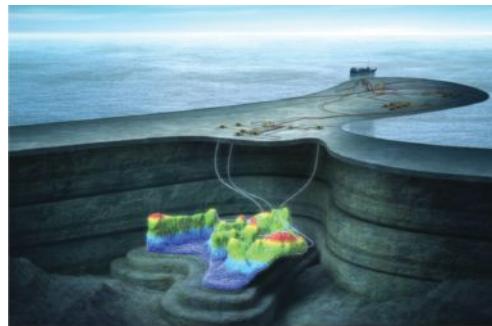
"The Frosk project has been delivered with high quality, on time and within budget by Aker BP's project team in close cooperation with our suppliers. This is a great example of what we can achieve with the alliance model, working as one team with our suppliers towards a common goal with shared incentives. Frosk is also an excellent illustration of how we can increase the value of our existing fields through higher production and lifetime extensions as well as reduced unit costs and emissions intensity," said Aker BP CEO Karl Johnny Hersvik.

The Frosk field is tied back to Alvheim FPSO in the North Sea via existing subsea infrastructure and utilizes existing capacity in the processing facilities with only a marginal increase in power consumption and CO₂ emissions.

The Alvheim area is among the most efficient assets on the Norwegian continental shelf, and the resource base has multiplied since start-up. This is the result of targeted exploration and reservoir development, technological innovation and not least the unique collaboration with key suppliers under Aker BP's alliance model.

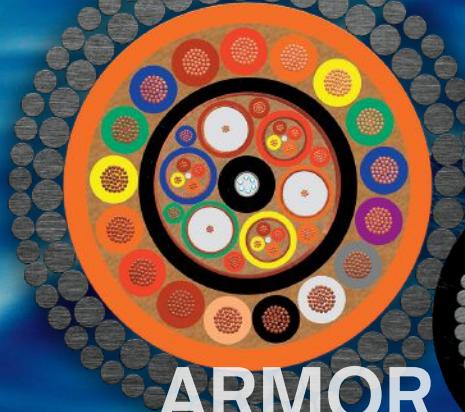
Through the alliance model, Alvheim benefits from continuity on rigs, vessels, facilities and personnel. This is a key success factor which allows for transfer of learnings and continuous improvement in methods and technology from one project to the next.

Frosk is the first of three new subsea tie-back projects to the Alvheim FPSO, with Kobra East & Gekko planned to come on stream early 2024 and Tyrving expected on stream in 2025.



» Recoverable reserves in Frosk are estimated at around 10 million barrels of oil equivalents (mmboe). (Image credit: Aker BP)

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 & ON&T Contributor*

CRUDE OIL:

Crude oil futures prices have been extremely volatile in recent weeks, largely due to the banking crisis originating in Silicon Valley but suddenly spreading to Europe. The bankruptcy of three technology-oriented banks in a matter of days forced emergency actions by banking regulators. Silvergate Bank, a cryptocurrency-focused bank in California closed, followed shortly by the seizure of Silicon Valley Bank, the nation's 16th largest commercial bank. It became the second-largest bank failure in history. Its takeover by the Federal Deposit Insurance Corporation was accompanied by the agency also closing Signature Bank, another cryptocurrency-focused bank in New York City. SVP was not a crypto bank, but rather a key lender and provider of banking services to technology startup companies and the venture capital funds that sponsor them.

SVB's failure was due to mismanagement by bank officials. Over 90 percent of its deposits were from startups and VC funds with balances exceeding the FDIC's \$250,000 insurance limit. In the two days before SVB's closure, it had deposit outflows of \$42 billion and \$100 billion, crippling the bank's liquidity. These bank closures kicked off a panic that the US banking system would have more failures. The root cause of the failures was the impact of the Federal Reserve's higher short-term interest rates used to fight inflation. Higher interest rates drive down the value of bonds, especially those with long maturities. Bonds, loans, and shareholder equity comprise a bank's capital. The bonds are the most liquid capital available to meet deposit withdrawals, but with a diminished value, selling them erases shareholder equity leading to bankruptcy.

US banking problems spread to European banks active in tech lending and potentially facing deposit withdrawals. Uncertainty about the fate of large international banks spurred a shotgun wedding of the two largest Swiss banks. The banking crisis spurred a tightening of credit standards and a shift away from risk-taking investing. Commodity trading is one of the riskiest



» Amid banking uncertainty, commodity market liquidity suddenly tightened, and a risk-averse mentality took hold.

venues and much of its capital depends on credit lines. Guess what? Commodity market liquidity suddenly tightened, and a risk-averse mentality gripped trader activity. Traders sold.

Financial speculators sold the equivalent of 142 million barrels in the six most important oil contracts in the week ending March 21, after selling 139 million barrels in the prior week. Total sales for the two weeks were the largest for any similar span since May 2017. Those fund managers slashed their combined position to just 289 million barrels on March 21—the 6th percentile for all weeks since 2013—down from 570 million barrels or the 46th percentile on March 7.

In contrast, oil demand continues to recover. Moreover, figures show the global oil industry is on track to construct the largest refinery capacity increase in 2023–24 since the 1980s. Four million additional barrels of crude oil will be needed to feed those refineries. The future for oil looks brighter than the near term, which should lift prices, just as happened in March's final week.

NATURAL GAS:

Weather continues to define the natural gas market. Winter is in its final days. The "shoulder" demand phase of the annual gas cycle is starting. Those familiar with March's "in like a lion, out like a lamb" expression may note that lions and lambs arrive and depart at different times in different regions of the country.

During the first four weeks of March, gas storage volumes, while continuing to be drawn down, declined until the middle of the month, before demand ticking up slightly. Up until mid-March, the 2023 weekly declines were smaller when compared to the declines for both 2022 and the 5-year average. In other words, March was experiencing the lamb in early March, but the lion then took over.

Going forward, gas demand for heating grows weaker every day. At the same time, gas production remained high. Gas production was up marginally over the prior week in the latest report. More significantly, compared to a year ago, gas production was 4.7 percent greater.

Liquefied natural gas exports are back to levels of year-ago before the Freeport LNG accident shut down the terminal for months. The good news for LNG is the approval of two new export terminals. Sempra will spend \$13 billion to construct a new terminal with an export capacity of 13 million tons annually that will start up in 2027. Phase Two of Venture Global's Plaquemines LNG will start exporting in 2025. Phase One will start in 2024. The two phases will export 20 million tons. As the leading LNG exporting country, these additional terminals will help keep the US in the lead and support gas demand for years.

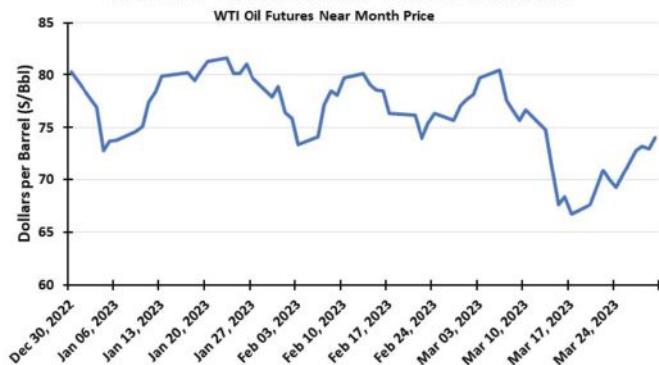
Weak winter heating demand, no additional LNG export capacity available, and sustained gas production have contributed to low gas prices. Year-over-year gas prices have fallen by 42 percent. The accompanying chart of weekly natural gas prices shows current prices below the long-term average low price that existed from 2015 to now. We plotted a new line showing the absolute low gas prices last seen in 2020 and 2016. Current gas prices are not yet down to that level, but it is possible events could send gas prices lower. For example, if another LNG terminal had an accident and was unable to export, the volumes of gas supplying that terminal would need to find a customer, likely at a lower price.

Stay tuned. Gas price volatility will continue until summer temperatures drive air conditioning use supplied by electricity generated from natural gas.

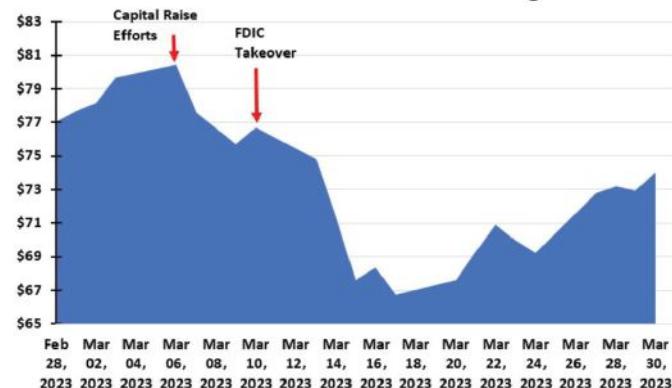
» LNG exports are back to levels before the Freeport LNG accident, but continued price volatility is likely through summer.



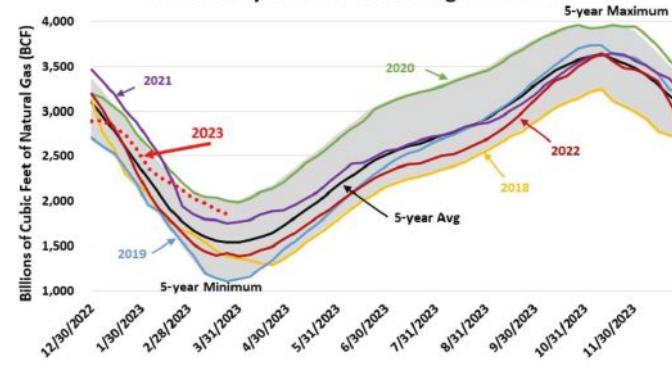
The 2023 Oil Price Roller Coaster Continues



March 2023 Oil Prices And SVB Saga

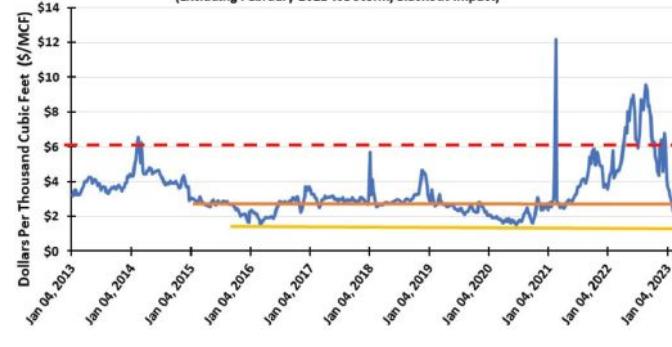


U.S. Weekly Natural Gas Storage Volumes



Weekly Natural Gas Prices

(Excluding February 2021 Ice Storm/Blackout Impact)



OFFSHORE OIL AND GAS SECTOR SET FOR HIGHEST GROWTH IN A DECADE

The offshore oil and gas (O&G) sector is set for the highest growth in a decade in the next two years, with \$214 billion of new project investments lined up. Rystad Energy research shows that annual greenfield capital expenditure (capex) broke the \$100 billion threshold in 2022 and will break it again in 2023—the first breach for two straight years since 2012 and 2013.

As global fossil fuel demand remains strong and countries look for carbon-friendly production sources, offshore is back in the spotlight. Offshore activity is expected to account for 68% of all sanctioned conventional hydrocarbons in 2023 and 2024, up from 40% between 2015–2018. Comparisons against this period are prudent as it predates the COVID-19 pandemic and related oil price crash. In terms of total project count, offshore developments will make up almost half of all sanctioned projects in the next two years, up from just 29% from 2015–2018.

These new investments will be a boon for the offshore services market, with supply chain spending to grow 16% in 2023 and 2024, a decade-high year-on-year increase of \$21 billion. Offshore rigs, vessels, subsea and floating production storage and offloading (FPSO) activity are all set to flourish.

One of the leading global drivers is the sizable expansion of offshore activities in the Middle East. For the first time, offshore upstream spending in the region will surpass all others, lifted by mammoth projects in Saudi Arabia, Qatar and the UAE. The area's offshore spending growth looks set to continue at least for the

next three years, growing from \$33 billion this year to \$41 billion in 2025. These countries are tapping into their vast offshore resources to meet rising global oil demand, backed by the necessary capital and infrastructure to outpace other producers.

"Offshore oil and gas production isn't going anywhere, and the sector matters now possibly more than ever. As one of the lower carbon-intensive methods of extracting hydrocarbons, offshore operators and service companies should expect a windfall in

the coming years as global superpowers try to reduce their carbon footprint while advancing the energy transition" said Rystad Energy's Head of Supply Chain Research, Audun Martinsen.

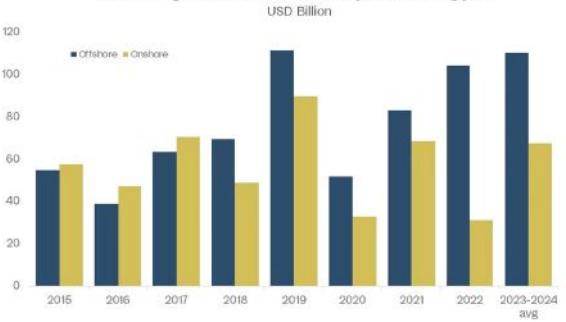
Although the Middle East is leading the way, South America, the UK and Brazil are just slightly behind. Investments in the North Sea from the UK and Norway will rise in the next two years. UK offshore spending is set to jump 30% this year to \$7 billion, while Norwegian investments will hit \$21.4 billion, an increase of 22% over 2022.

Brazilian upstream spending is projected to approach \$23 billion this year, with Guyana investments totaling \$7 billion. In North America, spending on offshore in the US will top \$17.5 billion and \$7.3 billion in Mexico.

Brazil state giant Petrobras plans to deploy 16 FPSOs across six fields before the end of this decade, while growth in the Guyanese Stabroek Block will also contribute to regional expansion. In long-term forecasts, Middle Eastern growth is set to continue, if not accelerate, while South American spending will slow in 2025.

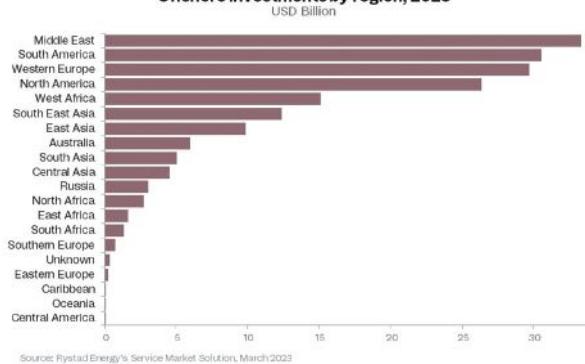


Offshore greenfield investment by sanctioning year



Source: Rystad Energy's Service Market Solution, March 2023
A Rystad Energy graphic

Offshore investments by region, 2023



Source: Rystad Energy's Service Market Solution, March 2023
A Rystad Energy graphic

EQUINOR MAKES SECOND OIL AND GAS DISCOVERY NEAR TROLL IN THE NORTH SEA

Equinor has again struck oil and gas near the Troll field in the North Sea. This is Equinor's eighth discovery in the area since 2019.

The volumes are estimated at between 24 and 84 million barrels of oil equivalent, with slightly more oil than gas. Named Heisenberg, the discovery well was drilled by the Deepsea Stavanger drilling rig. Equinor is the operator, and DNO is a partner.

The discovery is considered commercially interesting, partly because it can utilize existing infrastructure connected to the Troll B platform. However, an appraisal well is needed to get a more precise estimate of the size before it can be concluded whether the volumes can be recovered. The parties are considering drilling the appraisal well in 2024.

"Our Troll exploration play keeps delivering. With discoveries in eight out of nine



» Troll B's helicopter deck. (Image credit: Harald Pettersen/Equinor ASA)

exploration wells, we are approaching a success rate of 90%. We plan to further explore the area, while looking at possible development solutions for the discoveries that have been made. We have a good infrastructure in the area and can quickly

bring competitive barrels from here to the market at low cost and with low CO₂ emissions," said Equinor's Senior VP for Exploration and Production West, Geir Sørteit.

XODUS AND DAYMARK SIGN NORTH AMERICA OFFSHORE WIND MOU

Global energy consultancy Xodus has signed a Memorandum of Understanding with Daymark Energy Advisors to collaborate on advancing the development and deployment of projects in the rapidly growing North American offshore wind industry.

The partnership is the first of its kind for the offshore wind consultancy market in North America. Daymark brings deep knowledge and an integrated view of onshore energy infrastructure,

regulation, and markets while Xodus is a global leader in technocommercial offshore wind development.

Under the terms of the agreement, Xodus and Daymark will leverage expertise to drive innovation and accelerate the transition to a more sustainable energy future. The companies will also collaborate to efficiently answer key questions from developers and state agencies as activity ramps up.

In combining strengths and expertise, the 'surf-and-turf' offering will carve out a leadership presence in the offshore wind consulting market by providing an end-to-end understanding of the delivery of electricity from an offshore wind turbine through to the ratepayer.

Stephen Swindell, Managing Director at Xodus, said: "We have a long track record of activities in the global offshore wind, oil and gas, cables, and interconnectors sectors. Both parties bring different—but complementary—knowledge and skillsets to the energy market and infrastructure project consultancy."

Marc D. Montalvo, President & CEO of Daymark, added: "This is an exciting opportunity to combine our expertise—on land and at sea—to offer clients more complete solutions to the challenges they face and the questions they have about this growing industry."



CHECK THE TECH

AUTONOMOUS SURVEILLANCE OPS WITH USVs

When it comes to optimizing maritime surveillance in offshore—and often contested—waters, uncrewed surface vehicles, or USVs, present the ideal package for safe, cost-effective, and scalable remote operations.

The pace of USV advancement is primarily being driven by major defense, offshore energy, and science-focused entities, all seeking to establish new and validated in-field procedures that place humans 'on' the loop, as opposed to in it.

USVs are proving instrumental, with marine technologists in constant pursuit of the optimal balance—the marine engineering sweet spot—between operational utility and mission endurance.

USV DEVELOPER FROM DOWN UNDER

Australian outfit Ocius (Latin for "fleet"), headquartered in Sydney, is one such USV developer leading the charge. Following a rebrand in 2014, Ocius (formerly Solar Sailor) made the strategic pivot into USV R&D, and the team began working on uncrewed solar-, wind-, and wave-powered vessels, which resulted in a Capability Technology Demonstrator (CTD) award from the Defence Science and Technology Group in 2015.

This helped fuse a long-standing partnership with Thales, which kicked off with the creation of a 5.6 m prototype USV, AKA *Bruce*, for ASW ops in 2017.

» Bluebottle USVs deploy solar sails to capture solar and wind power. (Image credit: Ocius)

Additional innovation contracts followed, including a \$5.5M contract in 2020 to build five next-gen Bluebottle USVs and operate them in Australia's remote North. This exceeded expectations and now Ocius is under an acquisition contract with Navy for a further five by June 2023, the first 3 having been delivered.

POWER, PAYLOAD, PERFORMANCE

Bluebottles have proven that they can operate in sea state 5, launchable from a conventional boat ramp or deck crane, and—most notably—are powered by solar, wind, and wave energy.

Harnessing energy from the surrounding environment hinges on the USV's patented solar sail that, when deployed, can capitalize on solar and wind sources and when not required folds into the deck like the wing of a bird. Its custom rudder-flippers, which steer, guide, and generate forward thrust from the pitching of the vessel in the ocean waves.

Multiple sensor suites are available (integrated into the hull or supported by the comms mast) and are supported by a networked communication system to enable live event tracking.

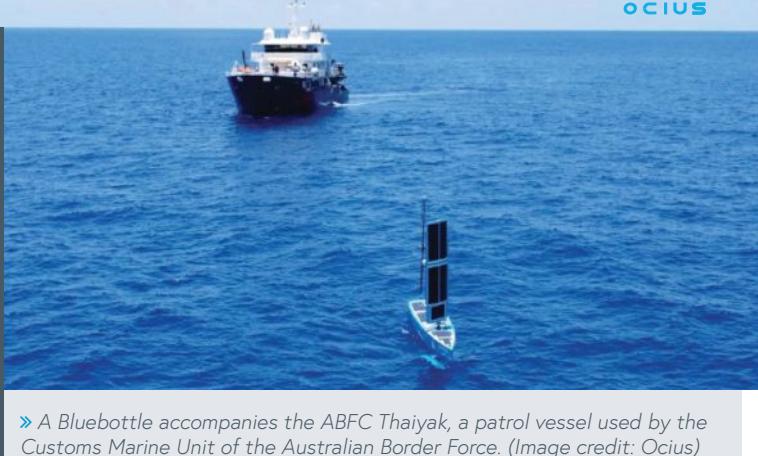
SCALING THE FUTURE

Over the last 15 months, Ocius USVs have completed 25,000 NM—unescorted—in Australia's EEZ, with full approval by the Australian Maritime Safety Authority (AMSA).

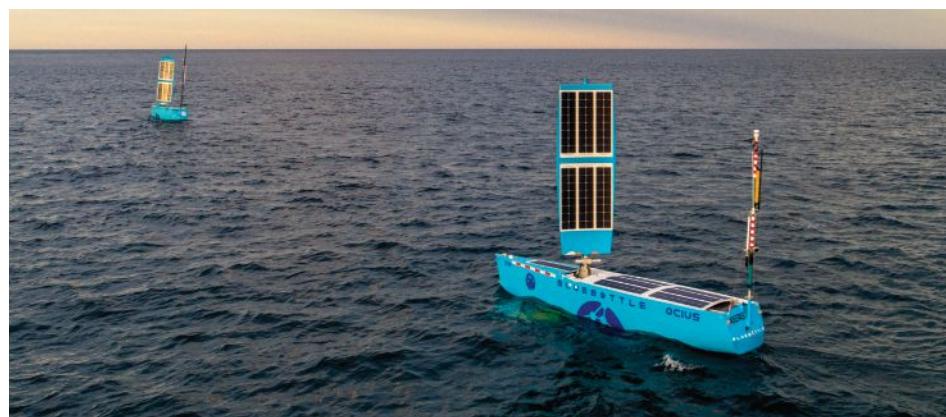
Right now, Ocius is continuing to work with Thales, testing new thin line arrays deployed to significant and varying depths from the Bluebottle 'reel in the keel' winch.

Ocius is also under contract with Trusted Autonomous Systems Defence CRC, UNSW, Australian Maritime College, and Australian Border Force on various USV-related projects, with details to be released in due course.

Speaking exclusively to ON&T, Ocius CEO Robert Dane, said: "This is a very busy and rewarding time in Ocius' journey to build and field superior, 100% Australian-made USVs capable of stripping away the logistical challenges—and of course costs—associated with relying on fossil fuels as a power source. At Ocius, we like to think we've advanced uncrewed marine technology to handle some of the toughest at-sea conditions and currents in the world, culminating in a fleet of lean, green, and mean USVs for all sorts of dull, deep, and dangerous operations."



» A Bluebottle accompanies the ABFC Thaiyak, a patrol vessel used by the Customs Marine Unit of the Australian Border Force. (Image credit: Ocius)



LHYFE AND CENTRICA TO DEVELOP OFFSHORE RENEWABLE GREEN HYDROGEN



Lhyfe and Centrica have agreed to jointly develop offshore renewable green hydrogen in the UK in a first for the country. The companies have signed a memorandum of understanding (MoU) that could accelerate green hydrogen as part of the energy transition in the UK.

Under the agreement, Lhyfe and Centrica will explore combining their expertise to collaborate on a pilot green hydrogen production site in the Southern North Sea.

The pilot will aim to combine Lhyfe's expertise on green hydrogen production and Centrica's experience of gas storage and infrastructure to ensure that the hydrogen produced can be safely stored and utilized in the UK. The end result would be proof that an end-to-end hydrogen production, storage, and distribution system is possible in the country.

The energy firms will also examine an additional partnership to deploy the technology at commercial scale alongside offshore wind electricity production.

Renewable green hydrogen coupled with offshore wind power is expected to play an increasingly important role in the UK's energy mix, particularly with rapid expansion expected in both of these areas over the next 5–10 years.

"We are pleased to announce this agreement with Centrica, which represents an exciting opportunity to drive forward the clean energy transition through large-scale offshore green hydrogen production, said Lhyfe's UK and

Ireland Country Manager Colin Brown. "Offshore electrolysis coupled with hydrogen storage will maximize the huge potential of offshore wind around the UK. The UK can become a global leader in the production of renewable green hydrogen, moving away from our reliance on fossil fuels and improving our homegrown energy security, while delivering net zero and boosting local economies."

Martin Scargill, Managing Director of Centrica Storage, added: "We are delighted to be working with our partners Lhyfe on another exciting and world-leading Hydrogen project.

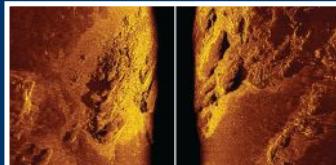
"Hydrogen is going to play a key role in decarbonizing the UK's power supply by 2035 and our long-term ambition is for Rough, our gas storage site, to be the world's largest hydrogen store, offering up to 16 TWh of storage capacity. This pilot will show how green hydrogen can be produced, moved and stored in the UK market; all while supporting the UK on its net zero journey."

The UK Government has doubled its low-carbon hydrogen production target from 5 GW to 10 GW by 2030, with at least half of this coming from green hydrogen. Hydrogen production is expected to initially support decarbonization of industrial clusters, like the Humber cluster with further use cases developing with a growing hydrogen economy.

A recent report by the Climate Change Committee confirmed the essential role of hydrogen production, storage and use in achieving the goal of a net zero electricity system in the UK by 2035.

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ENI COMPLETES INSTALLATION OF SEA WAVE ENERGY CONVERTER OFFSHORE ITALY

Eni announces that it has completed the installation of the world's first ISWEC (Inertial Sea Wave Energy Converter) device connected to the electricity grid of an island. It is located about 800 meters off the coast of the island of Pantelleria and can reach 260 kilowatts of peak power generation converted from wave energy. This experimental campaign, conducted under real operating conditions, will lead to useful results for developing the second-generation device currently under study.

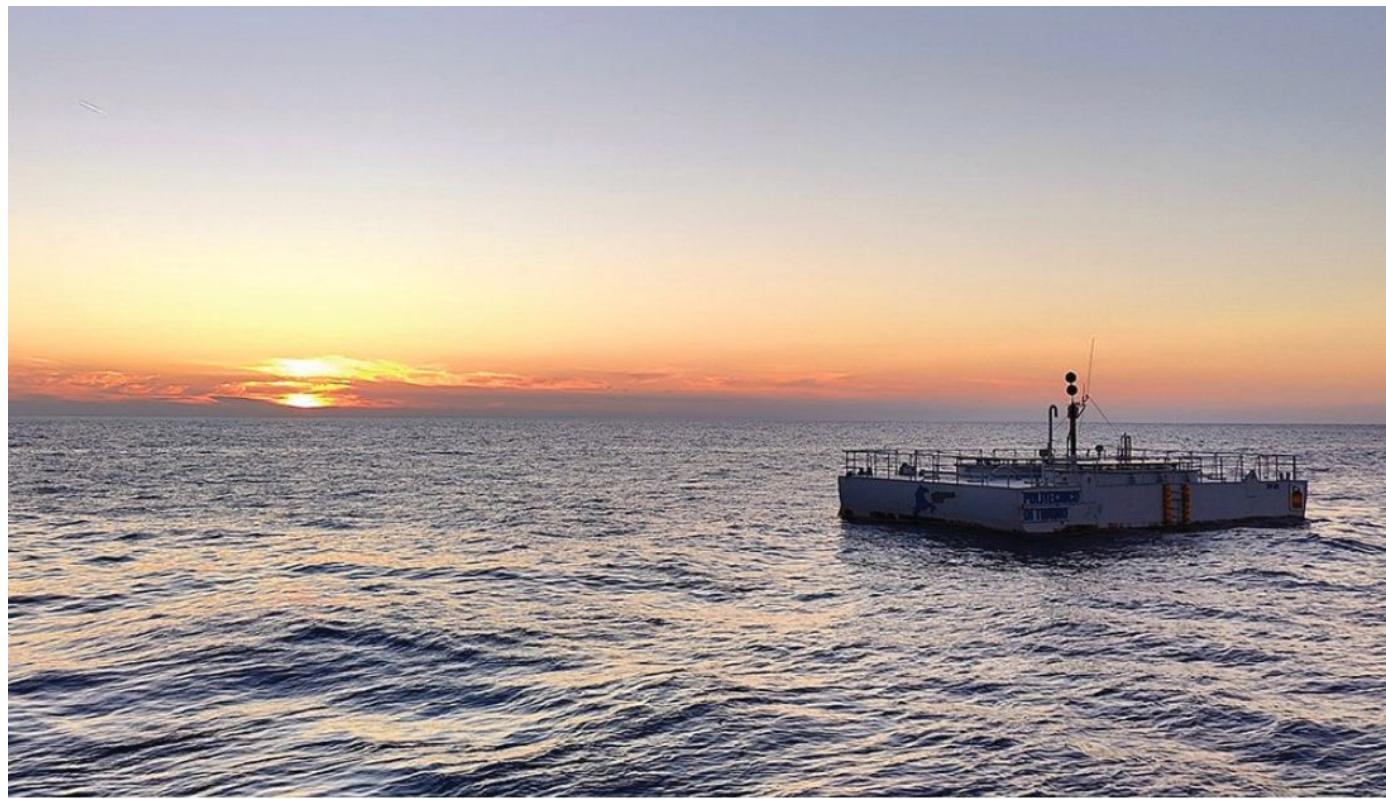
ISWEC was developed by Eni in collaboration with the Politecnico di Torino and Wave for Energy s.r.l. (a spinoff of the university). It is an innovative technology in the field of offshore renewable energy solutions, converting wave motion into electricity which then supplies energy to offshore infrastructure, small off-grid islands and coastal communities. ISWEC design can be optimized with reference to the metocean conditions of the site where it is installed by means of a genetic algorithm that leverages on the significant computing power of Eni's Green Data Centre (GDC) based in Ferrera Erbognone.

The machine consists of a steel hull measuring 8 x 15 m which houses the energy conversion system, consisting of two gyroscopic units, each more than 2 m in diameter. The device is held in place in a 35 m deep seabed by a special mooring system that responds to weather and sea conditions, consisting of three mooring lines and a swivel (a rotating joint). The electricity produced is transmitted ashore via an underwater electric cable.

Wave power is one of the main types of renewable energy and is currently untapped. Suffice it to consider that 70% of the Earth's surface is covered by water (97% of which is made up of seas and oceans). The power that could be generated from sea waves is estimated at around 2 terawatts globally, for a total of 18,000 terawatt-hours a year, almost the same as the entire planet's demand for electricity.

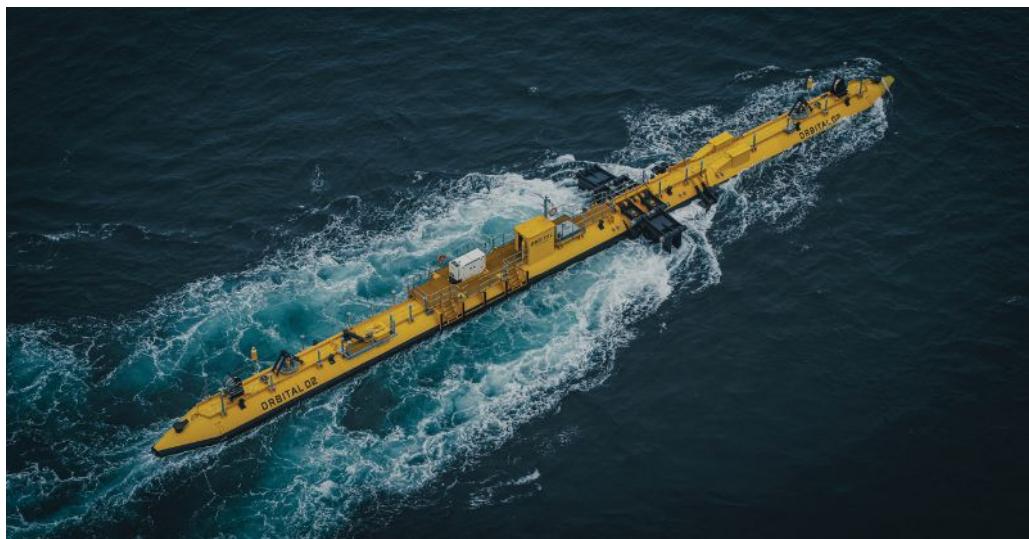
Energy from sea waves is also more predictable, constant and of higher energy density than that of the sun and wind, as it is available both during the day and at night. A further advantage of this technology is the considerable reduction of its impact on the landscape, since the device stands only 1 m above sea water. Moreover, ISWEC can be integrated perfectly with other offshore renewable energy production systems, such as wind power generators, both because it enhances the value of connection systems and because it can be integrated with other facilities in the same sea area, thereby maximizing the conversion of available energy.

The ISWEC technology is part of Eni's decarbonization plan and was mentioned by the EU Commission in its strategy on offshore renewable energy as a key example of sea wave energy conversion. The installation of the ISWEC in Pantelleria is the first step towards the decarbonization of the island, in line with the energy transition agenda.



» ISWEC consists of a steel hull measuring 8 x 15 m which houses the energy conversion system. (Image credit: Eni)

ORBITAL MARINE POWER UNVEils NEW 30 MW TIDAL ENERGY PROJECT IN SCOTLAND



» The 30 MW project would equate to the installation of 12 Orbital devices across the site. (Image credit: Orbital)

Orbital Marine Power (Orbital), the renewable energy company focused on the commercial deployment of its innovative floating tidal turbine technology, has announced that it has been awarded an Option Agreement from Crown Estate Scotland for a new tidal energy project in the Westray Firth.

Orkney-headquartered Orbital also confirmed it has a grid connection in place to service the pioneering project, which is located adjacent to the European Marine Energy Centre (EMEC) facility, where Orbital has already deployed the 2 MW O2, the world's most powerful tidal turbine, under commercial operation. Renewable projects in Orkney were recently given a boost by Ofgem announcing it is minded to approve a new 220 MW transmission connection, to be built from the Scottish mainland to service renewable power exports from the islands.

Following the award of contracts for difference (CfDs) in last year's AR4 process, Orbital is already targeting the

installation of three more of its tidal turbines at the EMEC site, alongside the O2, to expand its tidal generation capacity in the coming years.

In keeping with the company's strategy of carrying out major aspects of its manufacturing within the UK, the construction of the Westray project would be expected to result in over £120 million of domestic supply chain spend and create hundreds of jobs across construction and around a dozen new permanent jobs locally to provide operations and maintenance services.

The Option Agreement is for 30 MW, which would equate to approximately 12 Orbital devices installed across the site. The waters around Orkney have significant wider tidal stream energy potential and the Westray site offers just one example of how this can be harnessed to provide clean, predictable power.

The Orbital team is engaged with stakeholders and is progressing environmental

studies, with a view to reaching consent application as soon as possible. The company

also brings the benefit of extensive local operational and environmental data to help shape and inform optimal project design, having successfully installed, operated and monitored multiple floating tidal projects on the neighboring EMEC site since 2011.

Andrew Scott, CEO at Orbital Marine Power, said: "As the UK looks to accelerate the decarbonization of its energy system, we firmly believe tidal projects can bring unique benefits while harnessing a perfectly predictable and secure source of renewable energy. We're proud to be building that vision in Orkney with this investment in our Westray Project."

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FUGRO AND OCEAN INFINITY TO CONDUCT SURVEYS FOR OSSIAN OFFSHORE FLOATING WIND FARM



» Fugro's geotechnical drilling vessel, the *Fugro Scout* (left) and Ocean Infinity's multi-purpose support vessel, *Stril Explorer* (right). (Image credits: Fugro/Ocean Infinity)

The consortium behind Ossian floating offshore wind farm has awarded the contract for geotechnical investigations to two contractors: Fugro and Ocean Infinity.

The Ossian project is being delivered by a partnership of Scottish renewable energy developer SSE Renewables, Japanese conglomerate Marubeni Corporation and Danish fund management company Copenhagen Infrastructure Partners (CIP).

Set to be located across 858 sq km of seabed in waters off the east coast of Scotland, the project could power up to six million homes and offset up to 7.5 million tonnes of carbon dioxide emissions each year.

Fugro will focus on downhole geotechnical sampling and in situ cone penetration testing, while Ocean Infinity will focus on the seabed scope which will include shallow vibro-cores and deep push seabed cone penetration tests.

"This is a major step forward in the exploratory work needed to make the Ossian Wind Farm a reality. After a competitive tendering process, it was clear that Fugro and Ocean Infinity have the skills, equipment, knowledge and expertise to embark on a survey of this scale. The Ossian team look forward to working with both companies and to realizing the geotechnical investigation results which will be integral to the progression of what would be a world-leading floating wind project," said John Davidson of SSE Renewables, Offshore Geotechnical Technical Authority.

Fugro plans to use its purpose-built geotechnical drilling vessel, the *Fugro Scout*. The ship is equipped with ultra-deepwater drilling technology and state-of-the-art onboard systems which enable the vessel to safely carry out complex marine geotechnical operations.

Meanwhile, Ocean Infinity plans to use its vessel, *Stril Explorer*, which is a multi-purpose support vessel with state-of-the-art seabed geotechnical equipment onboard.



"We are excited to support project partners, SSE Renewables, Marubeni Corporation and Copenhagen Infrastructure Partners with the development of the Ossian wind farm. Our global expertise, resources and technical capabilities will be used to provide superior Geo-data on the soil conditions below the seafloor to help inform future designs and add value to the project," said Marscha De Bruijn, Project Manager for Fugro.

"We are thrilled to have been chosen by the project partners to support the Ossian wind farm development. We are committed to contributing to a more sustainable future and as such are very proud that our geotechnical services will play a significant role in the work needed to make this new floating wind farm a reality," said Nils Ingvarson, Chief Commercial Officer for Ocean Infinity.

Ocean Infinity expects to have completed its survey work by the end of May while Fugro expects its downhole scope survey to be completed at the start of July. The surveys will significantly improve the seabed understanding across the project site by ground-truthing the already acquired geophysical information. This will subsequently enable design development activities to progress such as anchor in-place and installation design.



» Geotechnical drilling vessel, the *Fugro Scout*. (Image credit: Fugro)

SEAVIEW ROV VPSU POWERS UP FALCON AND OTHERS

The SVS-708 SuperSea Power Supply and SVS-709 SubSea VPSU bring smart power management capabilities that extend the available power and umbilical power transmission capabilities for Inspection Class ROVs such as the Saab Seaeye Falcon, Observation Class vehicles such as Blue Robotics' BlueROV2 and many others.

The SVS-709 SubSea has been designed from the ground up to exploit the latest in high power solid state electronic components that enable rapid response to the dynamic current draw of challenging ROV operations. This allows operation over a much broader

voltage range with greatly improved reliability.

Long distance tunnel inspections can be particularly hard on ROVs. The load on the thrusters and circuit boards caused by the high duty cycle of thrusters running at full capacity for extended periods can result in system failure. Excess loading when the ROV is 5 km inside a tunnel can be extremely risky for both the vehicle and the client.

"One manageable failure can quickly escalate into something much more serious," said SeaView's Geoff Cook. "The capability to actively monitor



» The SVS-708 SuperSea Power Supply. (Image credit: SeaView)

not only the surface power supply—but real-time feedback from the subsea vehicle power supply unit is a potential lifesaver and great for peace of mind. Input voltage, internal temperature, and tether losses confirm that I'm running the ROV efficiently and enable me to mitigate problems before they occur."

The capability of the system to condition input voltage as needed enables painless swapping between umbilicals as short as 50 meters to as long as 5km without having to calculate and correct voltage compensation gain settings as required in conventional power supply systems.



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UTEC LAUNCHES VIRTUAL COLLABORATIVE ASSET MANAGEMENT TOOL

UTEC, a geoservices brand in Acteon's Data and Robotics division, has launched iSite Subsea, a game-changing, cloud-based platform giving users an intuitive 360° visualization of subsea assets and data. It is developed from UTEC's market-leading iSite collaborative virtual asset and data management platform and is specifically designed to meet the needs of the offshore renewable energy market, and oil and gas subsea asset owners.

Through iSite Subsea, users can source, view, manage, and report on seabed, survey and asset data using a single secure cloud-based interface, enabling interrogation and comparison of data over time, remotely, 24/7 and without specialist software knowledge.

Ultimately, this helps to reduce costs, lower risk, enhance health and safety, and deliver better informed decisions.

The new platform facilitates the digital delivery, throughout the lifecycle of a subsea asset, of geophysical, geotechnical, structural integrity monitoring, inspection, and maintenance surveys, giving developers and contractors access to the data they need to plan, evaluate, execute, and solve safety, environmental and risk scenarios.

The streamlined end-to-end service delivery, including data input, storage, and visualization, ensures that the latest data sets are always available to all users and eliminates the risk of double handling, incomplete data entries, multiple versions, and lost data/information.

For asset owners looking to consolidate key geo-referenced survey and inspection information, iSite Subsea is ideal because



» iSite Subsea enables users to source, view, manage, and report on seabed, survey, and asset data using a single secure cloud-based interface. (Image credit: UTEC)

it can interface seamlessly with existing databases, resulting in additional long-term cost savings.

"Energy customers have been using iSite to drive safety and efficiency, reducing costs on their above-water assets for more than 10 years," said Paul Smith, Managing Director, UTEC.

"We are now bringing the advantages of our product to the subsea market as a dedicated tool. iSite Subsea development has been driven by our customers' needs. It is designed to help them reduce the time and costs associated with multiple visits, lower risk, and achieve significant health and safety improvements through smart data management and interrogation tools that inform decisions."

DOF SUBSEA INKS \$35 MILLION IN CONTRACTS OFFSHORE BRAZIL



» Skandi Achiever. (Image credit: DOF Subsea)

DOF Subsea has announced that Petrobras has exercised an option for the diving support vessel *Skandi Achiever*, including ROV and diving services. The new commitment will now run until February 2024 and has commenced in direct continuation with the current commitment.

In addition, to the newly announced contract on the RSV vessel *Geoholm*, DOF has just signed another contract to perform survey services for the same period.

The contracts have a combined value in excess of \$35 million for the firm period.

DOF Subsea CEO, Mons S. Aase, stated: "I am very happy with the contract awards securing utilization of our personnel in Brazil and one of our key assets in the Group, *Skandi Achiever*. The contract award also confirms our strong position and track record in Brazil and strengthens our long relationship with Petrobras."

MCDERMOTT AWARDED FEED CONTRACT FROM SHELL TRINIDAD & TOBAGO

McDermott has been awarded a front-end engineering design (FEED) contract from Shell Trinidad and Tobago Limited for the Manatee gas development project as part of a competitive FEED process. Under the contract scope, McDermott will provide comprehensive FEED services for a wellhead platform, export pipeline system, shore approach, midstream pipeline and onshore control room.

This award follows the successful completion of an early contract engagement with Shell and leverages McDermott's key

engineering, procurement, construction and installation capabilities.

"The award of this next phase of the Manatee project builds on the portfolio of projects that McDermott's Subsea and Floating Facilities business line is executing for Shell," said Mahesh Swaminathan, McDermott's Senior Vice President, Subsea and Floating Facilities. "McDermott's comprehensive engineering design expertise and unique fabrication capabilities equip us to perform the required FEED work in-house, reduce

costs, ensure quality and maximize time efficiencies."

The Manatee field is located offshore Trinidad and Tobago in water depths of approximately 91 meters (299 feet). The field represents one of the country's largest natural gas reserves discovered to date and will help bolster the country's gas supply.

Engineering and execution planning efforts will be led by McDermott's team in Houston with support from Kuala Lumpur, Malaysia; Chennai, India; and Altamira, Mexico.



MERMAID SUBSEA UK RECEIVES MAJOR MULTI-WELL CONTRACT AWARD

Just months after the completion of its inaugural vessel-based well plugging and abandonment (P&A) campaign, Mermaid Subsea Services UK has announced the award of a major multi-well contract, to be carried out on behalf of a North Sea operator.

Accounting for the creation of up to 12 new roles at Mermaid's Aberdeen headquarters, the two-year contract will comprise the decommissioning of 22 wells and represents the integrated subsea provider's largest contract to date.

With activity already underway, Mermaid Regional Director, Scott Cormack, said: "We are delighted to announce the award of this contract, which follows hot on the heels of our well P&A activity during Q4 2022 with collaborative partner, Exceed.

"This project serves to underline the reputation we have so quickly gained for safe, efficient and cost-effective vessel-based well P&A, which draws upon our core team's combined track record across the decommissioning sector.

"Well P&A has been highlighted time and again as an important lever in the reduction of what accounts for approximately 50% of

all costs within the decom sector. The vessel-based P&A approach provided by Mermaid results in significant agility and flexibility across the whole work scope, which plays a critical role in the drive to reduce the North Sea's decommissioning bill."

Mermaid Offshore COO, Paul Whiley, added: "Congratulations to Scott and the Aberdeen team for what's been achieved here, as Mermaid continues to focus on this sunrise space for our offshore energy activities. Our strategy remains to provide quality to the proponent and returns to our stakeholders in equal measure."



» Scott Cormack,
Regional Director,
Mermaid Subsea
Services UK

DEEP-SEA ROV MOUNTED NISKIN ARRAYS CONTRIBUTE TO SEDIMENT PLUME MONITORING

Ocean Scientific International Ltd (OSIL) have released a dedicated deep-sea turbidity and water quality monitoring system for ROVs and subsea vehicles to aid with the accurate modelling of sediment plumes and their wider impact.

Certain deep-sea activities such as the collection of polymetallic nodules can generate large sediment plumes that affect the entire marine environment (seabed, water column, and marine organisms) over great distances, and The International Seabed Authority (ISA) is shortly due to finalize The Mining Code, which will provide a comprehensive set of rules, regulations and procedures issued by ISA to regulate prospecting, exploration and exploitation of marine minerals in the international seabed area, to manage these activities and minimize their impact.

The OSIL ROV Niskin Array uniquely combines an array of five individually triggered Niskin bottles with high accuracy turbidity and water quality sensors to provide real time data and water samples on demand, in addition to feedback on the system status,

enabling user to quantify the sediment plume scale and density. The Niskin bottles are fired independently by a new system designed and developed by OSIL, utilizing addressable solenoid actuators.

The innovative software-controlled system allows for a seamless interface with the client vehicle carrying the array, while the thin-walled solenoid housings themselves are oil filled, with a pressure compensation system ensuring that they can accommodate the range of changes in pressure and temperature experienced from sampling in the deep sea to deck setup in warmer climates.

The modular stackable arrays can be daisy chained together to create a larger network if required, and are rated to 6,000 m. The information gathered helps to improve our understanding of the ecological and environmental impacts of deep-sea activities, which leads to better informed management decisions and regulations surrounding these activities.



» Proposed deep-sea mining activities such as the collection of polymetallic nodules from the seabed will require ongoing sediment plume monitoring.
(Image credits: DEME Group/The Metals Company)



JF SUBTECH SIGNS SECOND CHARTER FOR 2023

James Fisher Subtech (JF Subtech) has signed its second charter agreement of 2023. Allowing for the exclusive use and operation of the multipurpose offshore vessel, *Olympic Taurus*, the agreement with Olympic Subsea increases JF Subtech's vessel availability and its capacity to support additional projects and further cements its commitment to the UK offshore energy industry.

The agreement will see the vessel utilized by both JF Subtech and sister company, James Fisher Renewables (JF Renewables), increasing operational uptime and flexibility at a time when vessel availability across the energy industry is limited. The *Olympic Taurus* has already been mobilized for work from

Montrose Port, Aberdeenshire, and fitted with a work class remotely operated vehicle (WROV), in support of an unexploded ordnance (UXO) identification, survey and disposal campaign in the North Sea.

Following completion of the campaign in early May, the vessel will be available for additional projects and mobilized in and around UK and European waters. The *Olympic Taurus'* adaptability means that it can be reconfigured for a wide range of work scopes, largely on UXO identification with ROV, IRM activities and air diving projects, core services for both JF Subtech and JF Renewables.

CGG, TGS AND BGP COMPLETE PHASE IV OF 3D MULTI-CLIENT SURVEY OFFSHORE SURINAME

CGG, a global technology and HPC leader, in a consortium with TGS and BGP, has announced the completion of Phase IV of the deepwater 3D seismic survey offshore Suriname. Fast-track products for this recently completed Phase IV will be ready for review towards the middle of this year, with the final products for the entire program available in late 2023.

Covering 1,800 sq km, Phase IV completes the programmed 14,500 sq km survey of newly acquired 3D data in deep and shallow water in the promising Guyana-Suriname basin. The program also includes over 6,400 sq km of reprocessed data. These new multi-client data will support Suriname's deep and shallow water bid rounds.

Dechun Lin, Executive Vice President, Earth Data, at CGG, said: "We are pleased

to have completed Phase IV of this major survey with our consortium partners, TGS and BGP. With our in-depth knowledge of the Suriname-Guyana region and leadership in high-end imaging technologies, CGG will deliver the high-resolution, high-fidelity images required to better understand Suriname's full potential."

David Hajovsky, Executive Vice President, Western Hemisphere, TGS, commented: "Suriname continues to play a vital role in expanding the availability of high-quality data in the Southern Atlantic, a priority for TGS. We're pleased to partner with CGG and BGP to enhance future exploration in this key region to further support our customer's investment opportunities, ultimately leading to actionable insights that drive decision-making."

Mark Richards, Senior Vice President of BGP

Multi-Client, added: "BGP are pleased to announce the completion of this new phase together with our partners, CGG and TGS. We believe this project will help provide clients with a better understanding of this frontier basin, aiding decisions on licensing round opportunities and exploration offshore Suriname."



» Map showing location of different phases of the Suriname 3D survey. (Image credit: CGG Earth Data)

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EPA SCIENTISTS DEPLOY UNDERWATER GLIDERS TO GREAT LAKES SURVEYS

The Great Lakes are essential for drinking water, recreation, transportation, hydroelectric power, and irrigation. The system provides more than 40 million people with drinking water and generates more than 1.5 million jobs. The lakes are also large enough to help cool nearby communities in summer and warm them in winter.

In addition, the Great Lakes provide an ecosystem that is home to more than 3,500 plants and animals, some of which are unique to these environments. Recent declines in water quality, especially those nearshore, have amplified the need to understand the connectivity between nearshore and offshore areas.

The Challenge

Observations between dynamic nearshore and offshore transitions pose a challenge for traditional observing systems. Some observations have been made using traditional methods, such as ship-based and buoy-based observations. Despite the success of gathering data using traditional methods, there are challenges, including the high cost of ship-based surveys and the infrequent sampling by satellite imagery, both of which are affected by weather conditions.

The Solution

Using the Teledyne Slocum glider, scientists were able to overcome these challenges. In contrast to shipboard observations, the Teledyne Slocum Glider is inexpensive to operate and can continue to collect data while being deployed for weeks at a time.

The Slocum Gliders can continuously profile the water column while heading to the next waypoint, collecting high temporal and spatial resolution data using a suite of onboard sensors specific to the mission. Glider observations have a distinct advantage. Because of the glider's profile in the water column, they can collect data regarding gradients of temperature and the concentration of



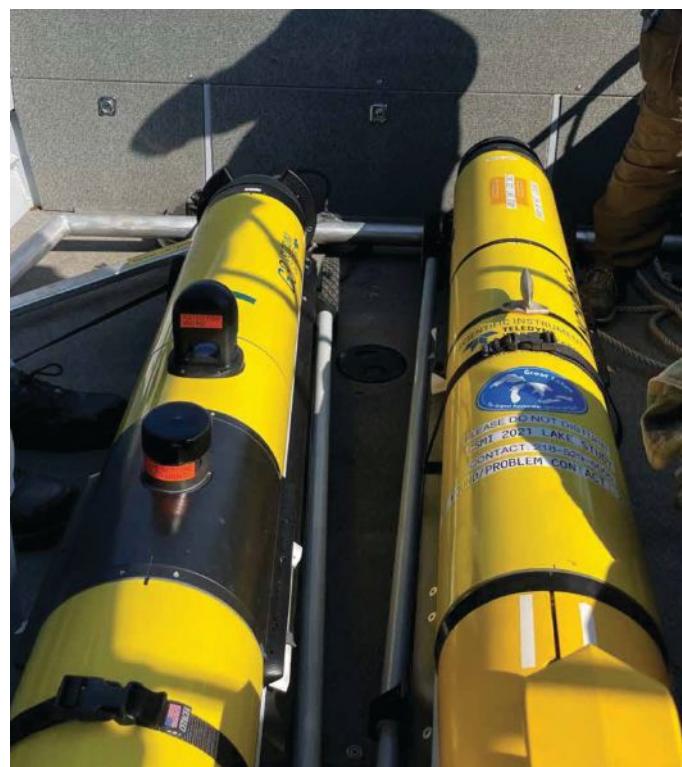
» Field crew load the EPA Great Lakes gliders for deployment in Lake Superior. Coordinated deployments with both gliders improve spatio-temporal resolution of observed features and expand the range of sensors beyond what can be carried by one glider. (Image credit: Dr. Paul McKinney)

chlorophyll along with other water quality parameters throughout the survey area.

During this survey, the Teledyne Slocum glider completed 3,000 vertical profiles over 1,000 km or 600 miles between early and late summer deployments. Data collected by the glider showed a seasonal difference in from early to late summer in an area of high thermal and chlorophyll gradients. Glider operations were able to expand observations used for water quality monitoring and modeling dramatically.

Since 2014, the US Environmental Protection Agency's (EPA's) Great Lakes National Program Office (GLNPO) and Office of Research and Development (ORD) have been using Teledyne Slocum Gliders in over twenty glider missions in all five of the Great Lakes to assess water quality trends and status.

The missions have collected more than 60,000 profiles in an area of glider transects encompassing over 7,200 km or almost 4,500 miles. Dr. Paul McKinney, Tom Hollenhorst, and Dr. Joel Hoffman conducted surveys using the Teledyne Slocum Glider to collect data in Lake Ontario and the Niagara River Plume. Through the sharing of data, the EPA aims to gain greater knowledge of the trends and status of the Great Lakes water quality while fostering future collaborations.



» Typically, deployment and recovery of EPA's gliders is accomplished using a trailerable boat and small crew, improving flexibility and response time for monitoring water quality events such as algae blooms. (Image credit: Dr. Paul McKinney)

TRENDSETTER WINS LLOG SALAMANCA MANIFOLD, CONNECTORS CONTRACT

Trendsetter Engineering has been awarded a significant contract for the provision of subsea hardware by LLOG Exploration Offshore for the Salamanca subsea developments at Leon and Castile.

"We're delighted to continue our great partnership with LLOG on the Salamanca Field Development," said Ron Downing, President of Trendsetter Engineering. "This project is a continuation of the great trust Trendsetter have developed with LLOG, building on recent successful deliveries for Spruance, Taggart and Dome Patrol."

Trendsetter's scope of work includes the design and manufacture of the subsea production manifold featuring Trendsetter's TCS subsea connectors along with valves sourced from Advanced Technology Valve S.p.A. (ATV) in Colico, Italy. Trendsetter is also supplying TCS connectors and ATV valves for the export tie-ins. The equipment is slated for delivery in early 2024.

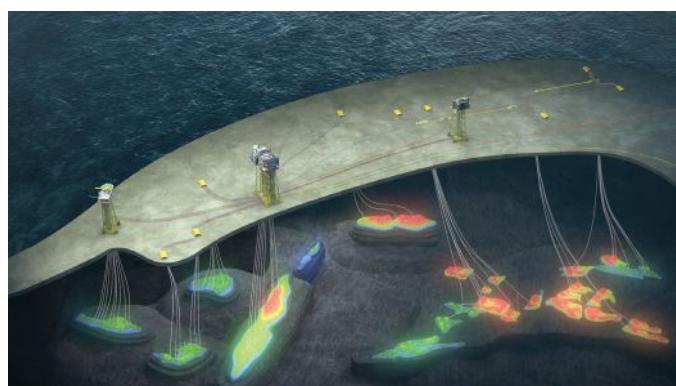
The Trendsetter Connection System (TCS) is a family of subsea connector solutions developed to meet industry needs for reliable, innovative connector products. The heart of the TCS is Trendsetter's

proprietary TEX metal-to-metal (MTM) gasket system. Trendsetter first introduced its subsea connector and TEX gasket technology to the industry in 2015 and has now since delivered more than 400 connectors to clients around the world. The product line spans 2" through 20" nominal bore sizes, as well as multi-bore, 400°F and 20,000 psi offerings.



» The Trendsetter Connection System (TCS) is a family of subsea connector solutions. (Image credit: Trendsetter Engineering)

ABL GROUP TO SUPPORT AKER BP ON AREA DEVELOPMENTS



» Illustration of the Yggdrasil area development. (Image credit: Aker BP)

ABL Group (ABL) has been awarded a contract by Aker BP to provide marine warranty survey (MWS) services for the Yggdrasil and Valhall PWP-Fenris offshore field development projects.

ABL's operation in Norway, based in Stavanger, has been appointed to provide marine warranty services for the transportation and installation operations relating to both fields. Project execution commenced in January 2023 with transportation and installation operations planned to be carried out in 2024, 2025, and 2026.

Yggdrasil, formerly known as NOAKA, consists of the Hugin, Fulla and Munin licence groups, and the area is located between Alvheim and Oseberg. The multi-field development is located on

the Norwegian continental shelf approximately 160 km west of Kollsnes, near Bergen, in water depths of 110–120 m.

The Yggdrasil area development will be comprised of the Hugin A processing platform with well area and living quarters, the Hugin B normally unmanned wellhead platform, the Munin unmanned production platform, and an extensive subsea development with a total of nine templates, pipelines and umbilicals. Fifty-five wells are planned in the area.

The Valhall PWP-Fenris development project will enable a lifetime extension of the Valhall field by adding a new central platform, PWP, bridge-linked to the existing Valhall PH platform. The Fenris field, which is located 50 km north of Valhall, will be developed as an unmanned installation. The production from Fenris will be tied-in to the new PWP platform in the central Valhall field.

Both developments are pending approval from the Norwegian Parliament.

"Yggdrasil will be the biggest field development offshore Norway during the coming years, while Valhall PWP-Fenris is an innovative redevelopment project. We are excited to be chosen as marine warranty survey provider for both projects. Our key role will be to help ensure that all transportation and offshore installation work is conducted safely and smoothly. Although each project is different, we bring with us several decades of experience from similar offshore projects into these area developments," said Peter Kingsland, Managing Director of ABL's Norwegian operation.

BLUEFIN ROBOTICS: CELEBRATING 25 YEARS OF UUVs



By Capt. Edward Lundquist
US Navy (Ret.)

General Dynamics Mission Systems (GDMS) Bluefin Robotics has a 25-year tradition of delivering unmanned underwater vehicles (UUVs) that have been customized for use by the military and research institutions to conduct challenging underwater missions and further undersea scientific knowledge.

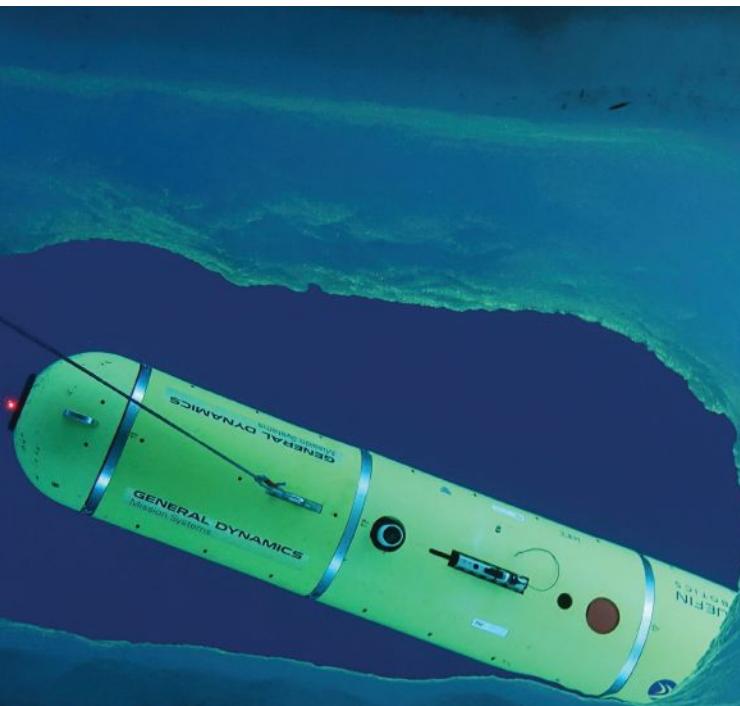
Bluefin Robotics vehicles have significant internal volume and power—including the power for on-board data processing that permits autonomous navigation and extended mission execution, and can be

readily adapted to varied missions by installing different payloads. The company offers a range of modular, free-flooded UUV platforms—including 21-inch, 12-inch and 9-inch diameter vehicles—and products.

Bluefin Robotics was started in 1997 to commercialize UUV technology that was being developed at Massachusetts Institute of Technology (MIT). In the early days of the fledgling company, parts of the vehicles would be wheeled between small workshops and garages where the development, manufacturing and assembly took place.

"Before I came onboard in 2007, Bluefin Robotics' first facility was a former auto parts warehouse a few blocks from MIT," said software engineer Steve Summit. "The company expanded into the 'ambulance garage,' so named because that's what it had been. The team literally rolled the vehicles across the street, dodging the traffic."

» A Bluefin Robotics-built MACRURA UUV deployed in the Arctic. (Image credit: MIT, GDMS)





» Knifefish is currently the only UUV that can find bottom or buried mines. (Image credit: GDMS)

SCALING UUV TECHNOLOGY

It became a wholly owned subsidiary of Battelle Memorial Institute in 2005. Later the company moved to spacious facilities in what was once the General Dynamics Quincy Shipyard and is now called the General Dynamics Mission Systems UUV Research, Development and Offshore Test facility.

With the maturation of the US Navy's Knifefish surface mine countermeasure (SMCM) UUV program, General Dynamics Mission Systems transferred the manufacturing and assembly to the General Dynamics Mission Systems UUV Manufacturing and Assembly Center of Excellence in Taunton, Massachusetts, co-located with a number of GDMS' product lines.

"Technology advancements for both autonomous underwater vehicles and sensors are allowing new and more detailed surveying of the seabed in challenging environments," said Dr. Laura Hooks, Vice President and General Manager of the Maritime and Strategic Systems business at GDMS.

"Given the increasing importance of unmanned systems in naval operations, our UUVs and other autonomous systems continue to be a focal point for investment and innovation. The pace of development will only increase as more users see the value of this technology in their mission areas."

THE FUTURE OF UNDERSEA AUTONOMY

With a 25-year history of UUVs, GDMS is ready for the future of undersea autonomy. Paul Dalton, Vice President of Autonomous Underwater Systems at GDMS said the Bluefin Robotics products have a strong history of being very reliable, leading edge UUVs.

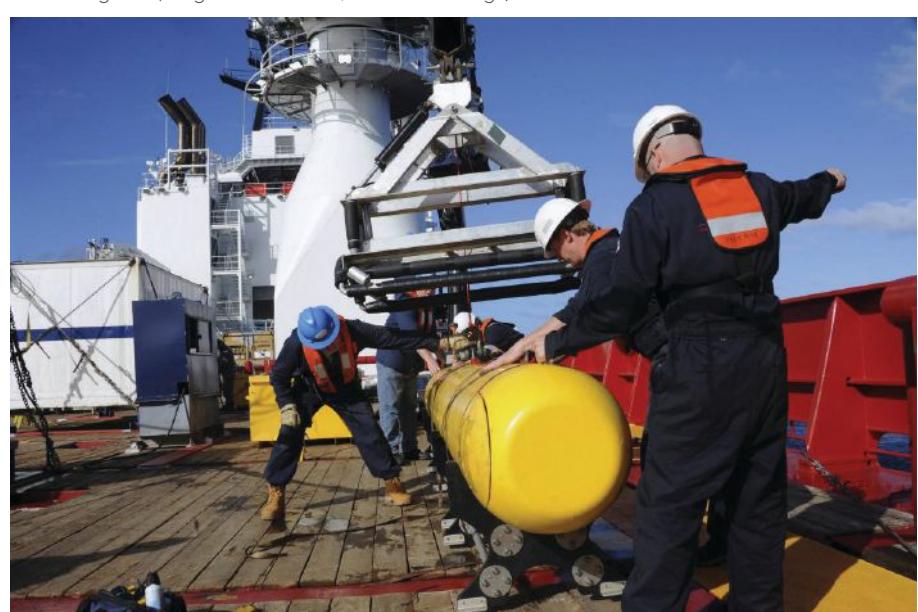
"GDMS Bluefin Robotics UUVs continue to shape future missions and unmanned maritime capabilities. We continue to leverage industry investments in energy, autonomy, and sensing technologies to execute increasingly complex missions in

the most challenging environment known to man. Today we are just beginning to realize the value these new and exciting capabilities can have in the undersea domain, and as our mission endurance and execution capabilities continue to mature. I have no doubt our UUVs will completely change the paradigm of undersea warfare," Dalton added.

Michael Guay joined soon after GDMS acquired Bluefin Robotics in 2016, first coming in to manage the Bluefin Robotics product line, then later expanding the team's portfolio in Science and Technology programs. He now leads the entire Autonomous Undersea Systems business segment, which includes Bluefin Robotics UUVs. "It was remarkable to come into an environment with so much heritage," Guay said.

"The introduction of the refreshed Bluefin-9 and Bluefin-12 UUVs in 2018 and 2019, respectively, was in part us paying homage to the amazing legacy of Bluefin Robotics. As we look forward as a business, it's with a continued, intense focus on developing unmanned systems that exceed our customers' expectations. Despite being in this space for 25 years, we still find ourselves at this unique convergence of technology, world events, policymaking, etc.—perhaps even more so now than in our past. In many ways, it feels like we're just at the beginning of this journey."

» A Bluefin-21, being deployed here, was used to help search for the missing Malaysia Airlines Flight 370 Boeing 777. (Image credit: GDMS/Phoenix Holdings)





» A Bluefin-9 on deck. (Image credit: GDMS)



» A Bluefin-12 being recovered. (Image credit: GDMS)

BLUEFIN UUVs IN THE FIELD

Bluefin Robotics vehicles have been adapted and employed in a variety of vehicles, systems, and missions around the world:

Macrura UUV

The MIT-owned and operated *Macrura* UUV has been employed in the biennial Ice Exercise (ICEX) in the Arctic. *Macrura* is a Bluefin-21, was fitted with an Inertial Navigation System (INS) and Doppler Velocity Log (DVL) to help it operate autonomously underneath the ice.

Reliant and Black Pearl UUVs

The Physical Acoustics Branch at the Naval Research Laboratory (NRL) in Washington, D.C., has employed their Reliant and Black Pearl autonomous UUVs to develop and test NRL's low-frequency broadband (LFBB) sonar for mine countermeasures, anti-submarine warfare, and counter-UUV applications. *Reliant* and *Black Pearl* are both based on the commercially available General Dynamics Mission Systems Bluefin Robotics-21 UUVs that have a 21-inch diameter.

Knifefish UUV

NRL's LBFF technology has been operationalized with the US Navy's *Knifefish* SMCM mine-hunting UUV that represents a critical element of the LCS Mine Countermeasure (MCM) mission package. Based on a Bluefin-21 platform, *Knifefish* is currently the only UUV that can find bottom or buried mines. It can also provide the LCS or host platform with environmental data to support mission planning and execution for other mine warfare systems.

MUSCLE and Black CAT UUVs

The NATO Science and Technology Organization Center for Maritime Research and Experimentation (CMRE) in La Spezia, Italy, has a pair of Bluefin-21s UUV's to develop a collaborative minehunting capability. The autonomous *Minehunting UUV for Shallow Water Covert Littoral Expeditions* (MUSCLE) experimentation platform and autonomous *Black CAT* have helped CMRE develop the Distributed and Decoupled (D2) Collaborative Autonomy Framework (D2CAF).

Deepwater Search

A Bluefin-21 known better as *Artemis*, operated by Phoenix International Holdings Inc., was used to provide salvage support to the US Navy to help search for the missing Malaysia Airlines Flight 370 Boeing 777 that disappeared in 2014 with 239 people on board. *Artemis* was modified to conduct very deep dives so it could approach the bottom of the Indian Ocean, which is as deep as 20,000 feet in the search area.

Royal Australian Navy SEA 1778

GDMS has delivered *Bluefin-9* and *Bluefin-12* UUVs to the Royal Australian Navy's (RAN) SEA 1778 deployable mine countermeasures (MCM) capability. SEA 1778 is taking the initial steps to introduce manned and unmanned vehicles, sensors, and weapons to provide a safe passage for forces moving through restricted waters or onto a beachhead from the sea.

HII AND OCEAN AERO TO PARTNER ON ADVANCED UNMANNED MARITIME CAPABILITIES

HII and Ocean Aero have initiated a strategic agreement to advance the combined capabilities of their respective unmanned maritime platforms and autonomy software solutions. The unmanned solution providers recently commenced multiple, simultaneous efforts to enhance the operational reach and duration of the platforms, collaborative autonomy behaviors, shared sensor fusion and perception capabilities, and accelerated seabed-to-shore data transmission methods.

"We are pleased to partner with Ocean Aero to further expand the operational capabilities of the US Armed Forces, partner nations and other maritime-focused commercial institutions," said Duane Fotheringham, President of the Unmanned Systems business group at HII's Mission Technologies division.

"We are excited to combine the best of our individual products to deliver an exceptional suite of solutions to our customers."

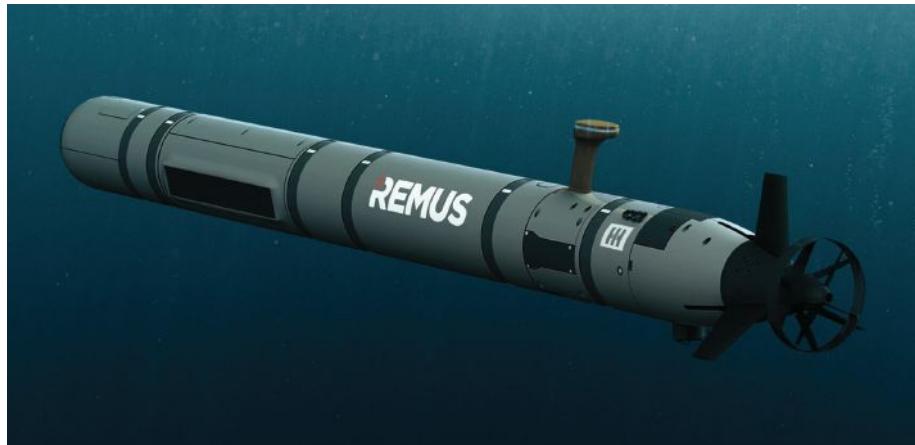
Kevin Decker, Ocean Aero CEO, added: "This is the perfect time for us to partner

with HII. With rising maritime challenges increasing worldwide, we need new capabilities to meet them. Incorporating our two firms' autonomous vehicle value propositions will unlock new tools for our customers at home and abroad."

HII and Ocean Aero are involved in several unmanned maritime systems initiatives and exercises across the globe. Ocean Aero recently completed Digital Horizon, the

US Fifth Fleet Maritime Domain Awareness exercise in the Arabian Gulf, where HII's REMUS vehicles (MK18 Mod 1 and MK18 Mod 2) have been deployed continuously since 2013.

The HII-Ocean Aero team is already planning to demonstrate their combined capabilities at future events in the region, in addition to other planned events and exercises for US and international partners.



» The Remus 620 UUV. (Image credit: HII)

DAMEN NAVAL COMPLETES MIDLIFE UPDATE OF HNLMS JOHAN DE WITT



Landing Platform Dock HNLMS *Johan de Witt* has left the Damen Naval shipyard in Vlissingen-Oost. Over the past 13 months, the amphibious transport ship has undergone a comprehensive Midlife Update (MLU) in conjunction with the third period of Appointed

Maintenance (BO3). Despite the tight schedule and several challenges, the ship was handed over to the Defense Materiel Organization (DMO) on Friday March 31, on schedule.

The MLU/BO3 was a joint project between Damen Naval and Damen Shiprepair Vlissingen (DSV). The companies share a shipyard in Vlissingen-Oost, where the *Johan de Witt* arrived on March 3, 2022. In July 2022, the ship was moved to DSV's dry dock for, among other things, conservation work on the underwater hull, superstructure, and all tanks. In November 2022, the *Johan de Witt* left the dry dock ahead of schedule and work continued quayside.

There were 69 MLU items planned, including refurbishment or replacement of equipment such as armament and communication systems, freshwater production (RO units), seawater pumps for firefighting and cooling, and more. The bridge, joint operations room, command, and engineering center were completely refurbished, and the masts were also rebuilt. Over 60 km of new cables were pulled, and new decking installed. Medical facilities on board, such as the operating room, IC beds and nursing room, were completely modernized.

MACARTNEY SUPPLIES ANOTHER FOUR WINCH SYSTEMS FOR NAVAL MCM USV PROGRAM

MacArtney Underwater Technology draws on in-house expert knowledge and long, close cooperation with Textron Systems to supply custom-built winches withstanding shock and vibration from exploding mines for the Common Unmanned Surface Vehicle (CUSV®) used on the US Navy's Mine Countermeasures Unmanned Surface Vehicle (MCM USV).

Textron Systems placed its first order in 2015 for winches designed to comply with MIL standard 901D for shock and vibration. They recently ordered four more after a one-year 'Winch Improvement Program', during which MacArtney improved design and performance in line with Textron Systems moving the CUSV system from prototype status to low-rate production.

Designed for MCM efforts

The CUSV system is a multi-mission unmanned surface vehicle with a large, configurable payload capacity. The system can be configured for sweeping, localization, and neutralizing mines and other explosive devices without human interaction.

The MacArtney winches on board Textron Systems' CUSV have to endure the shock of powerful explosions and violent vibrations. The winches have undergone a 'ruggedized program' to enhance their performance and survivability, including the use of aluminum and special alloys to make them lightweight and corrosion resistant, increasing pull force/winch weight ratio and adding fuel capacity for the boats.

Fascinating project

Kim Schultz, Project Manager for the program at MacArtney since its start in 2015, said: "MacArtney works in support of Textron Systems in the development of unique autonomous defense technology. This is a fascinating project involving our own in-house design and production teams, and I've had biweekly conference



» MacArtney Underwater Technology's custom winch solution for Textron Systems' CUSV. (Image credit: MacArtney)

calls with Textron Systems throughout the process. It differs from 'off-the-shelf' projects as the customer expects more reporting, and very high standards of innovation, development, specifications and—in particular—timing."

Other uses and markets

In addition to mine countermeasures, the CUSV can be used for a wide range of other defense and commercial applications due to its unique technology.

Empowering underwater technology since 1978, MacArtney Underwater Technology is a trusted and experienced provider of instrumentation platforms, underwater telemetry systems deployment and recovery systems to the ocean science, naval, and defense industries.

ARMADA MARINE ROBOTICS WINS SBIR PHASE II CONTRACT FROM US NAVY

ARMADA Marine Robotics has won a SBIR Phase II contract from the US Navy to continue development of an External Payload Delivery System (EPADS) for cylindrical Unmanned Underwater Vehicles (UUVs).

The contract is for \$1 million over two years with an Option for another \$1 million over two additional years.

The project extends work previously performed by ARMADA under a SBIR Phase I and work by Woods Hole Oceanographic Institution (WHOI) who will collaborate with ARMADA on the project.

Under this Phase II contract, ARMADA and WHOI will conduct several cycles of design, build and test resulting in a working prototype that has passed in-water testing at a Navy test facility.

Rusty Warren, CEO of ARMADA, said: "This is ARMADA's first Phase II win and a major step forward for the company. We are encouraged that the Navy is investing \$1M+ in a product that we can develop and build for them."

ARMADA is a spinout from WHOI with a primary focus on the commercialization of innovative technologies for underwater vehicles that was developed at WHOI.

CAPTAIN CHRISTIAN HAUGEN JOINS FORCYS TO LEAD BUSINESS DEVELOPMENT EFFORTS IN THE US



» Christian Haugen, USN (Ret.)

The undersea battlespace is becoming increasingly contested. In response to this threat, the United States and its allies are developing autonomous and remotely operated platforms that deliver enhanced mission capability, increased capacity, and improved lethality.

Forcys has appointed Captain Christian Haugen, USN (Ret.), to lead business development efforts in the United States in support of this evolving mission.

Backed by over fifty years of experience, Forcys offers the global maritime naval sector remote, autonomous, and networked control capabilities delivering integrated situational awareness to customers in the underwater domain.

Covering a range of maritime operations including asset protection, littoral strike, mine warfare, submarine rescue, and submarine and

anti-submarine warfare, Forcys seeks to transform the underwater domain by enabling increasingly distributed and automated operations. This is made possible by integrating and bringing to market world-changing solutions from leading technology partners Chelsea Technologies, EIVA, Sonardyne, Voyis, and Wavefront Systems.

Commenting on Christian Haugen's appointment, Ioseba Tena, Commercial Director of Forcys, said: "The United States has led the development and introduction into service of uncrewed underwater and surface vehicles over the last two decades. We want to play our part and Chris' appointment is part of a long-term commitment to develop solutions that will accelerate the introduction of more effective systems."

Christian Haugen, Business Development Manager for North America, added: "I am really looking forward to engaging with our existing customer base and eager to explore ways in which we may continue to add value. Beyond that, I am keen to explore ways in which we can closely integrate solutions from our technology partners to develop innovative capability to enhance the situational awareness and effectiveness of the Navy's fleet of unmanned systems."

CONSTRUCTION BEGINS ON ROYAL NAVY'S HMS BIRMINGHAM

Minister for Defense Procurement Alex Chalk recently attended the ceremony to officially begin construction on the future HMS *Birmingham* at BAE Systems' Govan shipyard in Glasgow.

All of the Royal Navy vessels will be built by BAE Systems on the Clyde, sustaining around 1,700 jobs in Scotland and 4,000 jobs in total across the wider UK maritime supply chain. BAE Systems plans to recruit a further 400 trades people and 200 apprentices for the program in 2023.

Work on the first three Type 26 ships is well under way with HMS *Glasgow* now at BAE Systems' Scotstoun shipyard to have her complex systems installed, HMS *Cardiff* currently being assembled and HMS *Belfast* in its early construction phase. HMS *Birmingham* is the first ship to be constructed under a £4.2 billion contract for the remaining five ships secured in November, which reflects the Ministry of Defense's confidence in the program.

The Type 26 is designed for anti-submarine warfare (ASW) and high-intensity air defense but can adapt its role quickly to transport high volumes of humanitarian aid and house medical facilities.

BAE Systems is investing approximately £15 million in a new Applied Shipbuilding Academy in Glasgow to support the development of the entire workforce, from apprentices through

to senior leaders. In addition, construction has begun on a modern shipbuilding hall worth more than £100 million, which will greatly enhance productivity on the Clyde to support the delivery of these eight ships and future orders.

The Commonwealths of Australia and Canada have selected the Type 26 design, which, together with the UK, provide an anticipated 32-ship program across the three nations.



» Rendering of the Type 26 frigate. (Image credit: BAE Systems)

ROVCO MAKES TWO NEW KEY APPOINTMENTS



» Marc Coull, Director of IRM (left), and Craig Davis, Director of Site Characterisation at Rovco

Rovco, a global provider of advanced subsea robotics and integrated survey solutions to the offshore wind and oil field decommissioning sectors, has taken a major step forward as it progresses ambitious plans for greater global and sectoral growth.

The company, which was founded in 2016, will now operate through two separate

business units, each one focusing and delivering on a specific area of expertise. Each unit will be led by a newly appointed director who will be charged with taking the business unit forward under the new structure.

Marc Coull, who joined the company last year as Operations Manager, has been promoted to Director of Inspection, Repair and Maintenance (IRM), which takes in the state-of-the-art subsea robotics-based IRM work that has been the foundation of the company's operations since its inception.

Craig Davis, formerly Global Account Director at Rovco, takes up the new role of Director of Site Characterization, and will be responsible for leading the development of the company's dedicated new marine site

characterisation business unit.

"Marc and Craig are acknowledged experts in their respective fields and will provide the leadership to build on Rovco's existing industry-leading reputation, developing these two new units and taking them forward to meet the very specific needs of our clients right across the energy industry," said Simon Miller, Rovco's Chief Revenue Officer.

"This is an important phase in Rovco's strategic growth plans and both Marc and Craig come from strong industry backgrounds and will be instrumental in helping take the company to the next level of growth."

Moving from a generalized company structure to the new set up with two specialist units will bring a number of benefits

to clients. The new business model will put the teams closer to their clients and support the delivery of a more bespoke solution, tailored to meet the needs of every individual client.

"Since its launch, Rovco has continued to build and expand the range of solutions we have delivered to our customers with relation to their inspection, repair and maintenance activity through the use of innovative and industry leading technology," said Mr Miller.

"However, we are increasingly being asked by clients to provide new and diverse services, particularly those relating to the shortfall which currently exists with regard to the carrying out of consenting surveys prior to the construction of new offshore installations."

AQUEOS APPOINTS NEW VP

Aqueos has announced the appointment of Eugenio Cortina to the position of VP of International Business and Strategic Development.

Eugenio brings to Aqueos more than 18 years of experience in subsea construction activities. During his tenure at TechnipFMC, from 2004–2022, he held various roles, starting as a Commercial Analyst in Mexico and then moving to Carlyss, LA. In Carlyss, he worked as a Field Engineer, Project Engineer, and Project Manager on subsea projects

in different regions such as the US Gulf of Mexico, Southeast Asia, Middle East, Trinidad & Tobago, Venezuela, and Brazil. Finally, he served as a Business Development Director based out of Mexico, expanding the company's operations in the region.

Eugenio holds a Bachelor of Science in Industrial Engineering from Universidad Iberoamericana in Mexico City and an Executive MBA from Hult International Business School, graduating Summa Cum Laude.

Ted Roche, Aqueos' CEO, commented: "Eugenio's personality, experience, education, and knowledge of the international markets and works to be performed, makes him an ideal addition to the Aqueos Team. We are looking forward to growing our international market footprint and have full confidence in his capabilities."

Aqueos Corporation utilizes its subsea experience and proven track record of excellence, professionalism, and safety to provide marine construction,

commercial diving, ROV and vessel contracting services to the oil and gas, civil, military and renewable energy sectors.



» Eugenio Cortina

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OIL SPILL RESPONSE LIMITED WELCOMES VANIA DE STEFANI AS NEW CEO



» OSRL CEO Vania De Stefani

Oil Spill Response Limited (OSRL) has announced the appointment of Vania De Stefani as its new CEO. Vania brings over 20 years of experience in the oil and gas industry, with a strong background in engineering, operations and process safety.

Vania began her career at Imperial College, where she led the scientific team responsible for developing fire and explosion models. She later joined BP, where she held various executive positions and most recently served as the Vice President of Operations for Mauritania and Senegal. In this role, she led geographically and culturally diverse teams and played a key role in the response to the Deepwater Horizon incident in the Gulf of Mexico. Vania has also led operational crises in other regions, including Europe, Asia, Africa, and the Middle East.

"I am excited to join the team at OSRL and lead this organization

that plays a critical role in protecting the environment and responding to oil spills," said Vania. "I look forward to working with our employees, customers, and stakeholders to advance OSRL's mission and continue to provide world-class oil spill response services."

OSRL is a leading provider of oil spill response services, with a mission to provide its members with resources to prepare for and respond to oil spills efficiently and effectively on a global basis. The organization works with industry, government, and NGOs to provide a comprehensive suite of oil spill response and services.

"We are delighted to have Vania join us as our new CEO," said Astrid Sorensen, Chair of OSRL's Board of Directors. "Her deep experience in the oil and gas industry, as well as her proven track record of leadership and technical expertise, will be invaluable as we continue to expand our services and support our members' and customers' needs."

Vania's appointment comes at an exciting time for OSRL, as the organization looks to build on its strong foundation and expand its services to meet the growing demand for oil spill response and preparedness.



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Houston, TX » May 1-4
<https://2023.otcnet.org>

Global Energy Transition

New York, NY » June 7-8
<https://events.reutersevents.com/energy-transition/global-energy-transition-new-york>

H2O Conference

Halifax, Canada » June 12-14
<https://www.h2oconference.ca/>

Suriname Energy, Oil, and Gas Summit

Paramaribo, Suriname » June 19-22
<https://suriname-energy.com/welcome>

US Offshore Wind

Boston, MA » July 11-12
<https://events.reutersevents.com/renewable-energy/offshore-wind-usa>

Dredging Summit & Expo

Las Vegas, NV » July 17-20
<https://dredging-expo.com/>

SPE Subsea Well Intervention

Galveston, TX » August 8-10
<https://www.spe.org/events/en/2023/symposium/23ssi/subsea-well-intervention.html>

Floating Wind Solutions South America

Rio de Janeiro, Brazil » September 18-20
<https://fwssouthamerica.com/>

OCEANS Gulf Coast

Biloxi, MS » September 25-28
<https://gulfcoast23.oceansconference.org/>

OTC Brasil

Rio de Janeiro, Brazil » October 24-26
<https://otcbrasil.org/>

EUROPE

Deep Sea Mining Summit

London, UK » May 3-4
www.deepsea-mining-summit.com

Undersea Defence Technology (UDT)

Rostock, Germany » May 9-11
www.udt-global.com

All-Energy

Glasgow, UK » May 10-11
www.all-energy.co.uk

EEGR Southern North Sea

Norwich, UK » May 24-25
<https://eeegr.com/events/sns23-vision-2030/>

OCEANS Limerick

Limerick, Ireland » June 5-8
www.limerick23.oceansconference.org

Renewable Energy Cyber Security Forum

Berlin, Germany » June 6-7
<https://www.leadventgrp.com/events/renewable-energy-cyber-security-forum/details>

Seawork

Southampton, UK » June 13-15
[https://seawork.com/](http://seawork.com/)

Underwater Technology Conference (UTC)

Bergen, Norway » June 13-15
[https://www.utc.no/](http://www.utc.no/)

Seanergy

Paris, France » June 20-21
www.seanergy-forum.com/en/seanergy2023

SPE Offshore Europe

Aberdeen, UK » September 5-8
[https://www.offshore-europe.co.uk/](http://www.offshore-europe.co.uk/)

OTHER REGIONS

Int'l Conference on Ocean, Offshore & Arctic Engineering

Melbourne, Australia » June 11-16
<https://event.asme.org/OMAE>

Autonomous Robotics and Unmanned Systems for Offshore Infrastructure

Virtual » June 28-29
<https://www.leadventgrp.com/events/autonomous-robotics-and-unmanned-systems-for-offshore-infrastructure/details>

Australia Wind Energy

Melbourne, Australia » July 25-26
<https://www.windenergyaustralia.com/>

Gastech

Singapore » September 5-8
www.gastechevent.com

Mozambique Gas & Energy Summit

Maputo, Mozambique » September 27-28
www.mozambiqueenergysummit.com

ADIPEC

Abu Dhabi, UAE » October 2-5
www.adippec.com

Eastern Mediterranean Conference

Cyprus » November 28-30
www.emc-cyprus.com

2023

MONTH & DEADLINES	EDITORIAL FOCUS & CONFERENCES	CONTENT
JAN/FEB Editorial: Jan. 20 Ad: Feb. 10	» OFFSHORE EXPLORATION US Hydro / March 12–16 CUCE / March 26–28 Int'l Partnering Forum / March 28–30	Editorial Topics: Offshore Infrastructure Development, Exploration of Deep-Sea Resources, ESG, Geotechnical Services Product Focus: Submersibles, AUVs, Lights, Cameras, Deck Handling Equipment, Research Vessels, Samplers
MARCH Editorial: Feb. 20 Ad: Mar. 10	» UNCREWED VEHICLES Ocean Business / April 18–20 OCEANS Limerick / June 6–8	Editorial Topics: Remote Marine Survey, Seafloor Mapping, Harbor Security, Long-Range Ocean Research, Coastal Monitoring Product Focus: USVs, AUVs, LARS, UAVs, Sonars, Propulsion and Positioning Systems
APRIL Editorial: Mar. 20 Ad: Apr. 7	» MARITIME DEFENSE & SECURITY UDT / May 9–11	Editorial Topics: Coastal Surveillance, Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW), Search & Rescue, Submarine Cable Infrastructure & Protection Product Focus: USVs, XLUUVs, AUVs, ROVs, Amphibious Vehicles, MCM, ASW
MAY Editorial: Apr. 14 Ad: May 5	» GREEN ENERGY TRANSITION UTC / June 13–15 Seanergy / June 20–21 US Offshore Wind / July 11–12	Editorial Topics: Offshore Wind Infrastructure & Supply Chain, Subsea Batteries, Wave Energy Systems, At-Sea Automation, CCS Systems, Hydrogen Product Focus: Offshore Turbines, Supply Vessels, Underwater Batteries, Subsea Connectors, Submarine Cables, Renewable Energy Systems
JUNE Editorial: May 22 Ad: June 9	» UNDERWATER SENSOR TECHNOLOGY & IMAGING	Editorial Topics: Underwater Navigation, Marine Archaeology, Environmental Coastal Monitoring Product Focus: ROVs, Lights, Cameras, Manipulators, Towed Arrays
JULY Spotlights: June 27 Ad: July 7	» UNCREWED VEHICLES BUYERS' GUIDE □	Editorial Topics: Special Edition
AUGUST Editorial: July 24 Ad: Aug. 11	» OCEAN OBSERVATION, DATA, & COMMUNICATIONS OCEANS Gulf Coast / September 25–28	Editorial Topics: Oceanography, Meteorology, Remote Sensing, Telemetry, Data Processing, Seafloor Mapping, Cloud-Based Data Storage Product Focus: Marine Observation Systems, Buoys, Drifters, Marine Research Vessels, Subsea Nodes, CTD, Acoustics, Biosensors
SEPTEMBER Editorial: Aug. 21 Ad: Sept. 8	» REMOTE MARINE OPERATIONS ACP Offshore WINDPOWER / Oct 3–4 Ocean Energy Europe / October 25–26 Offshore Energy / November 28–29	Editorial Topics: Subsea Inspection, Maintenance, Repair (IMR), Seabed Residency, Subsea Intervention, Oil Spill Response, Remote Operations Centers, Professional Development & Training Product Focus: Inspection AUVs, ROVs, USVs, Work-Class ROVs, Pipeline Pigs, Ultrasonic Imaging
OCT/NOV Editorial: Sept. 18 Ad: Oct. 6	» THE OFFSHORE DEVELOPER'S TOOLKIT	Editorial Topics: Offshore IoT, Asset Integrity Monitoring, Autonomous Control Systems, Digital Twin Technology, Decommissioning Services Product Focus: Predictive Maintenance Solutions, Electric Workboats, USVs, Untethered ROVs
DECEMBER Editorial: Oct. 30 Ad: Nov. 10	» THE FUTURE OF OCEAN TECHNOLOGY	Editorial Topics: Special Edition

WORLD'S FIRST HYDROGEN FERRY PUT INTO OPERATION IN NORWAY

Norled's MF *Hydra* was recently put into operation running on zero-emission hydrogen. In addition to the major maritime technology breakthrough, significant work has also been done to develop rules and regulations to enable Norwegian passenger ships to run on hydrogen.

Since the turn of the year, Norled has been carrying out system tests at the quay in Hjelmeland. With sea trials complete and successful, the company received the final approvals from the Norwegian Maritime Authority (NMA).

"There are only two parties in the world that use liquid hydrogen as a fuel," said Norled's Chief Technology Officer Erlend Hovland. "These are Norled with the MF *Hydra*, and then the space industry using it as fuel for launches. This says something about the giant technology leap now taken for the maritime industry."

Liquid hydrogen is set to play an important role in the green maritime transition, so the pilot project in Hjelmeland represents an important step for global shipping and offshore activities in general.

The Maritime CleanTech business cluster works closely with the maritime industry and encourages the use of new zero-emission technology.

"MF *Hydra* confirms Norway's world-leading position in the development of new green maritime solutions. By putting the world's first hydrogen ferry into operation on a Norwegian ferry connection, we are once again showing how purchasing power

and good public-private partnerships can be used to develop new and groundbreaking technology," commented CEO of Maritimme CleanTech Ada Jakobsen.

Germany-based Linde Engineering supplied the hydrogen systems on board, while Danish firm Ballard developed the fuel cells needed to produce electricity from hydrogen. Westcon, based in Ølensvåg, was responsible for equipping and completing the vessel together with system integrator SEAM from Karmøy. Seam also supplied the automation scope for the hydrogen system.

Corvus Energy provided the batteries for the MF *Hydra* and the vessel has been fully approved by Det Norske Veritas (DNV).



» *Hydra* with the white hydrogen tank visible. (Image credit: Norled)

CRAIG INTERNATIONAL OPENS NEW GLOBAL HQ



» *Craig House* in Aberdeen, Scotland. (Image credit: Craig International)

Craig International is marking its 25-year anniversary by moving its global headquarters to a new larger facility in Aberdeen.

The global procurement specialists to the energy industry have invested £1 million in acquiring and refurbishing 10,000 square feet of modern, energy efficient offices at Craig House on Tern Place in the city's Bridge of Don area.

Craig International has also taken a new warehouse at Potterton, on the outskirts of Aberdeen, which is powered by solar panels, in keeping with the company's commitment to reducing its environmental footprint.

Since being formed in 1998, Craig International has evolved from sourcing and supplying essential consumables for rigs in the North Sea to providing third party procurement of a diverse range of equipment, products, and services to energy companies in 55 countries across five continents.

Craig International has been at the forefront of digital procurement, introducing its technologically advanced platform, ebuy, back in 2011. The company continues to lead the way with its latest sustainability digital platform, ecobuy, which allows customers to procure more environmentally friendly products with a view to standardizing the energy industry's product lines.

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UTC is by many considered the best underwater technology conference in the world. Here, new connections are created, knowledge is shared, and important relations and networks are cultivated. UTC is where innovation is introduced and where the spark for further cooperations and new technology solutions are lit.

A selection of speakers at UTC 2023:



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Birns Aquamate design and manufacture underwater electrical connectors, cable assemblies, and cable terminations. The company produces a wide range of standard industry products such as the 5500 Series, SC, MC, LP, FAWL/FAWM, NANO, TC, Rubber Molded, etc. Birns Aquamate is the only manufacturer to guarantee compatibility with other uw connectors. Birns Aquamate also specializes in fast turn-around for custom design of special connector solutions. All connectors are manufactured under IEC ISO 9001:2015 certification. Dealers in Canada, Brazil, UK, Belgium, Holland, Norway, Germany, South Africa, Holland, Italy, and China.

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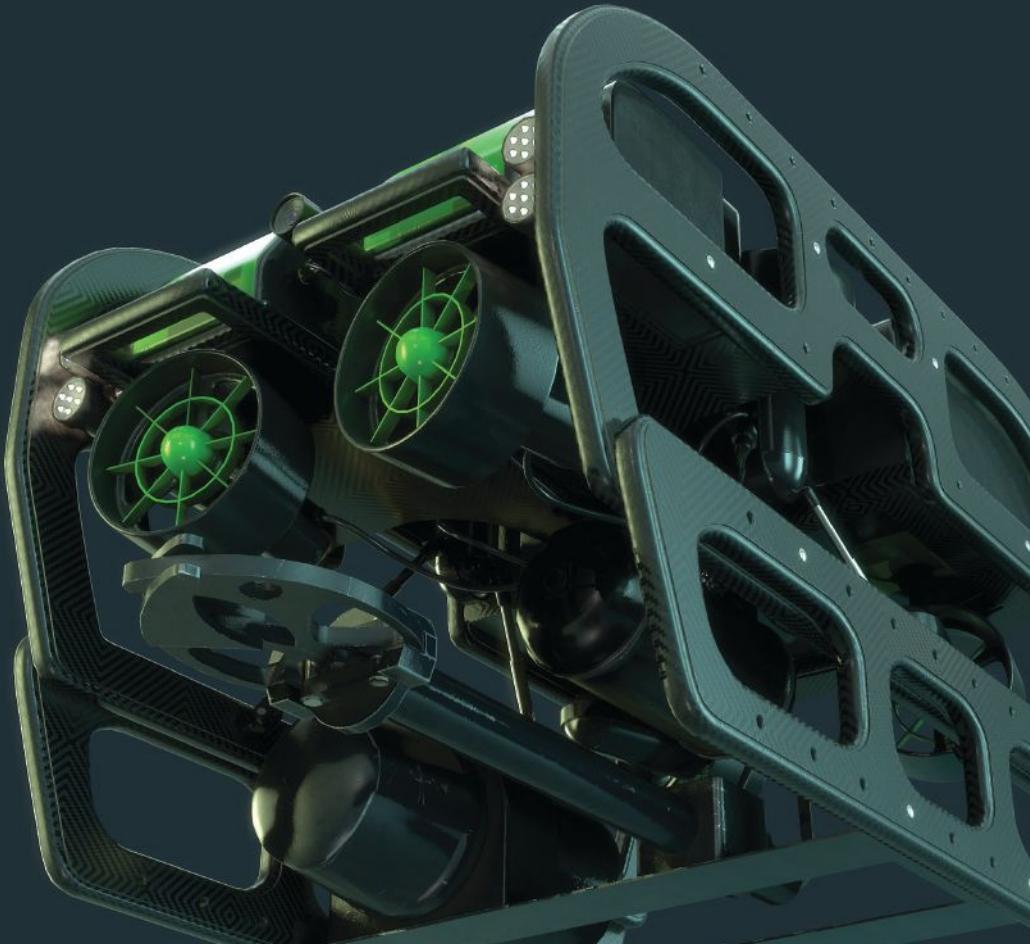
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