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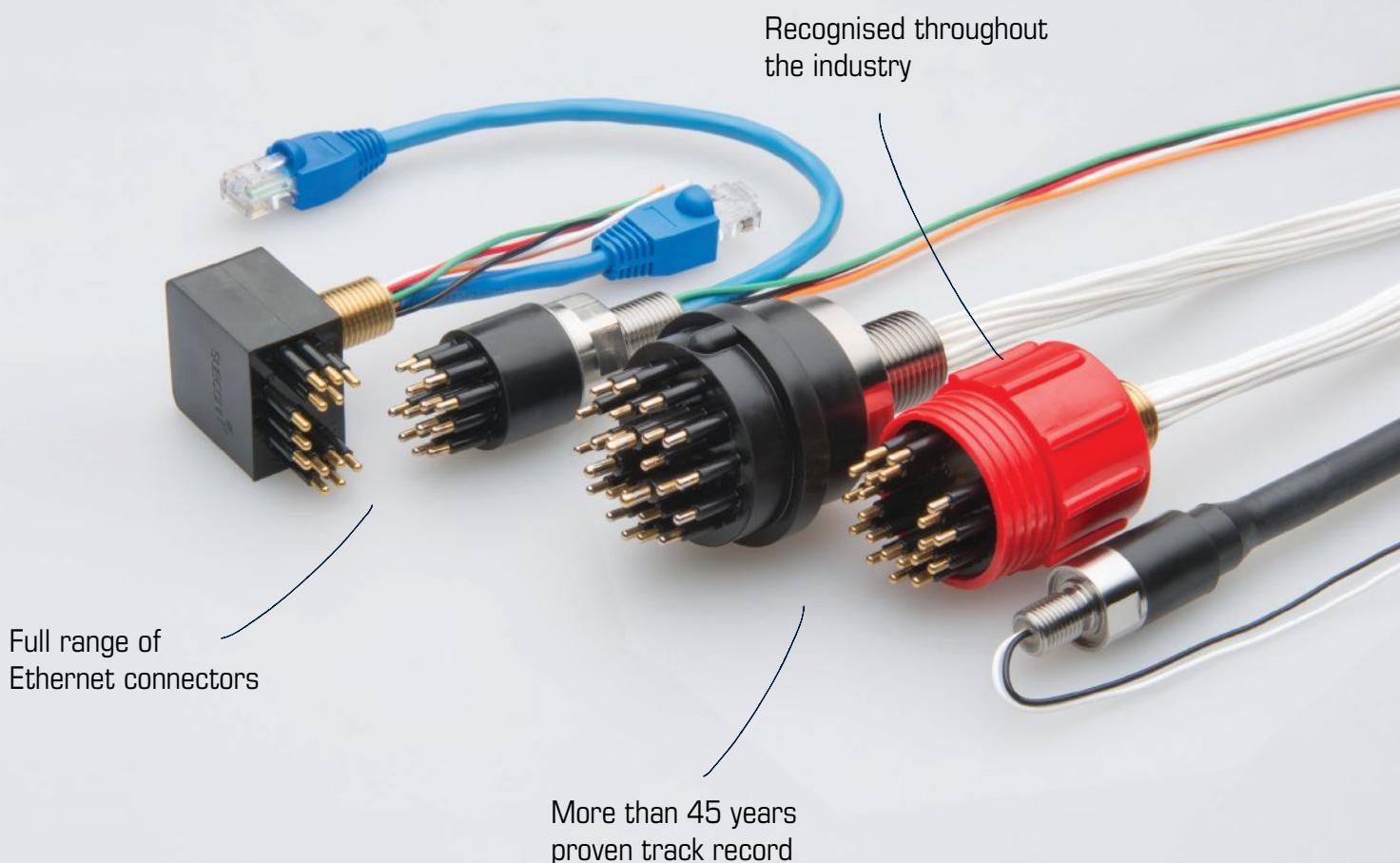
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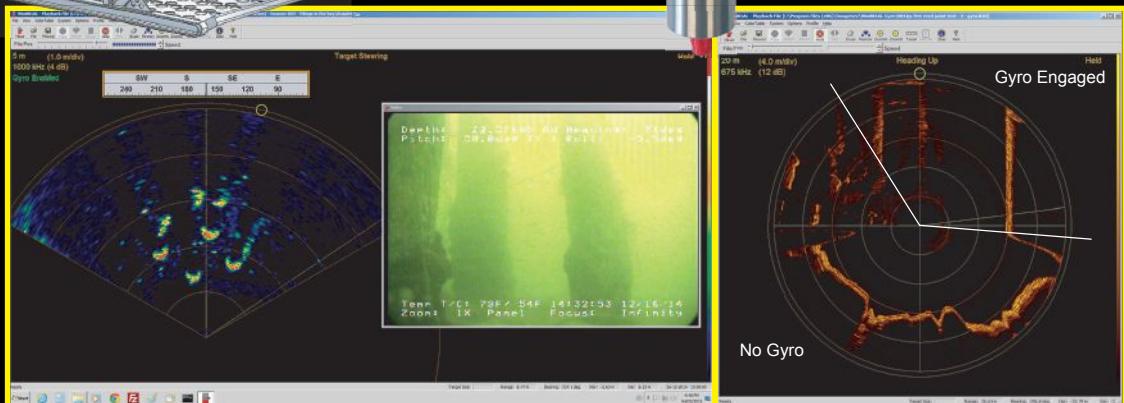
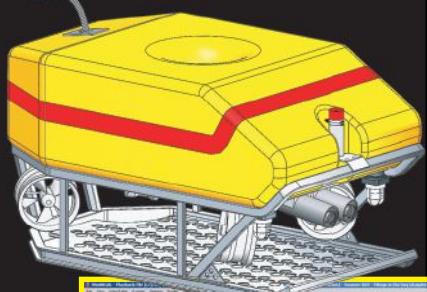
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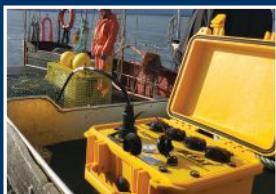
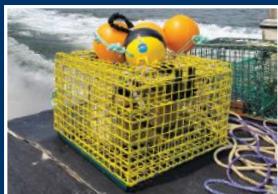
Ghost Gear

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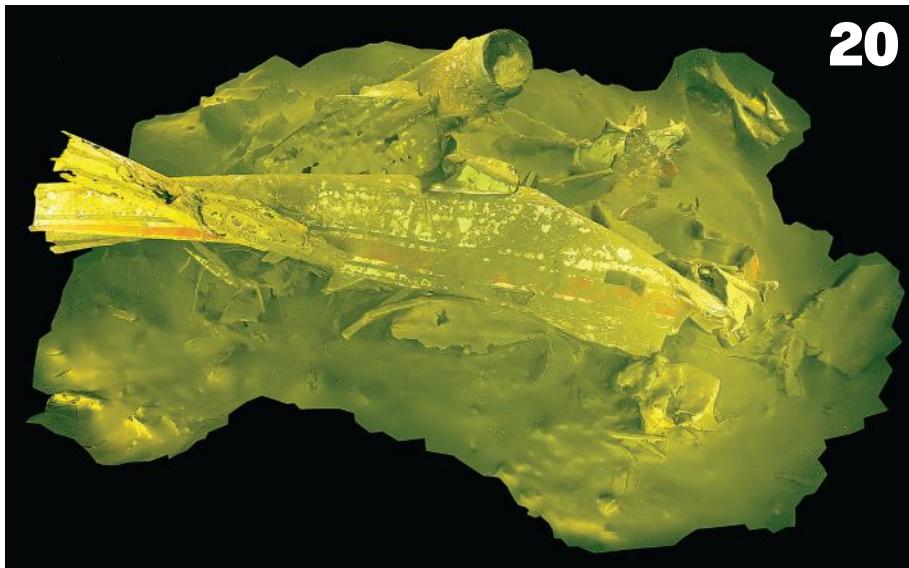
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CONTENTS



20

FRONTLINE

TAKE 5

16 THE ON&T INTERVIEW

ON&T visited Triton Submarines for a chat with CEO and Co-Founder Patrick Lahey, a leading expert on HOVs



30 COMMODITY MARKETS FLUCTUATE

Prices remain under pressure

CHECK THE TECH

42 SUBSPIRIT P-63

Pioneering sustainable submarine exploration

MONTHLY EXCLUSIVES

8 TELLING YESTERDAY'S STORIES TODAY

*Simone Pizzolato,
Commercial Manager, FET*

10 NO SUB FOR SUBMERSIBLES

Exploring the deep with WHOI
*Aaron Steiner, General Manager,
DSP&L*

20 MYSTERY SOLVED

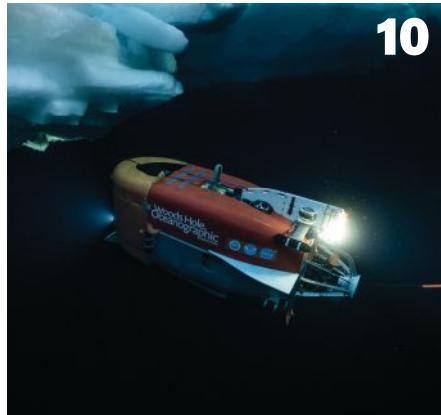
Side scan sonar data helps discover lost aircraft N400CP
*Gary Kozak, GK Consulting,
EdgeTech*

26 A DISTINCT SUBCATEGORY

Versatile manned submersibles for diverse objectives
*Charles Kohnen, Co-Founder &
Chairman, SEAmagine*

45 THE NEXT STEP

Safety and innovation in ocean exploration
World Submarine Organization (WSO)



10

FRONTIERS

- 14 OCEAN SCIENCE & TECHNOLOGY
- 24 OFFSHORE ENERGY
- 34 SUBSEA INTERVENTION & SURVEY
- 46 DEFENSE & SECURITY
- 52 OCEAN MILESTONES

CONTINUUM

- 54 EVENTS
- 55 EDITORIAL CALENDAR
- 60 OCEAN INDUSTRY DIRECTORY
- 66 ADVERTISERS INDEX

ON THE COVER



HOV Alvin and AUV
Orpheus on R/V
Atlantis during a June
2024 NSF and NOAA
funded expedition
investigating seeps
along the Aleutian
Margin. (Credit: WHOI)



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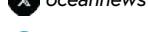
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Simone Pizzolato
Commercial Manager



To scour the bottom of the ocean and search for clues of humanity's past can be an enriching experience. With every shipwreck comes tales of life and death, of seafarers who perished and of others who lived to tell the tale. Decayed shipwrecks on the bottom of the seafloor can be a time capsule to another world.

Technology to explore, to analyze and to unearth secrets of the deep has never been more advanced. ROVs are becoming increasingly complex and intuitive machines while the safety measures for the divers who go down and gain some first-hand experience of wreckage is as high as it has ever been.

But despite all these welcome advances, there remains mystery and mystique. Indeed, as of June 2024, only 26.1% of the seabed has been mapped.

UNVEILING HISTORY

That is why, then, when significant discoveries are made, we are entitled to feel a sense of pride and accomplishment. Consider the recent retrieval of the bell from the USS Jacob Jones, a project that was 107 years in the making.

Having been sunk by a German submarine in 1917, its final resting place on the seabed remained a mystery until the vessel was finally located near the Isles of Scilly by a well-respected technical dive team in 2022. Earlier this year, a team led by the UK Ministry of Defence Salvage and Marine Operations (SALMO) recovered the highly valuable artefact from the ship, which has a notable spot in the history as the first

US Navy destroyer to be sunk by enemy action.

ROV DEPLOYMENT

Using a Forum Energy Technologies (FET) XLX-C work class remotely operated vehicle (ROV), the mission marked SALMO's first deployment of the system on what proved to be a poignant mission.

The USS *Jacob Jones* was torpedoed by a German U-boat in December 1917, with the loss of 64 men. The ship had been escorting a troop and supply convoy from Ireland to Brittany when it was hit and sank in just eight minutes. Before its sinking, the vessel had played an important role in the safeguarding of convoys transporting troops and supplies from the US to the UK and France. Due to the fact that its final resting place was estimated at around 100 m (328 ft) below the surface, there were fears that trophy hunters may target it, but it took advanced ROV technology, time, and commitment to finally complete the mission.

The joint project between the British Navy and its American counterparts to recover it has ensured that the ship's bell can be placed in the National Museum of the US Navy in Washington, DC for all to pay respect to its memory.

This is only one example of why continuing to explore the vast ocean is as important as it's ever been. Stories that have laid untold for decades can be unearthed and shared for generations to come, ensuring the seafarers of tomorrow know in whose steps they are following.

SMART SUBSEA SOLUTIONS

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NO SUB FOR SUBMERSIBLES

Exploring the deep with Woods Hole Oceanographic Institution



Aaron Steiner
General Manager



As is well documented, the vast majority of the Earth's oceans remain relatively unexplored. These blue expanses run deep—to over 11,000 m in some spots. This unknown is hard to fathom, literally and metaphorically, with much progress reliant on the advances of submersibles and the various supply chains dedicated to enhancing their impact on subsea discovery.

As a category, "submersibles" covers a broad range of vehicles—crewed and uncrewed—all designed to navigate and illuminate this often-mysterious underwater world, from surface to seabed.

It is in the deep where submersibles are proving increasingly instrumental. Where once simply gaining access to the deepest, darkest, most remote crevices was feat enough, today, thanks to the array

of modern equipment and instrumentation that these vehicles can support, deep ocean submersibles are able to efficiently expand upon our scientific knowledge of the baseline environmental conditions that frame ocean ecosystems and processes.

There are several noteworthy marine science institutions that have led the charge in this domain, but arguably none as revered as Woods Hole Oceanographic Institution (WHOI) in Falmouth, Massachusetts. WHOI's reputation as a leader in oceanographic exploration, education, and research has been built over nearly a century by the dedicated scientists, engineers, technicians, and administrators that tenaciously pursue a comprehensive understanding of the ocean. Henry Bigelow, the first director of WHOI, believed that "the most essential activities of the institution may be expected to center around the work at sea," and this core

tenant has led WHOI to design and field some of the most advanced and storied research submersibles in operation today.

DeepSea Power & Light has been a proud WHOI partner for over four decades. Within that time, DeepSea has collaborated with WHOI on a host of imaging and lighting solutions engineered to enhance the utility of WHOI submersibles, such as the 11-km rated Optim SeaCam 4K camera and general LED luminaires like the LED SeaLite.

This article, which celebrates WHOI's unmatched portfolio of submersible systems, serves as a timely reminder of what sector collaboration can achieve as ocean research becomes more important than ever. Thank you to Dr. Dan Fornari, Dr. Tim Shank, and Ken Kostel for contributing the images.

deepsea.com



▲ AUV Sentry being deployed on a 2024 dive to recently discovered hydrothermal vent fields along the East Pacific Rise at 9°50'N.
(Credit: Dana Yoerger, WHOI)



▲ (Credit: Dan Fornari, WHOI)

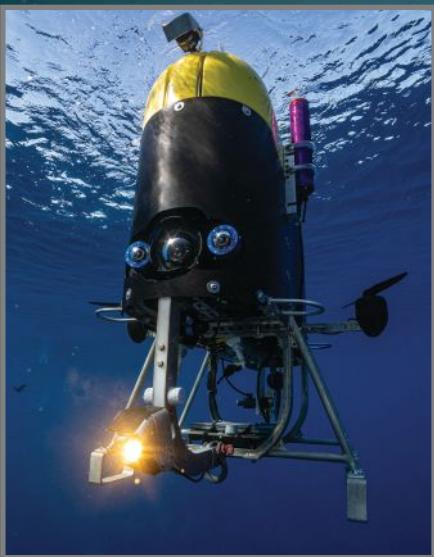
AUV SENTRY

AUV Sentry has proven to be one of the most capable and useful platforms in the WHOI NDSF fleet. Its long-range autonomous survey capabilities are used to reconnoiter large swaths of the seafloor, allowing for more efficient deployments of crewed and remotely operated submersibles. These long-range survey data sets contain acoustic and photographic images along with a suite of onboard environmental sensors and water samplers from overlapping missions revisiting areas months and years apart. This is enabling scientists to conduct longitudinal studies of seafloor phenomena, which are revealing details about geology and biological communities that cover areas orders of magnitude larger than what could be effectively covered otherwise.



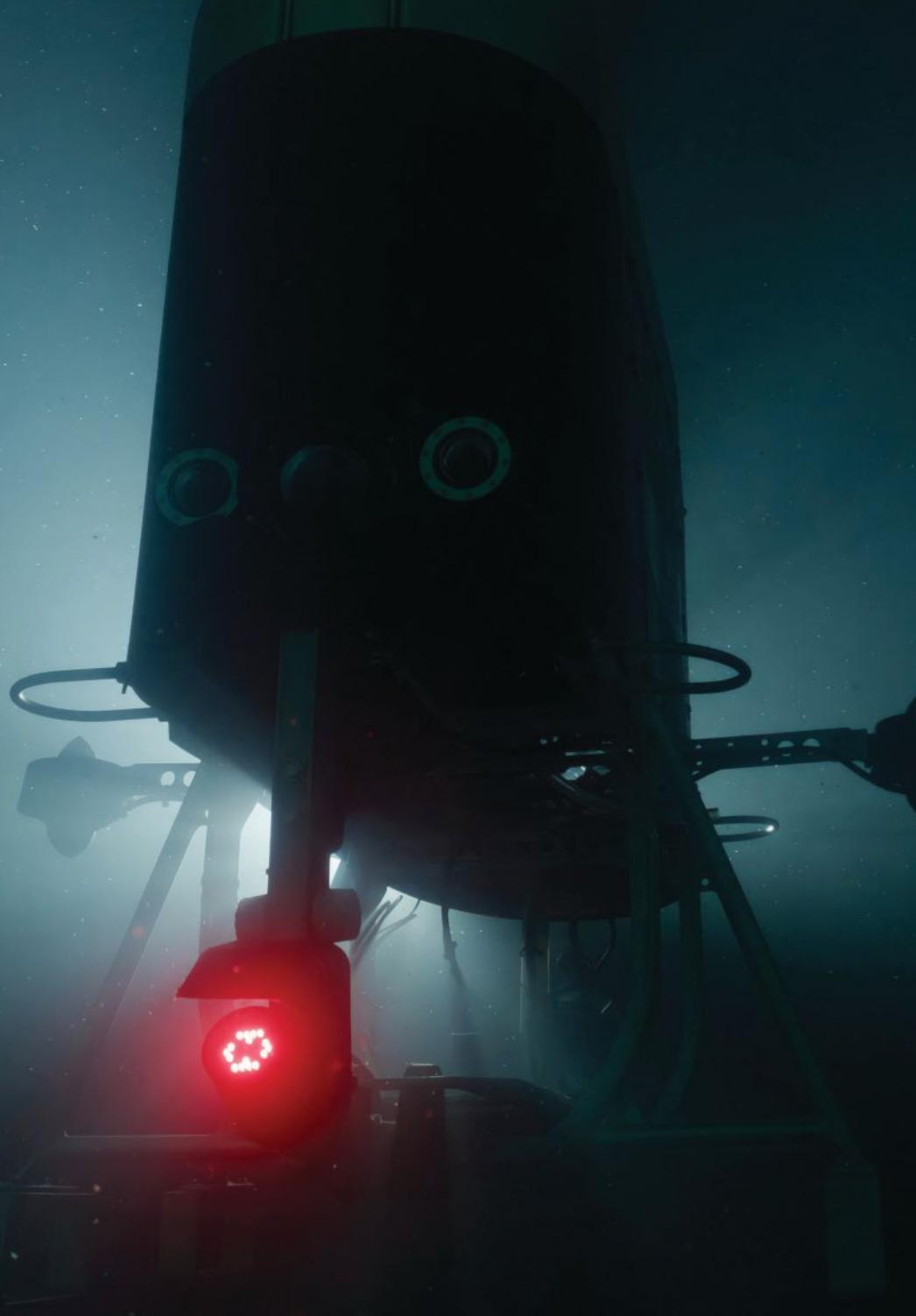
THE WHO'S WHOI OF DEEP-SEA SUBMERSIBLES

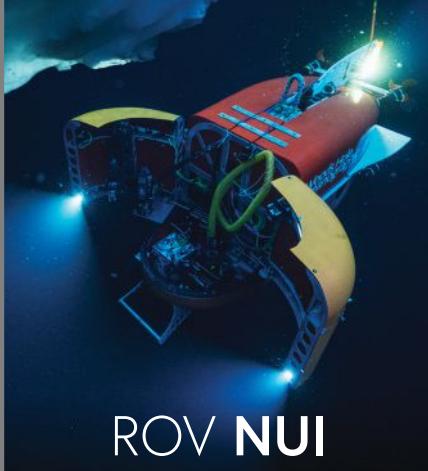
AUV MESOBOT



◀ (Credit: Marine Imaging Technologies, WHOI)

Mesobot is the latest addition to the fleet of submersible platforms operated by WHOI and fills a unique niche in ocean research needs. Specifically designed to operate in the mesopelagic zone 200–1,000 m below the surface, Mesobot operates autonomously using its imaging systems to find, track, and observe life in the largest habitat on the planet. It uses DeepSea Multiray® lights that can toggle between white LEDs for detailed full color imaging, and monochromatic LEDs in the far-red wavelengths that are less disruptive to the natural behaviors of midwater organisms.

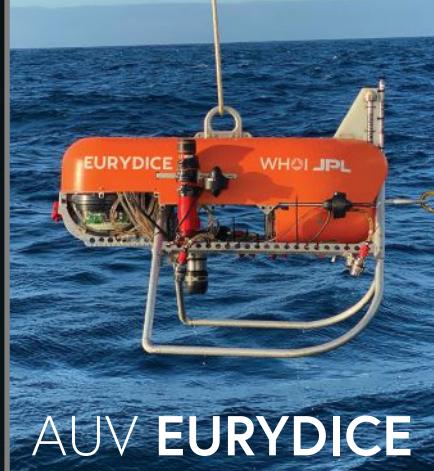




ROV NUI

◀ (Credit: Luis Lamar, Avatar Alliance Foundation)

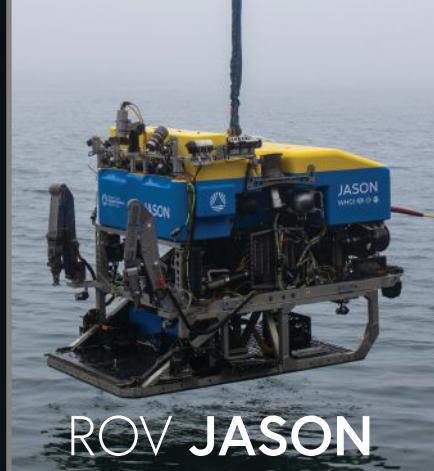
Hybrid ROV Nereid Under-Ice (NUI) has a 5 km operational depth limit, but perhaps more impressive is the 40 km lateral range this system can reach thanks to the neutrally buoyant optical fiber tether connecting it back to the mothership. As the name implies, NUI was designed for the task of exploring and studying the difficult to study and vast under-ice environments in the polar regions. NUI is capable of operating in both a fully autonomous mode to collect data on large areas and providing real-time remote control and telepresence over the light fiber tether.



AUV EURYDICE

◀ (Credit: Tim Shank, WHOI)

Coming from a joint development project between NASA JPL and WHOI, the twin AUVs Orpheus and Eurydice are the first in a new class of vehicles capable of exploring the deepest reaches of the ocean. Cost effective both to build and operate, these vehicles are equipped with advanced mapping and navigation software that allow them to operate independently and navigate unexplored seafloor terrain. Orpheus and Eurydice's payload is designed to be flexible and reconfigurable, and the recent integration of the IP Optim® SeaCam® gives these AUVs 4K imaging capabilities.



ROV JASON

◀ (Credit: Hannah Piecuch, WHOI)

The ROV Jason and Medea two body system is the workhorse of WHOI science operations. Capable of handling everything from delicate biological sampling using the dual manipulator arms to hauling massive payloads up to 4,000 lbs. thanks to its through frame lifting capabilities, no job is too small or too big for ROV Jason. A custom multi-channel FleXlink® media converter onboard Jason provides 4 high definition video feeds from HD Multi SeaCam fixed focus cameras around the vehicle that provide clear situational awareness for the pilot and science teams operating Jason.

HOV ALVIN

HOV Alvin, the iconic crewed submersible operated by WHOI and owned by the US Navy, is the cornerstone of WHOI's deep sea exploration capabilities. The extensive payload capacity and ability to carry three people make Alvin a versatile science platform. Now in its 60th year of operation, Alvin has proven itself time and time again as a valuable resource for understanding and exploring our oceans.

Multiple upgrades and refits have kept Alvin's capabilities relevant to scientific inquiry and expanded its reach into the depths. With a larger titanium crew sphere fitted in 2013 and new syntactic foam added in 2022, Alvin is now certified to operate at a maximum depth of 6,500 m. Alvin is seen here fitted with new Optim® SeaCam® 11,000-m rated 4K zoom cameras on the port and starboard pan-and-tilt units along with near daylight quality 90 CRI SeaLite® Sphere LED lights designed and built by DeepSea Power & Light.

◀ (Credit: Dan Fornari, WHOI)



ⓘ TO FIND OUT MORE ABOUT WHOI'S DEEP-DIVING SUBMERSIBLES, VISIT: whoi.edu

DEEP-SEA DISCOVERY PROVOKES QUESTIONS OF HOW OXYGEN IS PRODUCED

A discovery in the dark depths of the Pacific Ocean is challenging the scientific consensus of how oxygen is produced and has even called into question how life on Earth began.

Photosynthetic organisms like plants and algae use energy from sunlight to create the planet's oxygen, but new evidence, published in *Nature Geoscience*, has shown how oxygen is also produced in complete darkness at the seafloor 4,000 meters below the ocean surface, where no light can penetrate.

A team led by Professor Andrew Sweetman of the Scottish Association for Marine Science (SAMS) in Oban, a partner of UHI, made the "dark oxygen" discovery while sampling the seabed of the Clarion-Clipperton Zone, in the Pacific Ocean, to assess the possible impacts of deep-sea mining. This process would extract polymetallic nodules that contain metals such as manganese, nickel, and cobalt, which are required to produce lithium-ion batteries for electric vehicles and mobile phones.



▲ Species such as rat tail fishes can be found in the deep sea. (Credit: SAMS)

In the experiments, Professor Sweetman and colleagues found nodules carrying a very high electric charge, which could lead to the splitting of seawater into hydrogen and oxygen in a process called seawater electrolysis. Only a voltage of 1.5 V is needed for seawater electrolysis to occur—the same voltage as a typical AA battery. The team analyzed multiple nodules and recorded readings of up to 0.95

volts on some surfaces, meaning that significant voltages can occur when the nodules are clustered together.

Professor Sweetman now says that more investigation into "dark oxygen" production is required during deep-sea mineral extraction baseline investigations, as well as an assessment of how sediment smothering during mining may alter the process:

"When we first got this data, we thought the sensors were faulty because every study ever done in the deep sea has only seen oxygen being consumed rather than produced. We would come home and recalibrate the sensors, but over the course of 10 years, these strange oxygen readings kept showing up."

"We decided to take a backup method that worked differently to the optode sensors we were using, and when both methods came back with the same result, we knew we were onto something ground-breaking and unthought-of."

OCEAN AERO SELECTS FORCYS PAYLOADS TO ENHANCE UNDERWATER DOMAIN CAPABILITIES



▲ The Triton AUSV. (Credit: Ocean Aero)

Forcys has been selected by Ocean Aero as a payload provider for their world-leading autonomous underwater and surface vehicle (AUSV), the Triton.

The Triton is the world's only environmentally powered AUSV. Completely solar and wind powered, it can travel at speeds of up to 5 knots and can submerge for up to 5 days at 2 knots.

The Triton can be used as a force multiplier for defense operations, offering easy logistics, launch, and recovery while evading detection using autonomous avoidance and deep diving capabilities.

Forcys will be supplying Ocean Aero with SPRINT-Nav Mini, the world's smallest hybrid acoustic-inertial navigation technology from its technology partner Sonardyne and Solstice, the leading multi-aperture

sonar (MAS) for autonomous underwater vehicle (AUV) systems, from its technology partner Wavefront Systems.

Dan Zatezalo, Forcys' General Manager and Head of Global Sales, said: "We are thrilled that Ocean Aero has chosen us as their payload provider for defense applications. Their revolutionary technology is a great complement to our offer, and we think their customers are going to love the results."

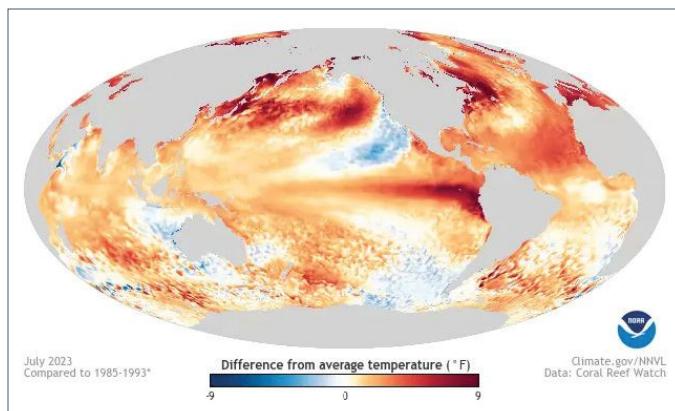
Bob Marthouse, COO from Ocean Aero, added: "A key differentiator in our selection process is the performance to power ratio. We need to maximize the value from our payloads while managing the power consumption to sustain our mission goals. This is where the technology from Forcys makes a significant difference. On our last mission, everyone was highly impressed with the Solstice MAS."

SCIENTISTS EXTEND EL NIÑO FORECASTS TO 18 MONTHS IN ADVANCE

From 2023 to 2024, the world experienced a major El Niño event, affecting everything from global weather and climate to ecosystems and economies. Now, with Foundation support from three grants and a new modeling approach, researchers at the University of Hawaii at Mānoa and other institutions can forecast El Niño-Southern Oscillation (ENSO) events as much as 18 months in advance—a major improvement to conventional climate model forecasting. The findings were recently published in the journal *Nature*.

Traditional operational forecasting models have been able to successfully predict ENSO events with lead times of more than one year. Researchers have been working for decades to change that. The new extended nonlinear recharge oscillator model—or XRO model, as scientists refer to it—offers an opportunity for more accurate and longer lead time El Niño predictions and global climate model improvements, the researchers say.

"El Niño affects the lives of Americans, and those around the world," said Yolande Serra, a Program Director in NSF's Division of Atmospheric and Geospace Sciences, which funded the research along

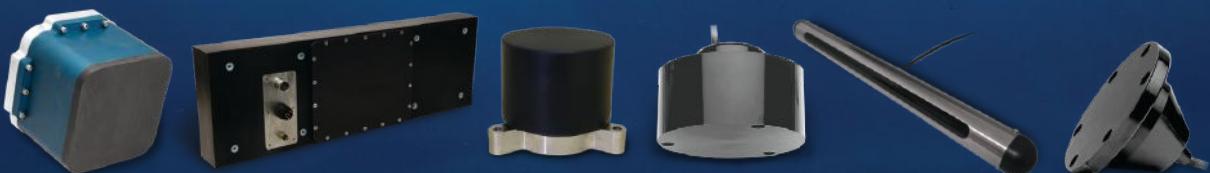


↑ Sea surface anomalies across the Earth in July 2023 during the 2023–2024 El Niño event. (Image credit: NOAA)

with NSF's Division of Ocean Sciences. "The ability to accurately forecast this phenomenon's arrival months earlier," said Serra, "is important to understanding global precipitation patterns."



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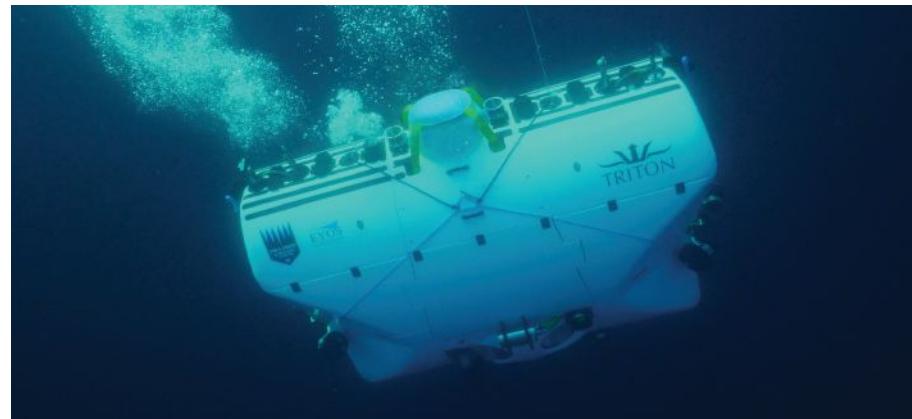
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This month, ON&T visited **Triton Submarines** in Sebastian, FL, for a chat with none other than **CEO and Co-Founder Patrick Lahey**, one of the world's pre-eminent experts on human-occupied vehicles (HOVs). Patrick was recently appointed to the Order of Canada for his outstanding achievement and service to the nation, which includes his leading role in the design and build of the world's deepest diving submersible used to carry out the Five Deeps Expedition in 2018–19.



▲ Triton 36,000/2. (Credit: Triton)

1 ON&T: The Five Deeps Expedition was unprecedented in terms of deep-sea exploration. Five years on, what lessons endure?

PL: The Five Deeps Expedition (FDE) was an extraordinary achievement, a 'tour de force,' and everyone at Triton is understandably proud of the revolutionary new sub or HOV we created for the FDE (the Triton 36,000/2 named Limiting Factor or LF by the original owner and renamed Bakunawa or Baku by the current owner).

Today, Baku has completed 20 dives to full ocean depth, more than 150 dives to depths between 6,000 and 11,000 m, and over 400 dives deeper than 4,000 m in total. During these dives, large areas of the deep ocean have been mapped, countless scientific samples have been collected and close to 100 new species identified.

Given the opportunity, we're committed to developing the next-generation full ocean depth (FOD) Triton sub. There really should be more than just one FOD Triton sub available to the scientific and exploration community. The ocean is vast, and we need to provide those who understand the value

of a human presence in the deep sea with the tools necessary for them to accomplish their objectives.

Subsea technologies have progressed significantly since the launch of the LF (Baku) in 2018. Since then, Triton has developed a FOD and DNV type approved battery system, (the Triton Hadal Battery System or THBS), to address the deficiencies we identified in the original battery system. Also, today we have access to an ever-increasing range of sensors and other equipment that would dramatically enhance the performance and utility of a next generation FOD Triton sub, including improvements to our unique navigation system and the addition of side scan sonar to map the seafloor at high resolution.

We made a transformative upgrade to the propulsion system by replacing geared thrusters with direct-drive units. The noise from the geared thrusters interfered with navigation and communications and required the sub to stop every time the pilot needed to communicate with the surface or update navigation, which was inefficient. With direct-drive thrusters, the pilot can interrogate a lander or communi-



with **Patrick Lahey**
CEO and Co-Founder



cate with the surface while underway with no interruption to the mission.

Navigating 11 km or nearly 6.9 miles below the surface is complicated, but advances in both software and processing technology allow us to locate targets with pinpoint accuracy today.

We will use an electric manipulator on the next generation FOD Triton instead of a hydraulic unit to improve efficiency and optimize performance. We had challenges with oils and their viscosities, and certain water temperatures impaired the hydraulic system's use.

Also, we would use the latest cameras and imaging technologies. The LF/Baku has three viewports: one for the pilot, one for the co-pilot, and one shared by the crew. There are four situational awareness cameras: one each looking forward, aft, to port and to starboard. By combining the latest in imaging technology with the most sophisticated virtual reality systems, we would dramatically enhance both the viewing experience and situational awareness of the crew. HOVs are a visual tool and the more compelling we can make the visual experience, the better we've done our job as a manufacturer.

2 ON&T: On safety, one year on from the OceanGate disaster, what lessons stick out?

PL: Unfortunately, the OceanGate tragedy reinforced old myths about HOVs, which are unfounded and bear no resemblance to reality. Most people don't realize the stringent safety requirements and regulations governing certified and fully accredited HOVs. In fact, it's worth pointing out that certified or classed HOVs continue to enjoy a 50-year track record of perfect safety.

The OceanGate contraption was an aberration, it was an experimental monstrosity that was not subjected to any type of peer review or accreditation process and as such it was not fit for human occupation and should never have carried people.

There's no place for experimental HOVs in the continued human-occupied exploration of the deep sea. We must insist all HOVs comply with the regulations of an internationally recognized and fully accredited certification agency or classification society. This is the best and only way to ensure future tragedies can be avoided.

3 **ON&T: How do you see the role of HOVs evolving alongside the increased application of uncrewed systems?**

PL: All areas of ocean technology are advancing quickly, including the analytical tools we use to design and evaluate complex structures, materials technology and electronics. The capabilities of a modern HOV have advanced so much in the last three decades they're barely recognizable to the primitive machines I started diving in more than 40 years ago but there's still more we can do to augment the utility of HOVs alongside autonomous and remotely operated vehicles.

Robotics, imaging systems, and sensors have transformed ocean exploration, but, for me, there is no substitute for a human presence at the site to experience things firsthand and drink in information in real time. I see AUVs and ROVs as complementary to HOVs.

4 **ON&T: As a pilot, can you put into words what the experience of full ocean depth feels like...**

PL: As a manufacturer, we spend much of our time designing, engineering, building, testing and maintaining HOVs and we don't get enough time to enjoy them like our clients do but I love and still treasure every moment I get to spend diving in a sub and these experiences have profoundly influenced and even transformed my life.

When I started Triton in 2007, we were focused on developing HOVs with extraordinary viewing, and the capacity to safely visit the deepest and most remote places on earth. We began with HOVs rated to 305 m (1,000 ft), moved to 1,000 m (3,300 ft), then on to 2,300 m (7,500 ft), and finally to FOD or 11,000 m (36,000 ft). At Triton, we're determined to extend our reach and broaden our perspective to the maximum.

I have been fortunate to have had so many rich and diverse experiences in HOVs: from



▲ Triton's 3300/3 submersible is capable of diving to 1,000 m and features an ultra-fine control system for precise maneuverability.

being part of salvage projects, such as the space shuttle Challenger recovery in 1986, to working with inspiring filmmakers like James Cameron during his Aliens of the Deep documentary in 2002, to participating in important research missions with brilliant scientists and prominent explorers over the last four decades who share my passion for the ocean. These wonderfully diverse experiences have given me an unique appreciation of the ocean, which was only possible through firsthand experience.

5 **ON&T: What is on the horizon for Triton Submarines in the second half of 2024?**

PL: On August 18, 2024, two of our Triton 3300/3 MKII submersibles (Nadir and Neptune), will be featured in "OceanXplorers"—a six-episode high-end, science-driven documentary series following the elite team of scientists and explorers aboard OceanX's remarkable research vessel, the *OceanXplorer*. Nadir and Neptune dive to 1,000 meters (3,300 feet) with a crew of three people on board.

We also have a new sub in the works—the Triton 660 AVA, the first sub with an elliptical pressure boundary, which is a complete departure from conventional design and by reducing the diameter and lengthening the pressure hull, we can carry more people in a smaller volume while still ensuring they're comfortable. The Triton 660/9 AVA is limited to 200 m (660 ft) because of its unusual geometry, and it weighs just 11 tons—making this unusually configured sub ideal for launching from a cruise ship.

Triton is also developing the first HOV capable of diving to 4,000 meters or (13,123 ft) with a transparent pressure hull made of acrylic 18-inches or 450 mm thick. This new sub (Triton 4KM/2 AE, The Explorer) will allow people to visit the abyssal zone of the ocean in a machine with a transparent pressure hull for the first time in history. The viewing from this uniquely configured craft will be superior to any HOV we've built to date and promises to give the occupants the most immersive experience ever possible in an HOV.

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NEW SEATRAC PARTNERSHIP TESTS USV IN OFFSHORE HYPOXIA MAPPING

Utilizing autonomous uncrewed vehicles and creating a sustainable US Gulf Coast continues to be one of the main goals for The University of Southern Mississippi (USM) and its partnership with SeaTrac Systems. Together, they embarked on a 14-day mission to analyze potential hypoxia levels in the Gulf and its effect on the future of marine life.

Also known as dead zones, hypoxia zones are areas in which oxygen levels in water are decreased due to nutrient pollution caused by runoff rich in nitrogen and phosphorus. Helping these zones regain levels includes decreasing nutrient levels through better agricultural practices, improving wastewater treatment, and watershed management strategies.

The partnership, which also included the National Oceanic and Atmospheric Admin-

istration (NOAA) Office of Marine and Aviation Operations (OMAO), saw a need to act swiftly to map the potential hypoxic zones in the Gulf by using SeaTrac's SP-48 uncrewed surface vehicle (USV).

While fully uncrewed, the remotely operated vessel gathered 24/7 real-time data in the waters and demonstrated sampling procedures and winch for profiling applications. During the project, SeaTrac personnel based in Marblehead, MA, oversaw the remote data collection and mapping. The USV transmitted data from sensors over cellular and satellite connections to servers at USM. The mission set a precedent for greater spatial and temporal data collection enabled through autonomy.

"These results highlight SP-48's ability to replace crewed vessels, avoiding the danger for humans who perform this type of



▲ SP-48 USV. (Credit: SeaTrac)

work manually. This also presents as a cost-effective solution, while the real-time data uploads help to advance operational oceanography and enhance the missions of NOAA," notes SeaTrac Co-Founder Jigger Herman.

The partnership continues to solidify the region's commitment to a sustainable Mississippi Gulf Coast.

AUTONOMOUS AQUATIC ROBOTS TO COLLECT DATA BY SKIMMING OCEAN BACTERIA

Futurists predict that more than one trillion autonomous nodes will be integrated into all human activities by 2035 as part of the Internet of Things (IoT). Soon, almost any object—big or small—will feed information to a central database without the need for human involvement.

Making this idea tricky is that 71% of the Earth's surface is covered in water, and aquatic environments pose critical environmental and logistical issues. To consider these challenges, the US Defense Advanced Research Projects Agency (DARPA) has started a program called the Ocean of Things.

Binghamton University Professor Seokheun "Sean" Choi, Anwar Elhadad, Ph.D. '24, and Ph.D. student Yang "Lexi" Gao have developed a self-powered "bug" that can skim across the water, and they hope it will revolutionize aquatic robotics.

Over the past decade, Choi—a faculty member at the Thomas J. Watson School of Engineering and Applied Science's Department of Electrical and Computer Engineering and director of the Center for Research

in Advanced Sensing Technologies and Environmental Sustainability (CREATE)—has received research funding from the Office of Naval Research to develop bacteria-powered biobatteries that have a possible 100-year shelf life.

The new aquatic robots use similar technology because they are more reliable under adverse conditions than solar, kinetic, or thermal energy systems. A Janus interface, which is hydrophilic on one side and hydrophobic on the other, lets in nutrients from the water and keeps them inside the device to fuel bacterial spore production.

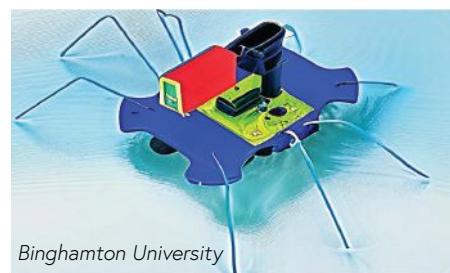
"When the environment is favorable for the bacteria, they become vegetative cells and generate power," he said, "but when the conditions are not favorable—for example, it's really cold or the nutrients are not available—they go back to spores. In that way, we can extend the operational life."

The Binghamton team's research showed power generation close to one milliwatt, which is enough to operate the robot's mechanical movement and any sensors that could track environmental data such

as water temperature, pollution levels, the movements of commercial vessels and aircraft, and the behaviors of aquatic animals.

The next step in refining these aquatic robots is testing which bacteria will be best for producing energy under stressful ocean conditions.

"We used very common bacterial cells, but we need to study further to know what is actually living in those areas of the ocean," Choi said. "Previously, we demonstrated that the combination of multiple bacterial cells can improve sustainability and power, so that's another idea. Maybe using machine learning, we can find the optimal combination of bacterial species to improve power density and sustainability."



Binghamton University

FRAUNHOFER ISOB DEVELOPS NEW USV SYSTEM AS PART OF THREE-YEAR RESEARCH PROJECT

Fraunhofer ISOB (Fraunhofer Institute of Optronics, System Technologies, and Image Exploitation IOSB) has developed a new USV that incorporates both sonar imaging and an optical system with two integrated cameras from IDS Imaging Development Systems.

The TAPS project seeks to optimize the use of uncrewed assets to accurately and efficiently shoreline waters, above and below the surface.

The USV, which measures approximately 2 x 1.5 x 1 m, travels along the relevant waterway and automatically avoids obstacles, whether stationary or moving. At a speed of 2 knots such a mission can last up to 20 hours.

The USV supports two uEye FA industrial cameras attached to a mast to facilitate infrastructure inspection as well as 3D

modeling of the shore-based features. Camera housings, lens tubes, and screwable connectors meet the requirements of IP code IP65/67 and are thus optimally pro-

tected against dirt, dust, and splash water.

The model used has the large-format 1.1" CMOS sensor IMX304 from Sony and delivers clear, noise-free images with a resolution of 4096 x 3000 pixels. high resolution cameras.

After data acquisition, the recorded images are transmitted together with the GNSS data to a ground control station, where a photogrammetric reconstruction is carried out. The 3D model can then be used for other tasks, such as visual inspections or bank monitoring.

As well as robustness and comprehensive weather protection, compact form factor was a prime consideration in camera selection. Integration via the standard GigE Vision interface enables the development and use of one driver for several systems with different cameras.



1 The USV is equipped with two uEye FA industrial cameras from IDS mounted on a mast to visually map above and below the waterline. (Credit: IDS Imaging Development Systems GmbH)

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MYSTERY SOLVED

Side scan sonar data helps discover lost aircraft N400CP



Garry Kozak
GK Consulting



THE RESULTING IMAGES CLEARLY SHOWED A LARGE DEBRIS FIELD REPRESENTATIVE OF A JET AIRCRAFT CRASH, BUT AN ROV DIVE WAS NEEDED TO GET PHOTOGRAPHIC CONFIRMATION THAT THIS WAS INDEED N400CP.

On January 27, 1971, a team from Atlanta, Georgia, real estate firm—Cousins Properties—had a team working on an urban renewal project in Burlington, Vermont. On completion of their business, the team scheduled a departure from Burlington International Airport on their corporate Rockwell Jet 1121 Commander registration N400CP.

The jet took off at 7:52 pm, heading northwest before making a left turn towards Providence, Rhode Island. The weather was bitterly cold, with a ceiling of 1,500 feet scattered with visibility of 5 miles, and a temperature of -4 degrees F. The takeoff appeared normal. The control tower followed the jet's progress as it made the left turn over Lake Champlain. The last radar point showed the jet on a heading of 170 degrees magnetic; then, all contact was lost. No mayday or communication was ever received. The plane's last radar position was approximately seven to eight miles from the airport on a heading of 270 degrees magnetic from the airport radar.

THE SEARCH BEGINS

Search and rescue operations began immediately, first by air and then attempting to use a small submarine. With temperatures plummeting, the lake soon froze over, and the search was suspended until the following spring. During the ice melt, debris from the plane was found on Shelburne Point, suggesting the wreck may be west of that area. Undersea search specialists Ocean Systems



▲ N400CP at Burlington International Airport just before the disappearance. (Credit: Barbara Nikitas)

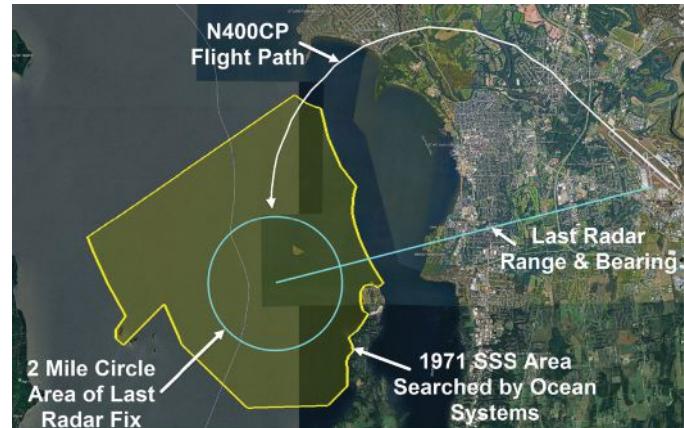
Inc. of Reston, Virginia, was contracted to investigate an area to the south of Juniper Island and west of Queneska Island. After two weeks, they still had not found that plane. At least 17 similar search operations would be carried out over the following years, the latest in 2014.

THE SEARCH CONTINUES

In 2014, a new search team arrived at Lake Champlain, and using the latest marine technology, an autonomous underwater vehicle (AUV) fitted with side scan sonar to perform the search, but again, there was no success. I had followed the story of the missing aircraft over the years and was convinced that critical details were being overlooked. Aware of side scan sonar data collected in 1997 to map archeological points of interest by Tom Manley of Middlebury College and Chris Sabick of the Lake Champlain Maritime Museum, I was able to scrutinize the survey results for any anomaly that could possibly unlock the mystery. Four suspicious anomalies were flagged.

FALSE ALARM

The project was put on hold until 2022, when I joined forces with Hans Hug of Sonar Search and Recovery in Exeter, NH, and his associate Bruce Stebbins from Billerica, MA. We conducted a remotely operated vehicle (ROV) dive to examine the first of the anomalies. It was not the plane.



▲ N400CP Flight Path and Area of Past Searches. (Credit: G. Kozak)



▲ N400CP custom black and red color livery. (Credit: G. Kozak/T. McDonald)

Then, in June 2023, Hug and I returned to the lake armed with a side scan sonar to relocate the other three anomalies. A subsequent ROV dive on July 6, 2023, showed shredded aluminum sheets with classic rivet holes, wing sections, and other plane parts. However, closer inspection showed stenciling on some of the aircraft parts, which suggested it was a military plane. The wreckage was later confirmed as a USAF Boeing model from the 1950s.

N400CP DISCOVERED

During the winter of 2023, I revisited the 1997 sonar and noticed another slight anomaly in approximately 200 feet of water West of Juniper Island, so it was flagged as a possible target of interest. On May 19, 2024, Hug and I returned to Lake Champlain to re-locate the target. Hug's high-resolution EdgeTech 4125i side scan sonar system was used because of its almost photographic capability. The resulting images clearly showed a large debris field representative of a jet aircraft crash, but an ROV dive was needed to get photographic confirmation that this was indeed N400CP.

ROV VIDEO CONFIRMATION

Tim McDonald of Marine Solutions, a marine contractor in Meredith, NH, joined the team to contribute his ROV and expertise.



▲ CJ 610 engine wreckage. (Credit: G. Kozak/T. McDonald)

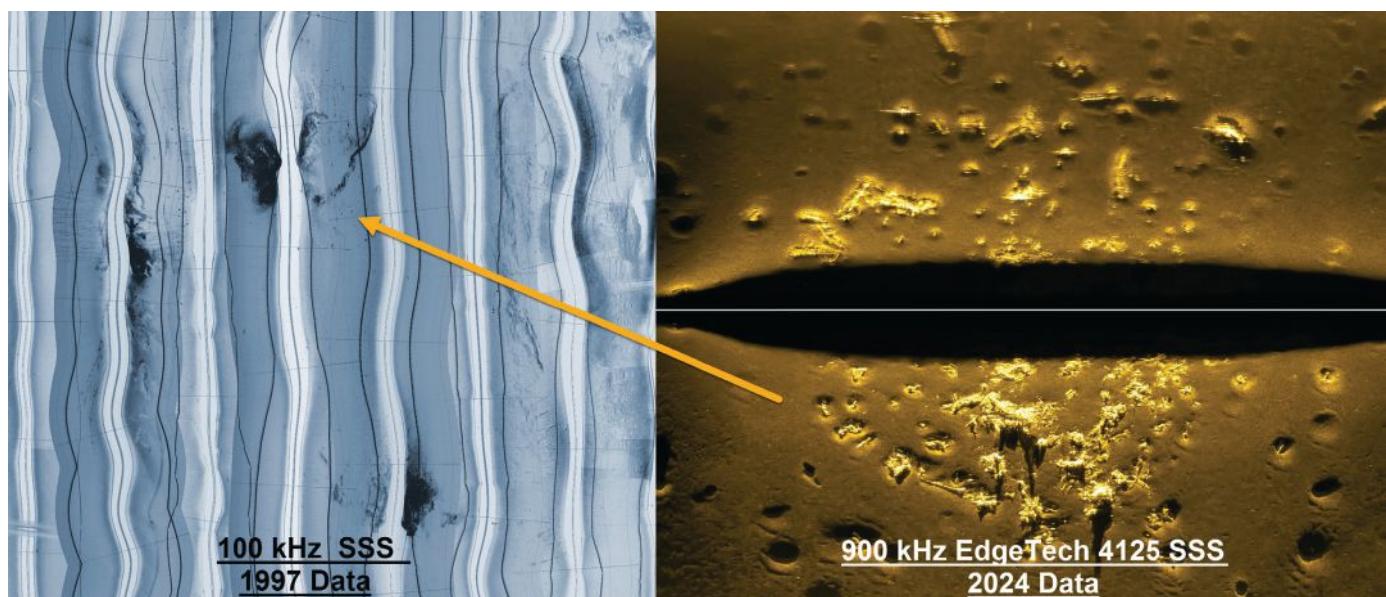
On May 25, 2024, the ROV was dropped to the lake floor, and the real-time video transmitted to the surface showed a broken plane fuselage, painted white with a red and black accent striping, the same custom paint scheme as N400CP.

Nearby were the remains of two turbine jet engines along with a broken wing. A section of the instrument panel was located along with wire bundles from the cockpit area. The video and pictures left no doubt that N400CP had finally been located and a 53-year-old mystery solved. Only video and pictures were recorded, and the wreck site was not disturbed in any way out of respect for the five people on board who lost their lives.

CLOSURE

The mystery of where the remains of the N400CP is finally known. The families of those lost were notified and were shocked to hear that the plane had been located and were very appreciative to know where their family members lay. Out of respect, the location will be kept confidential because it is a grave site.

2kozak.com
edgetech.com



▲ The original anomaly in 1997 data that lead to the crash site of N400CP. Wreckage confirmed with an EdgeTech 900 kHz SSS. (Credit: G. Kozak/H. Hug)



▲ AUV Ran deployed to survey the Dotson Ice Shelf in West Antarctica. (Credit: Filip Stedt)

AUV HELPS FURTHER UNDERSTANDING OF MELTING ICE SHELVES

An autonomous underwater vehicle (AUV) deployed by an international research team to monitor a glacier in Antarctica has yielded the first detailed maps of the underside of an ice shelf, revealing clues to future sea level rise. The findings are reported in the journal *Science Advances*.

"We have previously used satellite data and ice cores to observe how ice shelves change over time," explained Professor Anna Wåhlin from the University of Gothenburg and the paper's lead author. "By navigating the submersible into the cavity, we were able to get high-resolution maps of the ice underside. It's a bit like seeing the back of the moon for the first time."

"Our ability to project the future of the global coastline from rising sea levels in a warming world critically depends on data we obtain from beneath Antarctic ice shelves," added Professor David Holland from New York University's Courant Institute of Mathematical Sciences and one of the paper's authors.

The scientists programmed AUV Ran to dive into the cavity of Dotson Ice Shelf, 350 meters thick and located in West Antarctica, and scan the ice above it with an advanced sonar system. Dotson Ice Shelf is considered to have a potentially large impact on future sea level rise due to its size and location.

Over 27 days, the submarine traveled more than 1,000 km back and forth under the glacier, reaching 17 km into the cavity in order to capture the phenomena surrounding it.

Using the data captured by the AUV, the scientists were able to measure the currents below the glacier for the first time and prove why the western part of Dotson Ice Shelf melts so fast. The mapping showed, not surprisingly, that the glacier melts faster where strong underwater currents erode its base and, in particular, very high melt at vertical fractures that extend through the glacier.

But the findings also showed new patterns on the glacier base that raise troubling questions. The base is not smooth, but there is a peak and valley ice-scape with plateaus and formations resembling sand dunes. The researchers suggest that these may have been formed by flowing water under the influence of Earth's rotation.

"Earth's rotation is critical to understanding most phenomena in the climate system, notably hurricanes and other severe-weather phenomena," noted Holland. "It seems these exotic under-ice features are also intimately controlled and shaped by the spinning of the Earth."

"The maps that Ran produced represent a huge progress in our understanding of Antarctica's ice shelves," added Karen Alley, a glaciologist from the University of Manitoba and co-author of the paper. "We've had hints of how complex ice-shelf bases are but Ran uncovered a more extensive and complete picture than ever before. The imagery from the base of Dotson Ice shelf helps us interpret and calibrate what we see from the satellites."

Much of the fieldwork for the *Science Advances* study was conducted in 2022 when Holland led a team to install a mooring beneath the ice shelf. This innovative engineering effort involved drilling a 1,000-foot-deep, one-foot-wide hole through the ice shelf using a hot water drill. The mooring was successfully installed before the ice froze again, allowing scientists to collect data continuously for the past two years—and to produce a time series of the changes in the melting at the bottom of the ice shelf.

"The mapping has given us new data that we need to look at more closely," concludes Wåhlin. "It is clear that many previous assumptions about the melting of glacier undersides are falling short. Current models cannot explain the complex patterns we see. But with this method, we have a better chance of finding the answers."

FAROUNDER LAUNCHES CSB DATA EXPLORER TO HELP ACCELERATE SEAFLOOR MAPPING EFFORTS

FarSounder has launched CSB Data Explorer, a web-based platform that enables contributors of CSB (crowdsourced bathymetry) data to easily see where they've made contributions and gauge their support of the CSB community. This tool provides a visualization of where your vessel or vessels are making a difference in the ongoing task of mapping the world's oceans.

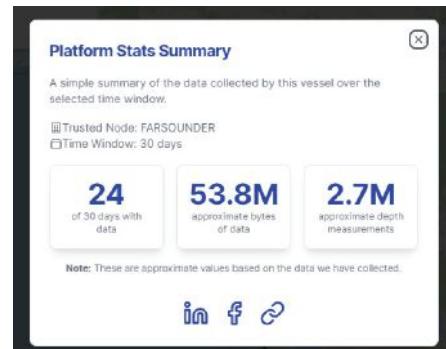
The CSB Data Explorer is an intuitive dashboard enabling users to view their contributions and monitor statistics highlighting the value of their individual contributions. In an effort to provide additional motivation through gamification, contributors can also compare their contributions to the overall FarSounder fleet's contributions and view the entire International Hydrographic

Organization's (IHO) CSB database on top of a global map.

"FarSounder has been a conduit for our customers to contribute bathymetric data to global mapping initiatives for more than six years. This dashboard was created as a result of our recent expansion of customers' anonymous donations with the latest software's ability to upload gathered data directly to the cloud," said Matthew Zimmerman, CEO of FarSounder.

The CSB Data Explorer was created in partnership with the International SeaKeepers Society, the IHO, and The Nippon Foundation-GEBCO Seabed 2030 Project.

Jamie McMichael-Phillips, Seabed 2030 Project Director, added: "CSB initiatives bring us significantly closer to our goal of



achieving a complete map of the ocean floor, which is beneficial for a whole host of reasons, including empowering the world to make policy decisions, manage the ocean sustainably and undertake scientific research. Every contribution, no matter how small, is invaluable in bringing us one step closer to a fully mapped seabed."

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BOEM RELEASES FINAL EIS FOR WIND PROJECT OFFSHORE MARYLAND

The Bureau of Ocean Energy Management (BOEM) recently announced the availability of its final Environmental Impact Statement (EIS) for a proposed wind project offshore Maryland. BOEM has now completed environmental reviews for ten commercial-scale offshore wind projects since the start of the Biden-Harris administration. If approved, this project could generate between 1,100 and 2,200 megawatts of clean, renewable energy for the Delmarva Peninsula, and power up to 770,000 homes.

US Wind is seeking approval for its proposed Maryland offshore wind project, which includes three planned phases. Two of those phases, MarWin and Momentum Wind, have received offshore renewable energy certificates from the State of Maryland.

BOEM held three public scoping meetings in June 2022 to solicit public input on the



environmental review process and hosted two in-person and two virtual public meetings in October 2023 to gather feedback on a draft of the EIS from Tribal Nations, local community members, commercial fishing interests, and other ocean users.

If approved, the project proposes to install up to 114 turbines, up to four offshore substation platforms, one meteorological tower, and up to four corridors for offshore

export cables, which would make landfall in Delaware Seashore State Park. The lease area is approximately 8.7 nautical miles (nm) offshore Maryland and approximately 9 nm offshore Sussex County, Delaware, at its closest points to shore.

If approved, the development and construction phases of the project could support an estimated 2,679 jobs annually over seven years.

CORVUS RECEIVES RINA TYPE APPROVAL FOR LARGE-SCALE BLUE WHALE ESS

Corvus Energy has announced that it has received Type Approval from RINA for its large-scale marine energy storage system (ESS), the Blue Whale ESS.

RINA Type Approval confirms that the Blue Whale ESS complies with RINA Rules for the Certification of Lithium Battery Systems. This approval, along with recently awarded type approval from DNV, demonstrates that the large-scale energy storage system

complies with the most stringent rules, regulations, and safety requirements in the industry, as defined by leading maritime class societies.

The result of a multimillion-dollar development program, the Blue Whale ESS is designed specifically for large vessels, like Cruise Ships, Ro-Pax and Service Operation Vessels (SOV), and vessels that require a large amount of energy.

The Blue Whale design incorporates the unsurpassed safety features of the Corvus Orca ESS, the world's most installed marine energy storage system, along with additional features that make it better equipped to meet the energy demands of large vessels.

For example, optimized energy density enables the Blue Whale to deliver more power. This, in turn, can extend the vessel's ability to achieve and maintain zero-emission operations, including during transit through emissions-restricted zones and port stays.

In addition to securing type approval from RINA and DNV, Corvus Energy is pursuing type approval from BV and ABS for the Blue Whale ESS.

More than fifteen Blue Whale orders, cumulatively totaling over 95 MWh, are already confirmed for delivery in 2024, 2025, and 2026, and the production facility is scaled for future capacity needs.



Rendering of a Corvus Blue Whale ESS. (Credit: Corvus Energy)

DOE ANNOUNCES FUNDING OPPORTUNITY FOR OFFSHORE WIND RESEARCH AND DEVELOPMENT

The US Department of Energy's (DOE) Wind Energy Technologies Office (WETO) has announced the Offshore Wind National and Regional Research and Development Funding Opportunity, which will award \$48.6 million for projects that address several major areas of need for offshore wind.

The areas include accelerating research and development of floating offshore wind platforms; exploring innovations for fixed-bottom foundations; improving offshore wildlife protection through new monitoring technologies; expanding the reach of the domestic supply chain; advancing US academic leadership in floating offshore wind; and investigating solutions to protect future infrastructure from lightning.

This funding opportunity represents one of DOE's single largest investments in offshore wind, comprised of \$48 million in funding from WETO with \$600,000 in funding support from the US Department of the Interior's (DOI) Bureau of Safety and Environmental Enforcement (BSEE).

Together, successful projects addressing the following topic areas under this funding opportunity announcement (FOA) will speed up the use of wind power off US coasts and contribute to a robust clean energy economy driven by a carbon-free power sector.

Topic Area 1: Floating Offshore Wind Platform Research and Development (\$20 million)

Topic Area 2: Innovation for Fixed-Bottom Offshore Wind Foundation Types and Supporting Infrastructure (\$7.5 million)

Topic Area 3: Technology Advancement to Inform Risk to Birds and Bats from Offshore Wind Energy (\$8 million)

Topic Area 4: Development of a Manufacturing and Supply Chain Offshore Wind Consortium in Great Lakes Region (\$5 million)

Topic Area 5: Floating Offshore Wind Center of Excellence (\$3.8 million)

Topic Area 6: Protecting the Future Offshore Wind Fleet against Lightning (\$4.3 million)

DOE and agency partners seek diverse applicant teams and this FOA seeks to encourage the participation of underserved communities and underrepresented groups. Applicants are highly encouraged to include individuals from groups historically underrepresented in the fields of science, technology, engineering, and math on their project teams.

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“THE INHERENT BENEFITS OF OBSERVING THE DEEP UNDERWATER ENVIRONMENT WITH THE NAKED EYE FROM A SAFE AND COMFORTABLE TRANSPARENT CABIN EXTEND FAR BEYOND SIMPLY FULFILLING THE DREAMS OF ADVENTURE SEEKERS.”

The human eye is a marvel of biological engineering, offering unparalleled adaptability and perception, especially in challenging environments, such as the underwater realm. Unlike cameras, which often require special filters and lighting to capture clear images beneath the surface, the eye's capability to perceive subtle color variations, motion, and depth in real time provides a richer, more accurate experience than any artificial lens can achieve. This natural adaptability and sensitivity to subtle changes in the underwater environment make our eyes remarkable tools for underwater exploration and observation.

Anyone who has had the opportunity to dive in a human occupied vehicle (HOV), or manned submersible, can attest to the vast difference between seeing the underwater world with the naked eye from inside the vehicle and viewing footage or images of the same dive—it simply doesn't compare. This simple fact is one of the key benefits that manned subs offer to various marine sectors, serving diverse purposes and objectives.

IMMERSIVE EXPERIENCE

The recreational and tourism marine sectors have been keen adopters of manned submersibles precisely for the incredible underwater viewing experience that these subs can provide to their occupants. Founded in 1995, SEAmagine, headquartered in California, is a prominent manufacturer of both personal and professional manned submersibles, and recently unveiled its latest AURORA series featuring five-to-nine-person interior configurations, emphasizing exceptional passenger viewing quality, comfortable seating, substantial personal space, a tranquil and quiet environment, and an overall enhanced passenger experience.

The company's AURORA submersible series feature a remarkable extra-large singular spherical acrylic window in which the passengers sit, as well as an additional rear metal hull to further increase the interior space for occupants and to separate the pilot area from the passenger area. This enhances privacy and personal space for passengers seated in the front window while ensuring the pilot remains comfort-

able and unhindered in the rear. The large spherical geometry of the acrylic window offers occupants superior optics in all directions since it ensures that their line of sight remains at a consistent 90-degree angle to the window's curvature, eliminating distortions that may occur with other window geometries.

Another remarkable feature is the serene and quiet interior of the cabin. The AURO-RAs boast powerful propulsion thrusters that operate without gearboxes, ensuring there is no loud pitching noise from the motors that could startle sea life or create an annoying hum inside the sub. To further enhance the peaceful atmosphere within the cabin, SEAmagine's interior design prioritized a quiet air conditioning system and fans, contributing to the tranquil environment. SEAmagine considers soundlessness an essential feature of its submersible designs, allowing passengers to have conversations undisturbed.

SEAmagine has extensively optimized the design of its submersibles to make passenger boarding and disembarking comfortable while the vehicle floats on the

surface. Unlike conventional designs with entry hatches atop acrylic bubbles (which impede the viewing field), SEAmagine's patented approach allows passengers to board via a horizontal top-deck with handrails, entering through the rear metal section of the hull and descending a short staircase to their seats. This design enhances convenience and safety for passengers, while ensuring panoramic visibility.

MORE EXPLORATION, MORE SCIENCE

The inherent benefits of observing the deep underwater environment with the naked eye from a safe and comfortable transparent cabin extend far beyond simply fulfilling the dreams of adventure seekers. SEAmagine has just recently delivered a scientific version of its three-person AURORA submersible, which is depth-rated to 1,300 meters and is equipped with various subsea tools and sampling devices. This SEAmagine submersible is embarking on a five-year National Geographic Pristine Seas expedition supporting scientific research aimed at expanding protected marine sanctuaries and achieving other scientific objectives. You can follow the sub's scientific journey across the tropical Pacific, starting this Fall, by finding Pristine Seas @natgeopristine seas on Instagram, Facebook, and TikTok.

This AURORA sub was custom fit with a sturdy protective cage surrounding it, designed to interface more effectively with the moon pool of the research vessel to which it is being integrated.

To assist the science work, the underwater navigation is based on GNSS, DVL, USBL, and Fiber-Optic Gyroscope. The vehicle is



A view from inside a SEAmagine 3-person submersible, poised just below the water's surface and ready to commence its dive. (Credit: SEAmagine)

equipped with a robust manipulator, sample trays, mud samplers, water samplers, CTDs, 8K UHD camera, imaging sonar, adjustable underwater lighting, scaling lasers, and even an eDNA sampling system.

Underwater eDNA sampling involves collecting and analyzing genetic material from the water to study the presence and diversity of organisms within aquatic environments. This method is particularly useful for marine biology, ecology, and conservation efforts, as it provides a non-invasive and efficient way to monitor biodiversity and detect specific species, including those that are elusive or rare. The submersible was equipped with eighteen eDNA pump samplers each individually programmable to automatically sample along specific depth profiles and time durations during a given dive cycle.

The combination of advanced subsea tools at the fingertips of the occupants inside the submersible, along with the occupants' unique perspective gained through direct, in situ observations, enhances insightful understanding and real-time decision-making. This highlights the enduring significance of manned submersibles as essential tools for advancing our knowledge of the ocean.

MORE OCEAN DISCOVERIES

Whether used for recreation or deep ocean science, manned submersibles enable greater accessibility to the depths so more people can make meaningful ocean discoveries.

Once you descend below 100 meters in a sub, there is a good chance you will see something undiscovered. The number of new observations already made from our subs is astounding, a frequency and occurrence that will only grow as sub operator dives become more common.

"Deep-sea penetration technologies, such as SEAmagine's, are a Godsend for scientific research and a better knowledge of these extremely difficult-to-access environments. They embody the partnership between researchers and private sea enthusiasts, which falls under the aegis of the 'citizen science' concept," remarks Dr. Eric Clua DVM Ph.D. of the Center for Insular Research and Observatory of the Environment.

While SEAmagine subs are designed to grant first-hand access to "extremely difficult-to-access environments," safety remains our number one priority. With an impeccable record of over 12,000 dives completed, SEAmagine boasts a proud reputation for a range of submersibles ranging from two to nine-person capacity, capable of diving depths from 100 to 2,300 meters. All models can be customized to meet specific requirements and are formally approved and classed by the American Bureau of Shipping (ABS).

SEAmagine.com

Launch of SEAmagine's 5-person AURORA-90 model during its sea trials at King Harbor in Redondo Beach, California. (Credit: SEAmagine)



SALUNDA SAFETY TECHNOLOGY SELECTED BY O&G MAJOR IN NORTH SEA

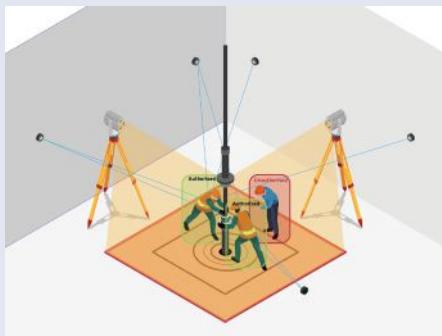
Salunda, the global leader in digitized solutions for safety critical industries, has secured an agreement to provide bp with its Crew Hawk Red Zone monitoring solution for use across the operator's North Sea assets.

The regional roll-out has been agreed following successful field trials of the system on bp's Clair Ridge platform and has been adopted to ensure safer Red Zone management for various hazardous operations.

It is the first time the technology has been used for well interventions.

Crew Hawk wirelessly monitors hazardous working environments in real time, tracking individuals and equipment to provide anonymized feedback that focuses on safe operations and minimizing risk.

Crew Hawk, which meets, or surpasses, the industry's stringent certification requirements (MET, IECEx and ATEX), allows users to set up perimeters in the working environment around areas that pose the greatest risk to personnel.



On entering an exclusion area, or Red Zone, notifications are sent to the individual's wearable device and other supervisors. (Credit: Salunda)

For dynamic situations, a zone can be triggered around activated equipment or machinery. Individuals then receive direct alerts should they enter these zones.

When an individual enters an exclusion area, or Red Zone, it instantly triggers an alarm, sending notifications to both the individual's personal locator and the area authority, allowing both parties to take corrective action.

Performance dashboards offer an overview of operational and safety statistics, while a playback feature allows for a more in-depth investigation of zone violations or incidents in a work area.

Heatmaps of the location of individuals can be used to optimize operating procedures, people placement and area layout.

TENNET & INTERTEK EXTEND COLLABORATION FOR OFFSHORE WIND GRID CONNECTION

Intertek, a leading Total Quality Assurance provider to industries worldwide, has been re-appointed by transmission system operator TenneT to provide long-term client representation services in support of North Sea offshore wind grid connections.

The European energy transition is a significant challenge, and its goal is to make Europe the first climate-neutral continent by 2050. As a result, Germany has set ambitious targets for offshore expansion. TenneT, a leading European transmission system operator, is connecting offshore wind farms in the Dutch and German North Sea to the onshore electricity grids of these countries.

Intertek Metoc has been appointed for the full framework contract scope that includes specialist client representation for maritime surveys, transport & installation (T&I) and technical inspection, repair and maintenance (IRM) work on offshore platform structures, and subsea cable installation and repair activities. The surveys include geophysical and geotechnical cable route surveys, UXO surveys and identification and clearance operations, subsea cable depth measurements, erosion studies, and geotechnical exploration drilling.

Dr. Andrew Page, Intertek Metoc Head of Site Characterisation and Engineering, commented: "We are delighted to have been selected by TenneT to continue our long-term relationship providing expert assurance services for critical North Sea offshore wind connections. It is exciting to be working on critical projects such as these and contributing our expertise to support acceleration of energy transition efforts in the region."

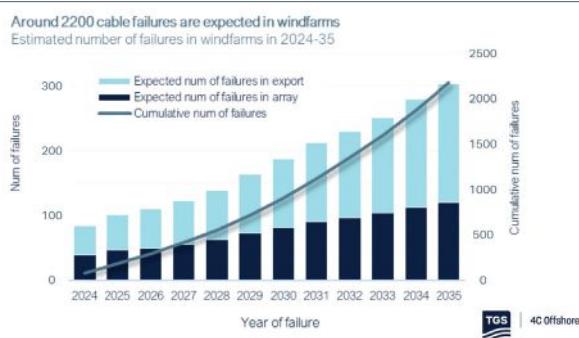


TenneT/Intertek

CABLE FAILURE PREDICTED TO BE CHALLENGE FOR THE FUTURE OF OFFSHORE WIND

TGS, the leading global provider of energy data and intelligence, has, for the first time, included a comprehensive analysis of cable failures in its latest quarterly Offshore Transmission and Cables report. This detailed report provides an in-depth examination of offshore wind cables and interconnectors, offering critical insights for industry stakeholders.

Leveraging specialist market intelligence from 4C Offshore, the report delves into the causes of cable failures in offshore wind, examines associated costs, and includes several case studies highlighting real-world impacts and solutions. It presents new data on



failure rates of offshore wind cables and interconnectors, predicting approximately 3,600 cable failures between 2024 and 2035, potentially costing around EUR 61.5 billion (\$66.5 billion).

Beyond cable failures, the report provides regular analysis of offshore transmission-related infrastructure, covering offshore wind platform demand, interconnector updates, changes in national environmental policies, ambitions influencing offshore transmission and cables, and global offshore grid developments.

This quarter's report forecasts strong demand for offshore wind platforms from 2024 to 2040. It anticipates the installation of approximately 832 substations globally during this period, underscoring the growing footprint of offshore wind infrastructure. The report also details recent developments and progress in European interconnector projects.

This latest report reinforces the fact that, with demand as robust as ever and 2030 targets looming, it's vital to understand the realities of cables and transmission, including the present and future risks and challenges.

The Q2 2024 Offshore Transmission and Cables Report is now available for subscribers to 4C Offshore market intelligence.

KENT WINS CONTRACT FOR CSU WITH SHELL

Kent, a leading engineering and services company, is pleased to announce it has been awarded a global three-year enterprise framework agreement (EFA) by Shell to provide Commissioning and Start-Up Services (CSU) across various onshore and offshore projects.

This contract encompasses a wide range of energy sectors, including oil, gas, and new energy initiatives, and reinforces Kent's opportunity to enhance project execution and efficiency globally.

Kent will support the portfolio with their highly experienced CSU workforce while implementing its best-in-class commissioning processes, systems, and tools throughout the program of works, including its custom-built Commissionability™ software.

This strategic contract will seek to support Shell in their desire to improve performance metrics by eliminating outcome variability related to commissioning readiness and execution while optimising the start-up schedule and reliability of new facilities.

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COMMODITY MARKETS FLUCTUATE

Prices remain under pressure



G. Allen Brooks

*Senior Fellow of the National Center
for Energy Analytics*



Energy Musings

energymusings.substack.com

CRUDE OIL

What is happening in the crude oil market is not on the front page of newspapers. Conditions are good for consumers because oil prices and petroleum product availability do not worry the average American. Regular gasoline pump prices are about \$3.45 a gallon, consistent since mid-March. Drivers would like them to be lower, but the pump price has been stable despite crude oil prices fluctuating between the low \$70s to the mid-\$80s a barrel.

US crude oil production continues to establish new records. Since 2012 when the shale oil revolution began, domestic production has grown 127 percent. Oil production continues growing despite concerns of operators that output growth from the giant Permian Basin oil field is slowing.

What has kept global oil prices stable is the uneven performance of economies

around the world. When forecasters predict rapid economic growth in one country or region, oil traders bid up oil prices. But when that growth fails to materialize or falls short of the forecasts, traders sell their oil contracts.

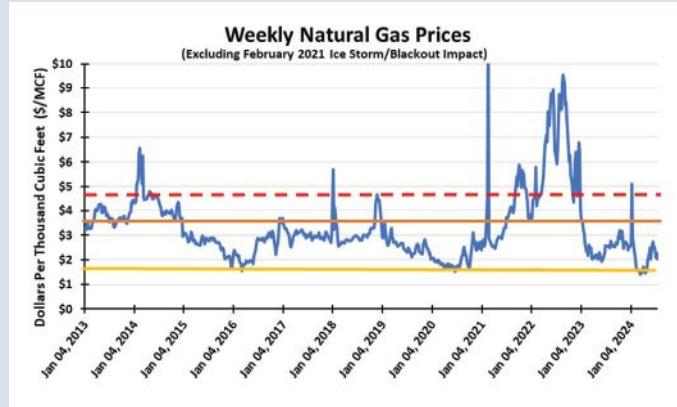
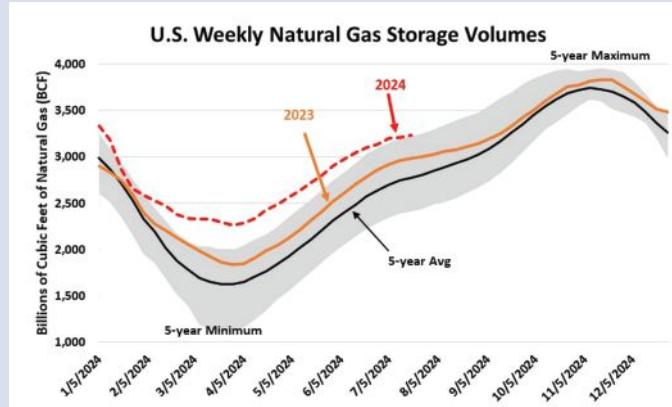
So far, 2024 has seen several episodes of false oil demand surges followed by market price disappointments. Compared to the first half of 2023, global oil imports (oil trade) this year are down by 151,000 barrels per day. That shortfall is from an average daily volume of 68 million barrels, representing a shortfall of two-tenths of one percent. Could that be within the margin of error since all these numbers are estimates? Comparing monthly volumes for the two years, we find January and February down in 2024 but up significantly in March and April before declining in May and June.

The market's cyclical has been managed masterfully by Saudi Arabia, the leader of

OPEC, and the country willing to absorb the biggest output cut to ensure stable oil prices. Saudi Arabia has played the controller role before. It has not been afraid to punish OPEC partners if they stray from the group's affirmed position. That happened in the early 1980s and again in 2014. Each time, consumers won as oil prices collapsed. Producers want and need reasonable oil prices to support their government needs while not destroying oil demand.

Signs of weakening economic growth are emerging, along with data showing inflation slowing. That combination should drive the Federal Reserve to cut interest rates. Additionally, exploding government debt would benefit from lower interest rates. The alternative to these economic and monetary conditions has tempered economic growth and oil demand. Lower interest rates and inflation should spur economic growth along with oil demand. That scenario will support oil prices.

JULY HEAT TRIMMED GAS STORAGE BUT DIDN'T HELP PRICES



Range-bound oil prices, coupled with uncertainty about future oil demand, keep investment in finding new hydrocarbon resources in check. Energy company surplus cash flows have gone to shareholders and financial deleveraging. In the future, less exploration spending will mean a tighter oil supply/demand balance pushing up oil prices. That is the road map to higher oil prices. How quickly it becomes a reality is unknown, but history suggests it is coming.

NATURAL GAS

Early July heat helped reduce the huge storage surplus that has dominated the discussion of pricing natural gas for much of this year. As of the most recent week's natural gas storage data, the current surplus is almost in line with the five-year peak storage volume of the same week. However, the progress in reducing the storage surplus did little for natural gas prices. They risk falling below the \$2 per thousand cubic feet level, a critical marker for gas traders and power company gas buyers.

One would have thought the heat would drive up natural gas demand. Depending on which day is highlighted we get different stories about market conditions. For example, a recent chart on the Energy Information Administration's (EIA) website shows that on July 9, amid the nationwide heat wave, the hourly electricity generated from natural gas reached a record of 6.9 million megawatt-hours. That exceeds any single day's consumption since January 2019 when the EIA began tracking the hourly fuel consumption for generating electricity.

Contrasting that record, the EIA's daily natural gas supply/demand chart for the past



▲ Regular gasoline prices at the pump remain stable at about \$3.45 since mid-March despite price fluctuations for crude oil per barrel.

365 days through July 24 shows gas production continuing to exceed consumption. How could that be?

In examining the data for the week of July 17–24, natural gas demand was weaker than expected. Surprisingly, the heat receiving much media attention in late July was not as extreme as reported. Natural gas consumption for power generation fell 10 percent from the prior week and was eight percent below year-ago consumption. Residential gas use was roughly five percent lower than the preceding week. Most other gas uses were flat or up for liquefied natural gas exports. In total, natural gas consumption that week was four billion cubic feet per day below the prior week's use and four and a half Bcf/d below the year-ago level.

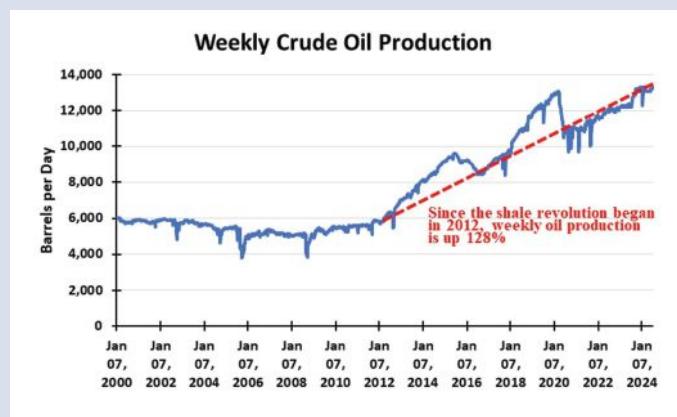
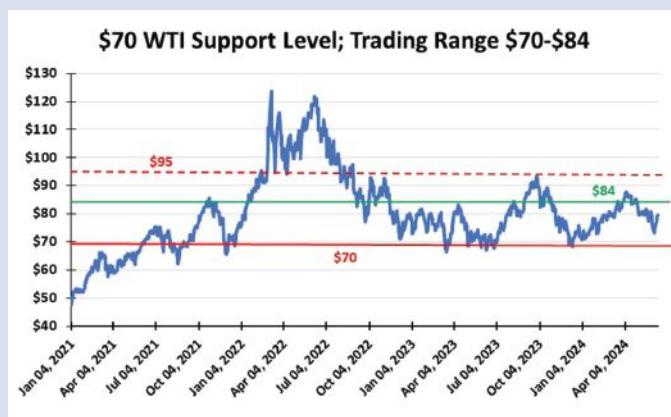
The lesson: to be careful believing media climate claims. They claimed July 21 was the warmest day in history. One would

have thought such a hot day would have driven up gas demand for generating electricity. But that wasn't the case judging from the weekly electricity data. Possibly all the hot weather was in areas with few people, so air conditioning demand did not impact electricity use as much as one would have thought.

While economic conditions during the second half of 2024 will impact natural gas demand, the key issues remain the weather, LNG exports, and gas supply. If, as has been reported, oil production in the Permian Basin is slowing, then associated natural gas output will also weaken. That could tighten the daily gas supply/demand balance heading into the cooler months at 2024's end. Such a scenario might encourage gas traders to buy contracts for future gas supply and lift prices.

i www.oceannews.com/frontline

US OIL OUTPUT IS UP AND PRICES REMAIN RANGE BOUND



RWE & SAITEC COMMISSION STUDY AT FLOATING OFFSHORE WIND PROJECT

The DemoSATH floating offshore wind turbine has been operational off the Basque coast since September 2023 and is providing first-hand insights into the challenges of operating floating wind turbines on the open sea.

Now, Spanish engineering firm Saitec Offshore Technologies and global offshore wind player RWE have launched the "DemoSATH Lab" initiative to carry out further environmental monitoring studies around the demonstrator. The DemoSATH Lab research will study the platform's interactions with the environment focusing on the possible impact on birds, the emission of underwater noise and the interactions of marine life with the structure. The program will last until at least the end of 2025 in order to span multiple seasons and weather conditions.

Bird interactions—This research will use data from the DTBird monitoring system that is already installed at the DemoSATH platform to better understand the interactions of birds with floating offshore wind turbines and foundations.

Underwater noise—The outputs from DemoSATH's underwater noise monitoring system will be compared to baseline underwater noise profiles recorded before and during installation in order to assess overall noise impact through the project lifetime.

Marine ecosystem biodiversity—A ROV will be deployed periodically to observe how marine life (such as invertebrates, fish and marine megafauna) interacts with the DemoSATH substructure, moorings, anchors and power cables within the local environment.

The DemoSATH platform, located 2 miles off the Basque coast at the Biscay Marine Energy Platform (BiMEP) testing area at Armintza, features a turbine with a capacity of 2 megawatts that was installed in September 2023. Its annual production is equivalent to the annual electricity consumption of approximately 2,000 Spanish households. As a result of this project,

floating offshore wind technology was introduced into Spain's energy mix for the first time.

The commissioning marked the beginning of a two-year operational period to gather data about the behavior of the "Swinging Around Twin Hull"—SATH technology, developed by Saitec Offshore Technologies. The success of the project is due to the combined capabilities of its partners: Saitec Offshore Technologies, the designer of the SATH technology, and project developers RWE, with its extensive expertise in the offshore wind sector, and Kansai Electric Power Co. Inc. (KEPCO), with its experience in the energy market.



RWE

NEXTGEO COMPLETES ACQUISITION OF SUBONICA TO STRENGTHEN OFFSHORE ENERGY OFFERING

NextGeo, a leading provider of marine geosciences and offshore construction support services to the energy sector recently announced the acquisition of Subonica, a company offering underwater surveying and inspection services using ROVs.

Subonica operates mainly in the fields of offshore energies, both renewable and traditional, submarine power cables, scientific research, environmental studies and monitoring, and underwater archaeology.

Giovanni Ranieri, CEO of NextGeo, said: "This M&A transaction is fully in line with

the growth and development path we declared at the time of listing and allows us to further expand our geophysical and environmental survey services offer. Specifically, thanks to the technological assets of Subonica, we will be able to strengthen our nearshore activities and thus diversify our business, which is now mainly focused on offshore activities.

"This is a further step that allows us to consolidate our position among the leaders in the sector and to credit ourselves among our customers as a reference partner offering cutting-edge technological solutions."



NextGeo CEO

MARINE ENERGY TECHNOLOGIES ACT TO JUMPSTART CLEAN ENERGY COMMERCIALIZATION

Two US Representatives, Nanette Barragán (CA-44) and Suzanne Bonamici (OR-01), have introduced the Marine Energy Technologies Acceleration Act, which is legislation that would invest \$1 billion to advance marine energy toward full-scale commercialization. Marine Energy harnesses the power from waves, tides, currents, and other water-based resources to generate a clean energy resource that can provide reliable, 24/7 clean power to communities.

The Marine Energy Technologies Acceleration Act would provide unprecedented levels of funding to the Department of Energy's Water Power Technologies Office for demonstration projects, research and development, detailed resource potential mapping, workforce development, and more efficient permitting processes.

"Nearly 40 percent of the US population lives in coastal communities where marine energy resources are abundant and offer tremendous potential to power our communities with clean, renewable energy, including California," said Rep. Barragán. "With the Marine Energy Technologies Acceleration Act, we can usher in an emerging clean energy resource to help our nation and our communities meet clean energy and decarbonization goals, reduce pollution, and create high-paying jobs."

There is an upcoming marine energy demonstration project by Eco

Wave Power at Altasea, a public-private ocean technology hub at the Port of Los Angeles. Eco Wave Power is set to install the first US onshore wave energy pilot station at the port in the coming months.

The legislation is cosponsored by Representatives Suzanne Bonamici (OR), Ed Case (HI), Rashida Tlaib (MI), Kevin Mullin (CA), Val Hoyle (OR), Troy Carter (LA), Salud Carbajal (CA), and Anne Kuster (NH).

The legislation is supported by the following organizations and businesses: Altasea, Anacapa Wave, Aquantis, Atlantic Marine Energy Center, Biosonics, Bluewater Network, C-Power, CalWave, Cardinal Engineering, DLZ Corporation, Ecomerit, Eco Wave Power, Emrgy, FluxMagic Inc., Hawaii Marine Energy Center, Hydrokinetic Energy Corp., Littoral Power, Marine Energy Council, National Hydropower Association, Ocean Conservancy, Ocean Energy USA Inc. Ocean Power Technologies, Ocean Renewable Power Company, Oscilla Power, Pacific Environment, Pacific Marine Energy Center, Pacific Ocean Energy Trust, PacWave, PB Mechanical Consulting Service, Southeast National Marine Renewable Energy Center, Streamwise Development, Tidal Energy Corp., Tide Mill Institute, Thompson Metal Fab, Triton Systems, Verdant Power Water Bros Desel, and 3U Technologies.

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Photo: Courtesy MTS Submarine Cmtee

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OCEAN INFINITY COMPLETES WIND FARM SURVEY FOR ØRSTED AND PGE IN BALTIC SEA

Ocean Infinity has completed a first-of-its-kind offshore wind farm survey for Ørsted and PGE in the Polish sector of the Baltic Sea, raising the bar for the future of marine surveying.

The project team based in Ocean Infinity's Operations Centre in Gothenburg, used a multi-beam echo sounder (MBES) and 3D multi-channel ultra-high resolution seismic (3D-UHRS) equipment deployed from an Ocean Infinity Armada lean-crewed vessel over 540 km to identify sub-surface boulders in support of the Baltica 2 project installation campaign for wind turbine generators (WTG) and offshore substation (OSS) locations.

"A conventional operation like this would require a much larger offshore team, significantly increasing operational risks and costs," stated Sara Andersson, Project Manager at Ocean Infinity. "Moving operational control from the vessel to the office requires a completely new approach to operational management, coordination, and execution. The safe completion of this project with such a lean crew offshore yet again demonstrates our ability to deliver high-quality survey data using innovative technology."

Key to the project's success was the use of real-time remote data management. Ørsted and PGE operate on a 24-hour delivery schedule, necessitating data products to be produced within 24 hours of logging off. This can pose a challenge even on conventional vessels, where data is logged and processed on the same server. With Ocean Infinity's sophisticated remote data collection system, however, the survey data was accessible to the office-

based processing team within the same timeframe as an offshore team would expect, enabling us to meet Ørsted's high expectations and deliver according to specification.



▲ Armada 7805 vessel. (Credit: Ocean Infinity)

ROVCO WINS SITE CHARACTERIZATION CONTRACT FOR FLOATING OFFSHORE WIND FARM



Rovco has been awarded the site characterization operations for Green Volt floating offshore wind farm, located 80 km east of Peterhead in Scotland. Scheduled to be fully operational in 2029, Green Volt will become one of the world's largest offshore floating windfarms. It will consist of up to 35 floating turbines and is expected to reduce CO₂ emissions by one million

tons per year, contributing up to 1.5 TWh of clean energy to the UK annually.

Developed by joint venture partners, Flotation Energy and Vårgrønn, Green Volt has the potential to generate enough green power to electrify several oil and gas platforms in the Outer Moray Firth (OWF) area with 560 MW capacity. Green Volt will also bolster the local supply chain, demonstrating a significant contribution to retaining and upskilling jobs in the floating offshore wind sector in Scotland.

The project will focus on geophysical surveys in the OWF array area, offshore and nearshore export cable corridors, shallow Piezocone Penetration Test (PCPT) and vibrocoring. Rovco's DP2 survey vessel, *Glomar Supporter*, will commence its geophysical operations from Aberdeen in July 2024.

The geophysical surveys carried out will be key in informing the anchor design for the floating turbines, streamlining Green Volt's development to become one of the world's largest offshore floating windfarms.

Craig Davis, Director of Site Characterization at Rovco, said, "We're delighted to be working with Flotation Energy and Vårgrønn, having been selected for Green Volt's site characterization operations. Not only does this demonstrate the usefulness of our cutting-edge technology, but it also underscores the versatility of Rovco's offshore wind capabilities, with the Green Volt project being our first focusing on shallow geotechnical data. We are proud to be involved in the delivery of this pioneering Scottish floating wind project and play a role in expanding the UK's growing offshore wind industry."

FUGRO COMPLETES COMPREHENSIVE SURVEY FOR ATLANTIC SHORES OFFSHORE WIND PROJECT

Fugro has successfully completed four years of continuous survey operations in New Jersey and New York for US-based offshore wind developer Atlantic Shores Offshore Wind. Supporting the site assessment of five projects across three lease areas totaling 1,000 km², Fugro worked with Atlantic Shores to pioneer a new data collection and management approach that increased survey efficiency by 30% and contributed to the recent federal approval of Atlantic Shores South, which will provide 2,800 MW of clean energy to New Jersey.

Traditionally, offshore wind site assessments have required multiple independent campaigns to gather oceanographic, seabed, soil and habitat data. Fugro streamlined this process by consolidating these efforts into a single, integrated program aligned with Atlantic Shores' portfolio strategy. To manage the large volumes of data associated with this approach—upwards of 100 TB—Fugro collaborated with Atlantic Shores to develop Fugro VirGeo®. This cloud-based Geo-data engagement and delivery platform provides internal stakeholders with real-time project information for faster decision making both in the field and office.

The platform also facilitated the first digital deliverables to federal regulators, supplementing the thousands of pages of reports required by current permitting standards. This push toward digital deliverables aims to increase transparency, build public trust, and further compress the development timeline through more efficient regulatory reviews, steps critical to achieving the aggressive national goal of deploying 30 GW of offshore wind energy by 2030.

"Given the shared values between Fugro and Atlantic Shores, we are proud of the longstanding partnership and commitment to advancing New Jersey's first offshore wind project," said Joris Veldhoven, CEO, Atlantic Shores Offshore Wind. "Over the last four years our teams have worked tirelessly to ensure we possess the most accurate data to develop our project portfolio safely and responsibly. Our partnership has led to industry innovations, advancements, and best practices that are charting the course for clean energy delivery now and for future generations."

Céline Gerson, Fugro's President and Group Director in the Americas, added: "The energy transition will require companies that are willing to lead by example—that work smarter to move faster while maintaining the highest accuracy and safety standards. Atlantic Shores is that kind of company, and we're incredibly proud to have partnered with them to accelerate their offshore wind development journey. We've achieved a great deal together in the last four years, and we're excited to keep this momentum going during future phases of development, working together to increase renewable energy in the US."

Throughout the four-year field program, Fugro achieved Atlantic Shores' stringent "Goal Zero" safety standard for people and the environment. This accomplishment was made possible by the safety excellence of Fugro's own team, as well as their subcontractors Alpine and S.T. Hudson Engineers, two local survey companies whose work on the project contributes to Atlantic Shores' commitment to New Jersey job creation.



▲ Fugro Enterprise. (Credit: Fugro)

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CABLE BURIAL OPERATIONS FOR NEXANS BY OEG RENEWABLES COMPLETED

OEG Renewables recently announced that two of the businesses within its cables service line, 23 Degrees Renewables and SEAJET Systems (SEAJET), have successfully delivered a turnkey cable burial campaign for Nexans, a leader in the design and manufacture of cable systems and services.

SEAJET utilized their innovative all-electric controlled flow excavation (E-CFE®) technology called HYDROMOLE to execute the work scope, which included trenching and burial of shallow water export cables at an offshore wind farm site in the UK.

The advanced control system built into HYDROMOLE allows performance to be monitored and optimized in real-time, ensuring reliability and maximizing project uptime. Other major benefits include vastly reduced CO₂ emissions, eliminating the risk of high-pressure, high-volume oil spills into the marine environment, and reduced noise pollution.

The HYDROMOLE was deployed from an ultra-shallow draft multicat vessel for the completion of the work scope. The compact deck space onboard the vessel allowed SEAJET to demonstrate the adaptability of the equipment spread, which was easily accommodated onto the vessel deck which had limited available space.

The project offered challenges with regard to the operational conditions, presenting tight weather windows to conduct work within and aggressively fluctuating tidal ranges. The specialist SEAJET



▲ Multicat vessel supporting the delivery of the HYDROMOLE. (Credit: OEG Renewables)

team, who are experts in working in these challenging shallow water conditions, successfully demonstrated that the HYDROMOLE system delivers up to 100% more power than any legacy hydraulic CFE systems currently on the market, even when presented with some of the most challenging conditions considered for this type of seabed intervention works.

STROHM WINS TCP FLOWLINE CONTRACT WITH TOTALENERGIES EP BRASIL

Strohm, a world's first and leading thermoplastic composite pipeline (TCP) technology company, has been awarded a contract by TotalEnergies EP Brasil for the supply of TCP Flowlines for an offshore field located in the Santos Basin in the Brazilian pre-salt area.

Due for installation in 2026, at a water depth of 2,200 meters, Strohm's innovative TCP solution has been selected for the first time for flowlines to be installed in ultra deep water. Qualified for 30 years' design life, this technology is immune to corrosion, including the Carbon Dioxide-induced stress corrosion cracking (SCC-CO₂), and as such provides TotalEnergies with a disruptive, long-term and low carbon footprint solution.

Renato Bastos, Vice President Brazil, Strohm, said: "The award of this contract marks a major step change in the offshore industry and at Strohm we are immensely

proud to be the first company to provide a TCP Flowline to TotalEnergies in Brazil for use in ultradeep water. Over the course of a year, a multidisciplinary team from TotalEnergies and Strohm, featuring employees from Brazil, France, and the Netherlands, have worked hand-in-hand to make this cutting-edge, disruptive solution a reality."

Thomas Leize, Project Manager at TotalEnergies, added: "This technology is important because it represents a solution to a long-lasting corrosion problem, at a competitive cost, applicable for ultra deep water, in line with our commitment of reducing emissions from our operations."

With an inner diameter of 6 inch and a 600-bar design pressure, the TCP Flowline will be used for gas injection in water depths of 2,200 meters. It will be installed using a standard pipelay support vessel (PLSV), as are operating currently in Brazil.



▲ Strohm TCP Flowline. (Credit: Strohm)

MAS PROJECT TO RECEIVE RADAR UPGRADE WITH CAMBRIDGE PIXEL SOFTWARE

The Mayflower Autonomous Ship (MAS), a groundbreaking research vessel, is set to receive a significant enhancement to its navigational capabilities. This includes advanced radar processing software from UK-based Cambridge Pixel to support a new SIMRAD radar. The upgrades, undertaken by unmanned vessel experts Submergence Group, also include the latest version of Guardian Autonomy from Marine AI.

The MAS project is focused on developing a vessel capable of traversing the Atlantic Ocean autonomously, devoid of any human intervention, while also supporting scientific research and education. The project was inspired by the iconic journey of the original Mayflower from Plymouth, UK, to the New World in 1620, and was started in 2019 as a collaboration between ProMare, IBM and a variety of industry and academic partners. It relies on cutting-edge technologies including artificial intelligence and advanced sensor systems such as radar to navigate and make decisions in real time.

Cambridge Pixel's technology is pivotal in enhancing the situational awareness and safety of the autonomous ship, enabling it to navigate the high seas with unprecedented precision and reliability. Their partnerships with leading radar manufacturers, including Simrad, enable their software to accept and convert proprietary data formats. The radar system upgrade will incorporate Cambridge Pix-

el's SPx Server application for advanced target tracking and SPx Fusion Server for the fusion of tracks from the multiple onboard sensors. This helps the MAS detect targets of all sizes, ensuring safe navigation by providing accurate data to Guardian Autonomy, the AI-enabled collision avoidance system from Marine AI.



▲ Cambridge Pixel's solutions enhance the navigational capabilities of the Mayflower Autonomous Ship. (Credit: Cambridge Pixel)



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INTER-ARRAY CABLE WORKS COMPLETED ON DOGGER BANK A OFFSHORE WIND FARM

More than 328 km of 66 KV inter-array cables have been successfully installed by delivery partners working on the construction of the world's largest offshore wind farm—Dogger Bank A.

The cables were laid by DEME Offshore's *Viking Neptun*, and burial works were completed by DEME Offshore's Living Stone.

This work marks the completion of all inter-array cables on the first phase of the

wind farm, Dogger Bank A, which began generating power in October 2023.

The network of 95 cables, in a multitude of lengths up to 8.6 miles, will connect Dogger Bank A's 95 Haliade-X 13 MW turbines to the Dogger Bank A offshore converter station. From here the electricity is converted into direct current for transmission to Dogger Bank A's onshore convertor station via a pioneering HVDC system.

The laying of cables is carried out using a specialist cable lay vessel that uses a carousel and tensioner device, to deploy cable over the stern chute of the vessel and onto the surface of the seabed. The second stage involves connecting the cable to the offshore platform and each individual wind turbine.

This challenging engineering process follows on from an intensive preparation period involving underwater surveys to ensure the cable laying corridor is clear of obstacles.

The 66 KV inter-array cables were manufactured by Hellenic Cables under a contract with Dogger Bank tier-one contractor DEME Offshore.



☛ *Viking Neptun*. (Credit: DEME Offshore/Dogger Bank A)

SCANREACH PARTNERS WITH PURUS TO IMPROVE ONBOARD PERSONNEL SAFETY

ScanReach, a pioneer in wireless maritime technology solutions, has partnered with Purus, a leading provider of maritime services for the gas transport and offshore wind industries, to improve the safety of its onboard personnel.

ScanReach will provide its wireless ConnectPOB (Personnel OnBoard) solution to four of Purus' Commissioning Service Operation Vessels (CSOV). Three are new builds, and one is an existing vessel that has already been retrofitted and is performing successfully.

ConnectPOB uses ScanReach's groundbreaking wireless technology to provide real-time personnel on-board (POB) location monitoring, enabling the crew and management to ensure the safety of all individuals on the vessel. In emergency situations, ConnectPOB is invaluable in coordinating responses and evacuations which ultimately safeguards lives.

Partnering with ScanReach for its CSOV fleet as their solution provides Purus with uninterrupted real-time data collection, which is vital for the onboard safety of its personnel. By using the ConnectPOB wearables, the safety of Purus staff will be increased not just during normal vessel operations but also during training exercises and in emergency situations. Purus will be able to locate crew quickly and easily, see who mustered, the locations of non-mustered personnel, and the number of crew onboard the vessel at any time. This information is vital during emergencies and shows Purus's commitment to enhanced crew safety aboard its vessels.

Dan Slater, VP Sales & Business Development for ScanReach, said: "We are delighted to be working in partnership with such a forward-thinking owner as Purus across their CSOV fleet. It further demonstrates the robustness of the ScanReach wireless technology and its ability to provide enhanced onboard safety for crews."

NEW SUBSEA PROCESSING MILESTONE ACHIEVED BY SAIPEM AND CURTISS-WRIGHT

Saipem and Curtiss-Wright Corporation have reached a significant milestone for the subsea applications industry: the completion of the qualification process of an all-electric seabed barrier fluid-less pump. Developed based on proprietary solutions inherited from the nuclear sector, this unprecedented technology will enable the subsea injection of treated sea water into a reservoir, thus extending the lifecycle of subsea fields.

While the conventional pumping system features a barrier fluid which serves as coolant, lubricant and insulation, the technology developed by Saipem and Curtiss-Wright is based instead on an innovative design whereby the subsea pump is cooled and lubricated by the sea water itself, while the motor is protected by a canned casing suitable for deepwater applications. The absence of the barrier fluid avoids the need for its constant replenishment and the risk of sea water contamination. Furthermore, due to Saipem's "all-electric" strategy, the technology allows the replacement of conventional hydraulic umbilicals with power/control cables, thus reducing costs. This pump is the first seal-less, barrier fluid-less subsea pump with such high power.

In 2018, Saipem and Curtiss-Wright signed an exclusive collaboration agreement to develop this new technology: a 3 MW full-scale



▲ All-electric seabed barrier fluid-less pump. (Credit: Saipem)

prototype has been manufactured and tested in water through an extensive specific program, which eventually confirmed the expected performance, robustness, and reliability.

This new solution is certified for several Saipem-proprietary subsea treatment technologies, including SPRINGS®, the subsea desulfation technology owned by Saipem, TotalEnergies and Veolia.

This certification represents a fundamental goal as it validates the achievement of Technology Readiness Level 4 (TRL 4) as witnessed and endorsed by Petrobras and TotalEnergies and it marks the commencement of the relevant commercialization on a global scale.

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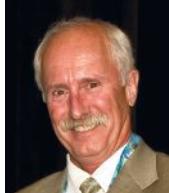
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UNBOXING THE OCEAN EXPLORATION MINDSET

A design philosophy for fit-for-purpose solutions



Ted Brockett



In the world of ocean exploration, where challenges abound and resources are often limited, the ability to channel creative, out-of-the-box thinking is a superpower. It comprises more than just a corporate buzzword; in engineering terms, it represents a disciplined and systematic approach to problem-solving.

The notion was popularized over 50 years ago by a management consultant's nine-dot conundrum—how to connect every dot using just four lines? The answer: Apply lateral thinking, looking beyond the confines of the box for a logical solution. The lesson is clear: by exhausting the options within the box, we might realize that the problem lies in the box itself, forcing us to question conventional thinking.

Marine technologists often face pressures to create entirely novel solutions to navigate legacy pitfalls. But often, true innovation lies in identifying when an existing solution, albeit conceived for another purpose, can inform a creative direction. Rather than reinventing the wheel (to borrow another shopworn colloquialism), can we build upon what's already spinning?

This interplay between leveraging and adapting tried-and-tested approaches is all too familiar to those of us in the deep-sea exploration business. The remotely operated vehicle (ROV) industry is a great example of how the successful application of a subsea asset for one purpose—initially to service offshore oil and gas E&P—can trigger innovation and utility across the entire ocean sector, spawning a growing

DEPLOYING ASSETS AT THESE DEPTHS CAN BE PERILOUS, AND VERY FEW OPERATORS ARE EQUIPPED TO DO THIS IN A COST-EFFECTIVE AND SUSTAINABLE MANNER.

range of ROV classes and models for an expanding array of underwater tasks.

Instead of settling for one-size-fits-all answers, outside-of-the-box thinking that capitalizes on existing successes proffers solutions to exacting needs. Whether it's designing a custom deck handling system or streamlining a manufacturing process for a winch, fit-for-purpose solutions enhance effectiveness and fuel meaningful progress.

MINING THE DEEP

Across the ocean sector, we are now seeing the fruits of such ingenuity, from the dawn of uncrewed surface vessels (USVs) to an ecosystem of intelligent sensors and systems in operation below the waterline. These technologies now touch almost every activity in the marine domain. But there is one emerging industry, yet to begin in earnest, that is less transparent when it comes to the application of advanced

ocean tech—deep-sea mining, or more specifically, the collection and processing of polymetallic nodules from the seafloor of the Clarion Clipperton Zone (CCZ) at depths greater than 4,000 meters.

Deploying assets at these depths can be perilous, and very few operators are equipped to do this in a cost-effective and sustainable manner. A large part of the proposed commercial extraction practices hinges on equipment borrowed from the offshore oil and gas playbook—drill ships and riser pipes—hence nullifying the need for reinvention. The same cannot be said, though, for the collector systems, the tethered vehicles designed to gather and feed the nodules into the riser pipe. While most mining entities remain relatively guarded about their proprietary systems, there are several documented collectors, all claiming to return a more precise and nondisruptive harvest than the last. The range of con-



▲ The onboard processing of polymetallic nodules during an ocean mining pilot test in the CCZ in the late 1970's: The collector vehicle, pictured on the right during land-based testing, was a novel hydraulic system designed for pioneering ocean exploration. (Credit: Ted Brockett)

cepts unquestionably reflects the degree of operational complexity at deep-sea depths.

From a purely economic standpoint, the key to establishing commercially sustainable operations—running drill ships is an expensive endeavor—is the yield of nodules per hour. Reliability at these challenging depths is paramount. If something breaks, so does the budget. This is where "out-of-the-box" thinking meets the "don't reinvent the wheel" mentality. Mining the CCZ is, by definition, a new frontier, but pertinent lessons from the past still remain.

KEEP. IT. SIMPLE. STUPID.

Back in the 1970s, I worked for International Nickel's Ocean Mining Development team. Tasked with developing a collector that could traverse the CCZ seabed without getting stuck in the soft, cohesive abyssal mud while collecting polymetallic nodules, the goal—much like today—was to introduce the nodules into the riser pipe for transport to the surface while minimizing the quantity of environmental disturbance.

Given the unknowns—not to mention the threat of financial ruin had things gone awry—our design approach was to keep things simple. Unlike other methods, we favored rudimentary towed designs and avoided tracked, self-propelled, or otherwise complicated blueprints. The collectors only had one moving part, an electric motor driving a simple ducted propeller-style water pump. This pragmatic design later went on to deliver almost 1,000 tons of nodules to the surface vessel during official pilot mining tests.

Our process was guided by practicality: how to cost-effectively test the designs before conducting in-situ tests in the CCZ, at which point we would be paying a high day rate for topside support. Initially, we developed eight different collector designs, all built to test scale, and created our own tow tank facility, repurposing unused land inside a local sand and gravel mining operation. We contracted a local mix plant to develop a batch of simulated seafloor mud and used broken-up concrete to simulate the nodules. We purchased water from the city and used a nearby fire hydrant for access.

Two and a half miles below the surface is not an environment to experiment in. With



▲ Custom winch and LARS designed and built to support deep-sea mining operations.
(Credit: Okeanus)

our repurposed testing facility, we were up and running collector tests in just a couple of weeks and were able to quickly eliminate several of our less productive designs, leaving more time at sea for the most promising concepts.

HARNESSING MODERN TECHNOLOGIES

Has the process for designing today's equipment for deep-sea deployments changed? There's no question that the end goals have shifted, with technological advances luring us further offshore into deeper, less familiar waters.

The ongoing innovation of smarter sensors, communication systems, new composite materials, more resilient coatings, etc., all help extend the ambition of offshore campaigns. And that's without factoring in the true promise presented by the steady integration of artificial intelligence and machine learning techniques.

When compared to early deep-sea mining prototyping, the resources available today, nearly 50 years later, enables us to do more than simply explore; they afford us the opportunity to scale an industrial ecosystem to responsibly identify and establish new commercial opportunities in the Blue Economy.

While the tools of the trade have progressed, a mindset governed by practicality endures. Field-ready equipment for seabed minerals extraction at 4,500 m down begins with a set of practical requirements or statement of work, which the Okeanus

team then draws up in close partnership with a client.

This development cycle, a succession of critical stage gates—each that demands rigorous testing and evaluation—takes time. But this collaborative process and consultation is the key to delivering truly fit-for-purpose, turnkey solutions. Those words are used all too freely in technology circles, but "keeping it simple" is always a highly complex, multidisciplinary task in the world of deep ocean engineering.

Over the last few years, we have partnered with a customer to develop, build, and service a custom skid-mounted 10-ton SWL winch, and LARS proved built specifically to handle a tethered drill for ocean mining activities. The fully rotational LARS incorporates several unique features and modes of operation, including a custom telescoping docking head design and assembly (with failsafe latches), oversized dual groove over-boarding sheave, and an operator-adjustable motion damping to enable safe and efficient launch and recovery operations in high sea states.

Squaring what is possible with modern ocean technology with what's needed in the field today is nothing if not a balancing act. Against the backdrop of ever-smarter technologies driven by AI, edge computing, and seamless real-time communications, the ocean technologist's role is increasingly the arbiter in the tussle between inspiring innovation and optimizing proven approaches.

SUBSPIRIT P-63

Pioneering sustainable submarine exploration

In an era where sustainability and technological advancement must come together, the Subspirit P-63 submarine serves as a prime example of eco-conscious engineering. The only commercially licensed submarine in Switzerland, the P-63 demonstrates that modern maritime technology can be both environmentally responsible and extraordinarily versatile.

Offering a diving experience like no other, the P-63 transports passengers into the depths of Lake Lucerne, providing a unique glimpse into the area's ecology and history. The lake's pristine condition acts as a time capsule, preserving wrecks in remarkable detail. Passengers onboard the P-63 can explore various sites, including a C-35 Swiss biplane from 1941, among many others. By facilitating access to these historical sites, Subspirit not only educates the public but also assists marine archaeologists in identifying unknown wrecks and surveying key pieces of Lake Lucerne's maritime history.



WITH THE OCULUS MULTIBEAM IMAGING SONAR FROM BLUEPRINT SUBSEA, THE P-63 FINDS ITS TARGETS IN ABSOLUTE DARKNESS. IN REAL TIME, THE WRECKS CAN BE RECOGNIZED FROM AFAR ON OUR SCREENS.

—Philippe Epelbaum, Founder of Subspirit



At the heart of the Subspirit submarine are four electric motors, each powered by a dedicated circuit. This innovative design ensures optimal efficiency and safety while underscoring a strong commitment to sustainable practices. By leveraging electric power, the submarine significantly reduces its environmental impact, making a crucial contribution to the protection of aquatic ecosystems and the mitigation of pollution in Alpine lakes.



Subspirit/Blueprint Subsea



Subspirit/Blueprint Subsea

Safety is paramount in Subspirit's operations; the submarine is equipped with multiple redundant emergency systems. Applying Archimedes' principle, the P-63 is engineered to be positively buoyant and can ascend to the surface rapidly from any depth. As a fail-safe, weights can be jettisoned to facilitate this process, and releasing a recovery buoy and emptying a regulation tank can further accelerate an emergency ascent. Adhering to DNV regulations, the submarine has an onboard survival time of 96 hours, supported by oxygen reserve tanks, CO₂ filters, and lithium hydroxide curtains.

On the surface, a support vessel captained by an experienced member of the Subspirit team maintains continuous contact with the submarine via hydrophone-based voice communication. The SeaTrac USBL positioning system from Blueprint Subsea provides precise location data and supports text messaging communication technology. The submarine's safety systems undergo rigorous testing in accordance with DNV guidelines, and regular maintenance ensures their optimal performance.

Subspirit can serve as a versatile tool for a range of underwater operations, dependent on the specific instruments and equipment it carries. Potential applications include locating and maintaining submerged pipelines, creating detailed digital lakebed profiles, and conducting environmental surveys. With its onboard gripper tool and advanced Oculus sonar system, the P-63 can also assist local emergency services in search and recovery operations, enhancing the capabilities of rescue missions and contributing to public safety efforts.

Subspirit stands as a testament to the ingenuity of its founder, Philippe Epelbaum, and his continuous pursuit of sustainable exploration. The submarine's blend of advanced technology, stringent safety measures, and environmental consciousness make it a remarkable example of modern maritime engineering. Whether for commercial, scientific, or recreational purposes, Subspirit offers an unparalleled gateway to the underwater world. At a time when responsible environmental action is crucial in technological development, the Subspirit submarine leads by example.

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SLB WINS ULTRA-DEEPWATER CONTRACT FOR PETROBRAS DEVELOPMENT PROJECT

SLB has announced a major contract award by Petrobras, following a competitive tender, to its OneSubsea™ joint venture for their standardized, pre-salt subsea production systems and related services. The scope covers the further development of two oil fields in the strategically important Santos Basin.

As part of the second development of the Atapu and Sepia fields, SLB OneSubsea will provide the Petrobras-standard configured, pre-salt vertical trees, subsea distribution units, subsea control systems, and pipeline systems, along with related installation, commissioning, and life-of-field services. Much of the technology and equipment to be deployed, including the vertical trees and subsea control systems, will be produced and serviced locally at SLB OneSubsea's facilities in Brazil.

"This award deepens our valued partnership with Petrobras, and we are proud to be supporting the development of such important assets to Brazil," said Mads Hjelmeland, CEO of SLB OneSubsea. "Leveraging our proven, locally developed technology platform facilitates on-time delivery and maximizes local content from our Brazilian manufacturing and service facilities. Brazil is a key market for us, and our continued in-country investments are key to supporting the growth we envisage for the region."

These projects add to Petrobras' material pre-salt investments and will enable the addition of two new floating production, storage, and offloading (FPSO) platforms, P-84 (Atapu) and P-85 (Sepia). They will each have a daily production capacity of 225,000 barrels of oil per day and processing of 10 million cubic meters of gas per day.



▲ SLB OneSubsea manufacturing facility in Curitiba, Brazil.
(Credit: SLB OneSubsea)



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VARD TO BUILD THIRD CSOV FOR REM OFFSHORE TO SUPPORT GLOBAL OFFSHORE WIND OPERATIONS



▲ VARD 4 19 CSOV. (Credit: VARD)

Rem Offshore has signed a contract for the design and construction of a state-of-the-art CSOV (Commissioning Service Operation Vessel) with VARD. This is the third CSOV VARD delivers to REM Offshore. The first two, *REM Power* and *REM Wind*, were delivered in 2023 and 2024 respectively.

The CSOV is tailored to provide services during the construction, operation, and maintenance of offshore wind farms worldwide. The VARD 4 19 design, developed by Vard Design in Ålesund, is a highly versatile platform for all support operations for offshore wind farms, focusing on onboard

logistics, safety, comfort, and superior functionality.

The vessel will be equipped with a diesel-electric and battery hybrid propulsion system designed for highly flexible and fuel-efficient operation.

Substantial volumes in the vessel are set aside for future upgrades or conversion to zero emission energy sources.

Vard Electro's SeaQ integrated bridge system will be part of the equipment onboard. The SeaQ bridge is the highest level of

bridge integration with an extended architecture. The bridge uses a combination of VARD-developed integration solutions combined with touch screens to gather various systems into one operator station. The system has full-function startup and control functions. The Kongsberg Group delivers the decision support system to the SeaQ integrated bridge system.

The vessel is also equipped with Metizoft's Life Cycle Assessment system (LCA), which measures the vessel's environmental impact through each step of its life cycle, from raw material extraction to disposal. By analyzing all relevant Environmental Product Declarations (EPDs), a complete assessment of the total environmental impact is made.

A highly specialized and customized work vessel delivered by Mare Safety provides safe, comfortable, and efficient transport of technicians and cargo between the CSOV and the wind turbines.

The CSOV is 85 x 19.5 m with cabins for up to 120 people, including 93 wind turbine technicians and a crew of up to 27 people. The vessel will be built at Vard Vung Tau in Vietnam and is scheduled for delivery in Q4 2026.

DOF SECURES MULTIPLE VESSEL CONTRACTS FROM PETROBRAS FOR WORK IN BRAZIL

DOF has announced multiple contract awards with Petrobras and a 1st Tier EPCI-SURF Contractor in Brazil.

AHTS *Skandi Jupiter* and AHTS *Skandi Mercury*, both under management contracts with DOF, have been contracted by Petrobras to operate as AHTS 230t BP after the same competitive tender process earlier this year that led to the contract of *Skandi Amazonas*, *Skandi Rio*, and *Skandi Botafogo*.

Both *Skandi Jupiter* and *Skandi Mercury* are currently operating in the North Sea region and are planned to be mobilized to Brazil after modifications to comply with Petrobras requirements. Both contracts, with 3-year durations plus options, are sched-

uled to start by 2Q or 3Q 2025 but can be adjusted by mutual agreement.

Also in Brazil, *Skandi Salvador*, a Brazilian built and flagged MPSV equipped with 140t AHC crane and two WROVs, was chartered by a 1st Tier EPCI-SURF Contractor for a 180-day firm period plus options, to support their operations at Petrobras Pre-Salt fields developments. Contract commencement is immediately.

Skandi Salvador is currently operating for Petrobras at Libra as an MPSV, and redelivery is scheduled for the beginning of August. Geoholm started the contract as a front-runner until *Skandi Salvador* was released from her current commitments.

In parallel with the charter contract, the 1st Tier EPCI Contractor also awarded a Survey Services contract on board of both vessels to DOF Subsea Brazil.



THE NEXT STEP

Safety and innovation in ocean exploration



Rodolphe Holler



Will Kohnen

Executive Director

Capt. G. Clark (USN Ret)

Deputy Director

Gregory Cotten, PhD

Secretary

“
THE JUNE 2023 TRAGEDY INVOLVING OCEANGATE'S TITAN SUBMERSIBLE HIGHLIGHTED THE IMPORTANCE OF ADHERING TO ESTABLISHED SAFETY STANDARDS, INDUSTRY REGULATIONS, AND UNDERGOING THIRD-PARTY TESTING AND VALIDATION.

”

Since 1968, the Marine Technology Society's (MTS) Manned Undersea Vehicles (MUV) committee, now known as the MTS Submarine Committee, has been at the forefront of promoting safe and responsible deep ocean exploration. For over 50 years, the Submersible industry built an admirable safety record through rigorous engineering practices, safety standards, and collaboration with federal agencies such as the US Coast Guard, US Navy, and leading classification societies.

However, the June 2023 tragedy involving OceanGate's Titan submersible highlighted the importance of adhering to established safety standards, industry regulations, and undergoing third-party testing and validation.

Today, less than 10 active submersibles can reach depths of 4,000 meters or more, all are designed and operated under third party review. Globally, there are 215 active submersibles with some reaching as deep as 11,000 meters. These submersibles serve diverse purposes, including personal use, tourism, commercial ventures, research, expeditions, submarine rescue, and security operations.

TYPES OF SUBMERSIBLES

Deep Ocean Exploration: These vehicles are typically national research submersibles diving 4,000 meters or deeper, certified and third party inspected, reflecting high construction, maintenance, and operational costs.

Tourist Submersibles: Operating in coral

reefs at shallow depths of 30–100 meters, these submersibles accommodate 10–40 passengers in a dry, 1-atmosphere cabin. They adhere to rigorous safety standards (Class), are regulated by Port Authorities (Coast Guard) and internationally by the IMO Safety Circular 981.

Private and Expedition Submersibles:

These submersibles, operating at depths of 100–2,000 meters, can carry 1–10 people to explore remote deep-sea locations. They are typically classed and inspected by IACS Classification societies.

Recreational Submersibles: Unclassed or uncertified submersibles for personal use only, often adventurers, hobbyists or home-built, which may operate outside industry safety standards and regulation.

SAFETY AND STANDARDS

The submersible industry has an impressive safety record, with zero fatalities from 1974 to 2023 despite a significant increase in dives, particularly with the rise of tourism submersibles in the 1990s and 2000s, and the rapid growth of expedition submersibles over the past 15 years. This track record underscores the effectiveness of the industry's stringent safety standards and regulations.

Key organizations involved in classing and regulating submersibles include:

1. International Maritime Organization (IMO)
2. State Port Authorities: Coast Guard & Maritime Affairs

3. Classification Societies: IACS members (International Association of Classification Societies): ABS, DNV, LR, BV, NAVSEA, NK, RINA, CCS

Stakeholder industry organizations include:

4. Marine Technology Society, Submarine Committee
5. World Submarine Organization (WSO)

THE FUTURE

Establishing comprehensive operational standards is imperative during times of rapid growth. MTS continues to disseminate marine technology information, to promote educational programs and advance the development of tools for marine exploration of the oceans.

The World Submarine Organization's mission is to unite the global submarine community, fostering innovation and safety through its annual symposium and advocacy for a universal submarine operations standard. WSO aims to ensure a legacy of safety and innovation, addressing jurisdictional issues and promoting global safety guidelines.

As the industry evolves, it is crucial to collaborate and prepare for future challenges. These organizations remain steadfast in their mission to advocate for responsible submersible operations, and safe ocean exploration.

workboatshow.com/submarine-symposium

US NAVY CONDUCTS LIVE-FIRE DEMO FROM CUSV AT RIMPAC 2024



The US Navy achieved a significant milestone at the Rim of the Pacific (RIMPAC) 2024 exercise with the successful launching and testing of Poniard rockets from a common unmanned surface vehicle (CUSV). The test is part of the Navy's mission to continually enhance and expand its maritime capabilities and operational flexibility via security cooperation and innovation with allies and partners.

Multiple Poniard rockets, low-cost guided munitions, were fired from the CUSV during a series of exercises conducted off the coast of Hawaii. The live-fire demonstration was the culminating event of an ongoing Foreign Comparative Test (FCT) project under the auspices of the Office of the Under Secretary of Defense for Research and Engineering (OUSD R&E). This innovative capability test demonstrates the Navy's commitment to integrating mature cutting-edge technology into its operations to maintain maritime superiority and readiness.

This live fire demonstration was part of the RIMPAC exercise, held biennially in and around the Hawaiian Islands, which is the world's largest international maritime warfare exercise hosted by US Third Fleet. It provides a unique training opportunity for participating nations' navies to foster and sustain cooperative relationships that are critical to ensuring the safety and security of the world's oceans. This year's exercise includes 29 nations, 40 surface ships, three submarines, more than 150 aircraft, and 25,000 personnel.

The Navy's LCS mission modules program is a part of the Program Executive Office, Unmanned and Small Combatants portfolio, which designs, develops, builds, and delivers the Navy's unmanned maritime systems; mine warfare systems; special warfare systems; expeditionary warfare systems; and small surface combatants.



LOCKHEED MARTIN AWARDS RADAR CONTRACT TO SPANISH COMPANIES IN SUPPLY CHAIN EXPANSION

Lockheed Martin, the global aerospace and deterrence company, awarded Indra, Escribano Mechanical and Engineering, and ICM (Integral de Conexión y Montajes, S.L.) purchase orders for AN/SPY-7(V)2 components on the F-110 frigate.

As part of Lockheed Martin's commitment to expanding its international supply chain, these purchase orders aim to integrate Spain into the company's global SPY-7 supply chain, enhancing resiliency and expanding production capacity.

"These strategic collaborations empower local industries, strengthen communities, and drive economic growth, all while providing the most advanced defense capabilities for 21st Century Security®," said Amr Hussein, Vice President of Multi-Domain Combat Solutions at Lockheed Martin. "By incorporating Spanish industry into radar production, we are committing to diversify our supply chain and add capacity that enhances our global supply chain."

Lockheed Martin and Spanish industry have worked together to produce over 90 watercoolers and auxiliary equipment, 30,000 cables, 1.8 m power supplies, and microelectronic and RF components for the global SPY-1 fleet.

For over two decades, Lockheed Martin has worked in close collaboration with Spanish industry on radar development and naval and airborne computing systems. They are committed to continuing this successful partnership and developing cutting-edge platforms together that will provide defense capabilities and service for many years to come.



▲ SPY-7(V)2 radar in Spain's F-110 multi-mission frigate recently completed a significant milestone, the technical sessions of the Critical Design Review. (Credit: Lockheed Martin)

SEEBYTE'S MULTI-DOMAIN C2 SYSTEM CONTRACT RENEWED TO SUPPORT MCM OPERATIONS

SeeByte, the global leader in smart software solutions for robotic and autonomous systems, has announced the Belgian Navy has renewed their contract for SeeTrack v4 and Automatic Target Recognition (ATR) System licenses for their fleet of autonomous underwater vehicles.

The Belgian Navy is using SeeTrack for in-field mission planning and post-mission analysis using their fleet of HII REMUS 300 and 100 vehicles.

SeeByte is continually working with the Belgian Navy to include SeeByte's software and training materials in their in-house training program at the NATO Naval Mine Warfare Centre of Excellence.

The latest version of SeeTrack provides enhanced planning, monitoring and post mission analysis capabilities for managing multiple sensors and platforms on a single user interface, aiding efficient decision making and reducing the training burden.

Managing multiple platforms and sensors at one time from SeeTrack's common user interface will help to maximize the capabilities of the Belgian Navy's uncrewed systems and offer a level of interoperability while working with other nations.

SeeByte will work together with the Belgian Navy during this year's NATO Exercise REPMUS 2024 to demonstrate interoperability between different navies' autonomous systems.



Belgian Navy REMUS vehicle during in-water SeeByte SeeTrack trials.
(Credit: Belgian Navy)

DAMEN CONTRACT FOR ASD TUG 3010

Damen has signed a contract with the Lithuanian Defense Resources Agency under the Ministry of National Defense for the acquisition of a new ASD Tug 3010. The tug is to be delivered to the Naval Forces within nine months.

Lithuanian Minister of National Defence Laurynas Kasčiūnas, stated: "By acquiring this harbor tug, Lithuania strengthens its position as a maritime nation and provides the necessary operational capabilities to the Navy."

Damen Sales Manager Justin Rietveld, added: "The Damen ASD 3010 is a well-proven design and very capable of serving the needs of the Lithuanian Navy, both in terms of tug capabilities as well as performance in ice conditions."

The large open working deck allows the vessel to carry out a wide range of activities, such as firefighting, towing targets, assisting in pollution control, and other operations as specified in the technical requirements."

The signing ceremony was also attended by the Ambassador of the Netherlands, Jack Twiss Quarles van Ufford.

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DIGITAL EDGE SUBSEA

FIRST MCMV BUILT FOR THE BELGIAN NAVY BEGINS SEA TRIALS



The *Oostende*, the first of the series of mine countermeasures vessels (MCMVs) in the Belgian-Dutch rMCM program intended for the Belgian Navy, recently began its first sea trials campaign from Concarneau. The rMCM program is being led by Belgium Naval & Robotics, a consortium formed by Naval Group and Exail, and involves Kership (a joint venture between Piriou and Naval Group) as industrial prime contractor.

Launched in 2021, the *Oostende* first took to water on March 29, 2023, followed by the second ship in the series, the *Vlissingen*, for the Royal Netherlands Navy on October 19, 2023, and the *Tournai* on June 24, 2024.

The fourth ship in the series, the *Scheveningen*, is due to be launched in December 2024. In total, seven of the twelve ships in the series are currently under construction at various stages of completion.

Delivery of the *Oostende* is scheduled for the summer of 2025 in Zeebrugge, Belgium. Deliveries of the other ships will then be staggered until mid-2030.

Awarded in 2019 to Belgium Naval & Robotics, the consortium formed by Naval Group and Exail, the rMCM program is a major component of European defense cooperation. Naval Group is responsible

for ship design, overall integration, testing and commissioning of the mission system. The ships are built and assembled by Piriou, under the industrial project management of Kership, a joint venture between Naval Group and Piriou. Exail is in charge of the drones' mission system. Most of these drones will be produced and maintained in Belgium.

The solution acquired by the Belgian and Dutch navies represents a complete paradigm shift in the way mines are fought, with a ship and ship's control and mine-fighting personnel remaining at a distance from the danger (stand-off). This solution also means that the speed at which the mined area can be dealt with is ten times faster than that of conventional means.

These specialized mine warfare vessels will be the first to have the capacity to embark, launch, or fly and reconfigure a range of surface drones (vessels of around 12 meters and 19 tonnes), underwater drones, and aerial drones. The mine countermeasures vessels will use a fully robotized system to detect, classify, identify, and neutralize mines. They can withstand underwater explosions and have very low acoustic, electrical, and magnetic signatures, which is in line with the missions to be carried out.

EVOLVED CAPE-CLASS PATROL BOAT DELIVERED TO ROYAL AUSTRALIAN NAVY BY AUSTAL

Austal Australia has delivered the seventh Evolved Cape-class Patrol Boat (ECCPB), ADV *Cape Solander*, to the Royal Australian Navy.

The SEA1445-1 Evolved Cape-class Patrol Boat (ECCPB) project, initially constructing six 58-meter aluminum monohull patrol boats for the Royal Australian Navy from May 2020, was extended by two vessels in April 2022 and a further two vessels in February 2024, bringing the total to ten vessels.

The Evolved Capes feature new, larger amenities to accommodate up to 32 people, improved quality of life systems, and advanced sustainment intelligence systems that further enhance the Royal Australian Navy's ability to fight and win at sea.

The patrol boats will be utilized for a wide variety of constabulary and naval missions and play a critical role in Australia's national security as a high-performing, reliable, and effective maritime asset.



ADV *Cape Solander*. (Credit: Austal/RAN)

MACARTNEY WINS CONTRACT WITH T. MARIOTTI FOR NEW ITALIAN NAVY VESSEL

MacArtney has been entrusted the role of one-stop solution partner, delivering critical underwater systems that bolster the security, safety, surveillance, and rescue efforts of the Italian Navy's Special and Diving Operations - Submarine Rescue Ship (SDO-SuRS) contracted to Italian shipbuilder T. Mariotti.

MacArtney's expertise in underwater systems integration proved paramount in delivering a comprehensive solution for the Italian Navy's SDO-SuRS. The solution comprises MacArtney's electric launch and recovery system eLARS™ and advanced technology from esteemed business partners Klein, AML Oceanographic and Sonardyne, providing high-res Side Scan Sonar, Moving Vessel Profilers, and Diver Detection Sonar systems.

Combined, these enhancements from MacArtney and its partners improve the vessel's launch and recovery, security,

and surveillance capabilities. They also strengthen safety measures by enhancing the detection of unauthorized divers and vessels, tracking movements, and improving underwater imaging, thereby advancing the SDO-SuRS's search and recovery operations.

The newly-built 120 m SDO-SuRS replaces the retiring Nave Anteo as the Italian Navy's (Marina Militare Italiana) primary Special and Diving Operations – Submarine Rescue Ship. It elevates both naval and civil underwater operations, supporting rescue missions, special tasks, and marine infrastructure protection.

T. Mariotti selected the MacArtney eLARS as a key feature of the SDO-SuRS. The eLARS technology provides an eco-friendly, compact, and reliable all-electric system. Its efficiency exceeds that of hydraulic systems by more than 30%. At the same time, eliminating pressurised oil over water

significantly reduces oil spillage risks. Additionally, it features a self-assessment capability for preventive maintenance and enables remote shore-based operation, optimising overall processes.



1 The groundbreaking contract with T. Mariotti for the Italian Navy SDO-SuRS also represents the debut of the first all-electric eLARSTM in the Italian market. (Credit: MacArtney)

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NEW TELEDYNE GAVIA AUV SERVICE CENTER OPENS IN POLAND TO SUPPORT NAVAL OPS

Teledyne Gavia ehf. was in attendance at the grand opening of the Gavia autonomous underwater vehicle (AUV) Service Center established by ENAMOR Limited in Gdynia, Poland.

ENAMOR Limited has supported the Polish Navy's expanding fleet of Gavia AUVs for over a decade. To commemorate this long-standing relationship, the Service Center has been opened in partnership with the Polish Naval Academy. Several honored guests, including highly respected Polish Navy Admirals, Captains, and Officers, attended the grand opening in July 2024. Representatives from Teledyne Gavia in Iceland, Teledyne Marine personnel from the United States and Europe, as well as various NATO partners and Gavia AUV Users, attended the grand opening.

Teledyne Gavia and ENAMOR have developed a robust partnership over the past ten years. The Polish Navy's initial acquisition of Gavia AUVs in 2013 was facilitated through a contract secured by ENAMOR Limited. Following the delivery, the Polish Navy received guidance and training from both Teledyne Gavia ehf. and ENAMOR Limited.

The Polish Navy has been successfully operating Gavia AUVs for mine countermeasures (MCM) since 2013. Beginning with that initial delivery, ENAMOR has continued to support the Polish Navy both operationally and technically over the last decade.

With an increased number of Gavia AUVs in Poland and with other NATO users, com-

bined with an increase in critical underwater projects in Europe, comes an increased need for Gavia service and support outside of Iceland. To expand Gavia's technical support in Europe and increase ENAMOR's technical support capabilities, ENAMOR has dedicated personnel and investments to open a Gavia AUV Service Center in Gdynia, Poland.



Teledyne Gavia

SENEDIA AND UTIC FORGE PARTNERSHIP WITH DEFENCE TEAMING CENTRE IN AUSTRALIA

SENEDIA, the Alliance for Defense Tech, Talent, and Innovation and the Undersea Technology Innovation Consortium (UTIC), have entered a partnership with the Defence Teaming Centre (DTC) in Adelaide, South Australia. The partnership is the result of a shared, deep commitment to the AUKUS (Australia, United Kingdom, United States) agreement aimed at promoting a free and open Indo-Pacific.

As partners, SENEDIA, UTIC, and DTC will share insights on their respective efforts related to workforce development, small business assistance, supply chain development, and advanced research and commercialization. SENEDIA and UTIC will make some of their networking and education opportunities available to DTC members.

"The historic agreement made through AUKUS lays the foundation for the most significant integration of our undersea and military capabilities ever achieved between the United States, Australia, and the UK," said US Senator Jack Reed (RI), Chairman of the Senate Armed Services Committee. "For this partnership to protect

global security, improve the capabilities of our allies, and ensure effective collaboration across nations, we need these points of connection at every level of the defense ecosystem, including our industry leaders."

"SENEDIA's support for job training and supply chain development perfectly fits the urgent requirements for Australia to uplift its submarine industrial base. Programs like eastern Connecticut's Manufacturing Pipeline Initiative, which SENEDIA helps fund, is a great example of how the US can strengthen Australia's maritime economy," said Rep Joe Courtney, Ranking Member of the House Seapower Subcommittee and Co-Chair of the Congressional AUKUS Working Group.

"Individually and together, our organizations are focused on supporting our collective submarine shipbuilding and undersea technology ecosystems, including closing the gaps in human capital, cyber resiliency, and modernization of defense manufacturing capacity," said Molly Donohue Magee, CEO of SENEDIA and UTIC.



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ISA ELECTS NEW SECRETARY-GENERAL AT CRITICAL MOMENT FOR OCEAN MINING



The International Seabed Authority (ISA) has announced that Brazilian oceanographer Letícia Carvalho has been elected the new Secretary-General for the 2025–2028 term.

The election took place during the ISA's 29th session of the Assembly, held July 29–August 2, 2024. Carvalho will be replacing Michael Lodge, who has held the position since 2016, at a pivotal time in deep-sea mining. There are reportedly 32 states that—including France, Guatemala and Honduras—who want to cease

all planned mining activity in international waters until additional marine environmental research is conducted.

Despite this, Canadian mining company The Metals Company (TMC) is still expected to apply for a license sometime this year, adding mounting pressure on the ISA to define a clear set of rules and regulations—also referred to as the "Mining Code"—that govern extraction protocols and procedures.

In a press release, the ISA stated that Carvalho's new position will help move along the process: "The ISA Secretariat extends its congratulations to Ms. Carvalho and looks forward to working with her in the future to further our shared goals and to ensure the deep seabed is regulated and protected for the benefit of all humanity."

The ISA also formally expressed its "immense gratitude and recognition to Secretary-General Michael Lodge for his transformative leadership and dedicated service in the service of ISA, the Member States and the United Nations Convention on the Law of the Sea for over 30 years," recognizing the significant progress made in recent years to establish the building blocks for the sustainable management of deep-sea resources, including the advancement of scientific research as it pertains to deep-sea environments.

CYAN RENEWABLES ACQUIRES MMA OFFSHORE TO EXPAND OFFSHORE WIND IN ASIA PACIFIC

Cyan Renewables (Cyan), Asia's leading offshore wind services platform based in Singapore, has announced its acquisition of Australian offshore marine services provider MMA Offshore (MMA) for A\$1.1 billion (US\$702 million). This transaction marks the region's largest take-private deal in the offshore wind energy services industry, strengthening Cyan's position in the Asia Pacific (APAC) region and underscoring the sector's crucial role in achieving net zero goals.

Cyan plans to retain MMA's workforce, leveraging and expanding its expertise, assets, and operating model to further penetrate the offshore wind support services market globally and in Asia. In addition to supporting existing clients in the offshore energy and broader maritime industries with its marine and subsea services, Cyan will actively pursue growth opportunities through mergers and acquisitions and organic expansion.

The deal comes amid increasing demand to adopt renewable and clean energy. According to the International Energy Agency (IEA), global clean energy capacity must triple by 2030 to meet net zero emissions by 2050. The wind farm market is projected to grow at a CAGR of 21.4% from 2024 to 2034. At the same time, the global demand for vessels in the offshore wind sector is expected to outpace supply significantly, particularly as the average turbine size

has increased, with some projects now planning to install turbines as large as 15 MW.



With the acquisition, Singapore-based Cyan Renewables set to become the Largest APAC Platform for Offshore Wind Energy Services. (Credit: Cyan Renewables)

SPACE PERSPECTIVE LAUNCH MARINE SPACEPORT BUILT BY GUICE OFFSHORE

Space Perspective recently unveiled the Marine Spaceport (MS) Voyager, the world's first and only marine spaceport. The purpose-built 294-foot vessel was built by offshore supply-vessel transportation specialist Guice Offshore and designed to stage the launch and retrieval operations of Spaceship Neptune—Space Perspective's unique flight system—making the space travel company the first to prioritize ocean-based launches.

MS Voyager's innovative and patented launch system employs a series of rollers that work in tandem to maneuver the balloons as they stand upright on the vessel's 200-foot-long deck. This design allows for a significantly reduced launch footprint compared to traditional balloon launches, eliminating the need for an aircraft carrier.

The MS Voyager features Dynamic Positioning, four engines, and four generators, as well as a bridge-located Mission Control to coordinate launch and landing operations.

The deck handling of Spaceship Neptune will be supported by a custom 52-foot

A-frame—the largest known purpose-built space capsule retrieval A-frame. This water landing method, which has been used since the Apollo era and by SpaceX, ensures a safe return to Earth, drawing on the exercise of Space Perspective's team of former SpaceX and NASA launch and retrieval specialists.

Taber MacCallum, Space Perspective Founder and Co-CEO, shared his thoughts on this milestone, "The capability to launch and retrieve the Neptune capsule at sea creates worldwide scalability along with an unprecedented closure of the routine operations safety case. We are proud to bring a new spaceflight capability to Port Canaveral and the Space Coast."



▲ MS Voyager. (Credit: Space Perspective)

OTG LAUNCHES NEW ONLINE COURSE FOR METHANOL AS ALTERNATIVE FUEL

Ocean Technologies Group (OTG), the global leader in maritime Human Capital Management and operational technologies, has launched a pioneering new e-learning course: *Methanol Fuel Safety*.

As the world looks to reduce its dependency on fossil fuels in favor of cleaner energy, methanol has emerged as an increasingly popular option due to its low emissions, production versatility, and cost-effectiveness when compared to other alternative fuels. Recent data indicates methanol has overtaken liquified natural gas (LNG) as the preferred alternative fuel for new ships in 2023.

According to the Methanol Institute, there are currently 251 methanol newbuild vessels on the water or in the order book. Well-established technologies also allow for easy conversion of existing marine internal combustion engines to run on methanol.

Most methanol orders are for containerships, with a few for bulk and car carriers. Although LNG remains popular, particularly for new builds in container and car carrier segments, the total number

of LNG orders fell from 222 in 2022 to 130 in 2023. These figures reflect the industry's broader move towards exploring various alternative fuels to achieve a greener future.

Recognizing the importance of this trend and in response to customer desire to start preparing their seafarers for new fuels, OTG has developed a new e-learning title on *Methanol Fuel Safety*. The course curriculum aligns with ongoing work in industry groups to establish training standards for working safely with new fuels. This comprehensive program provides operators with essential knowledge on the safe handling and storage of methanol fuel and provides guidance on managing leaks and fires.

The title considers all applicable industry regulations and guidelines available such as "The International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels (IGF Code)" and the IMO's interim guidelines for "The Safety of Ships Using Methyl/Ethyl Alcohol as Fuel."

AMERICAS

Unmanned Maritime Systems Technology USA

Arlington, VA | September 23–25

www.smgconferences.com/defence/northamerica/conference/umst-usa

OCEANS Halifax

Halifax, Canada | September 23–26

<https://halifax24.oceansconference.org>

American Floating Offshore Wind Technical Summit

Portland, ME | September 24–25

<https://umaine.edu/afloat/>

Industrial Decarbonization North America 2024

Pittsburgh, PA | October 1–2

<https://events.reutersevents.com/energy-transition/industry-usa>

ACP Offshore WINDPOWER

Atlantic City, NJ | October 28–30

<https://cleanpower.org/offshore-windpower>

International Workboat Show

New Orleans, LA | November 12–14

www.workboatshow.com

Underwater Intervention

New Orleans, LA | November 12–14

www.workboatshow.com/underwater-intervention

EUROPE

WindEnergy Hamburg

Hamburg, Germany | September 24–27

www.windenergyhamburg.com

Sea Tech Week

Brest, France | October 15–17

www.seatechweek.eu

FloatMed

Bari, Italy | October 21–23

<https://float-med.com>

Marine Energy Transition Forum

Antwerp, Belgium | October 22–23

www.petrospot.com/events/metf24

Euronaval

Villepinte, France | November 4–7

www.euronaval.fr

Ocean Energy Europe

Aviemore, Scotland | November 5–6

www.oceanenergy-europe.eu/annual-event/ocean-energy-europe-2024

Marine Autonomy and Technology Showcase (MATS)

Southampton, UK | November 5–7

[https://noc-events.co.uk/mats-2024](http://noc-events.co.uk/mats-2024)

Offshore Energy Conference & Exhibition

Amsterdam, The Netherlands | November 26–27

<https://oeec.biz>

OTHER REGIONS

Underwater Minerals Conference

Rarotonga, Cook Islands | September 15–21

www.underwaterminerals.org

International Conference on Ocean Energy (ICOE)

Victoria, Australia | September 17–19

www.ocean-energy-systems.org/icoe/conferences/icoe-2024-melbourne/

WIND EXPO

Chiba, Japan | October 2–4

www.wsew.jp/hub/en-gb/about/wd.html

Mediterranean Offshore Conference

Alexandria, Egypt | October 20–22

<https://moc-egypt.com>

All-Energy Australia

Melbourne, Australia | October 23–24

www.all-energy.com.au

ADIPEC

Abu Dhabi, UAE | November 4–7

www.adipic.com

MAST Australia

Adelaide, Australia | November 19–21

<https://mastconfex.com/australia2024>

OSEA Energy Week

Singapore | November 19–21

www.osea-asia.com

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2024 EDITORIAL CALENDAR

| MONTH | DEADLINES | EDITORIAL FOCUS AND SHOW DISTRIBUTION | THEME FOCUS |
|----------------------|--|---|--|
| SEPTEMBER | Editorial: August 12 Ad: August 30 | REMOTE MARINE OPERATIONS • Sea Tech Week® October 15–17 • ACP Offshore WINDPOWER October 28–30 • Ocean Energy Europe November 5–6 • Offshore Energy Exhibition & Conference November 26–27 | Marine autonomy, digital twins, remote monitoring and intervention |
| OCTOBER/ NOVEMBER | Editorial: September 9 Ad: September 27 | UNCREWED VEHICLES & MARINE ROBOTICS • Marine Autonomy and Technology Showcase (MATS) Nov 5–7 • International Workboat Show November 12–14 | USV R&D, emerging applications, breakthroughs in remote ops |
| DECEMBER | Editorial: October 17 Ad: October 28 | THE FUTURE OF OCEAN TECHNOLOGY | <i>Special Edition</i> |

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TRIPLE SUCCESS FOR 3T TRAINING SERVICES IN PRESTIGIOUS GWO AWARDS

Global training pioneer 3t Training Services has consolidated its position as the UK's largest and leading training provider after securing multiple finalist spots at the GWO Safety and Training Awards.

Nominated in three separate categories at the prestigious awards ceremony, 3t Training Services is one of only three companies nominated for 'Training Team of the Year Northern Europe'. This achievement simultaneously highlighted 3t's commitment to excellence not just on a company level but a personal one too, two of its team members are up for individual awards in the 'Young Achiever of the Year' and 'Instructor of the Year' categories, respectively.

Funded Account Manager at 3t, Paige Convery, 26, is one of three people worldwide in the running for Young Achiever of the Year. Similarly, 3t's Blade Repair Instructor, Scott Bradley, is one of five instructors worldwide to be nominated for the highly prized Instructor of the Year title—securing his place as a finalist after being voted for by delegates who have completed their training with 3t under Scott's guidance.

As one of the most recognized and respected training bodies for the global wind industry, the Global Wind Organisation's (GWO)

annual awards recognize the best of the best among the international wind training providers. The final winners of the GWO Safety and Training Awards will be named at an Awards Ceremony on October 9, 2024, held at the GWO Forum in Florida, US.



▲ 3t's GWO Blade Repair course. (Credit: 3t)

GULF OF MEXICO DEAD ZONE CURRENTLY LARGER THAN AVERAGE

NOAA-supported scientists have revealed that this year's Gulf of Mexico "dead zone"—an area of low to no oxygen that can kill fish and marine life—is approximately 6,705 square miles, the 12th largest zone on record in 38 years of measurement. This figure equates to more than 4 million acres of habitat potentially unavailable to

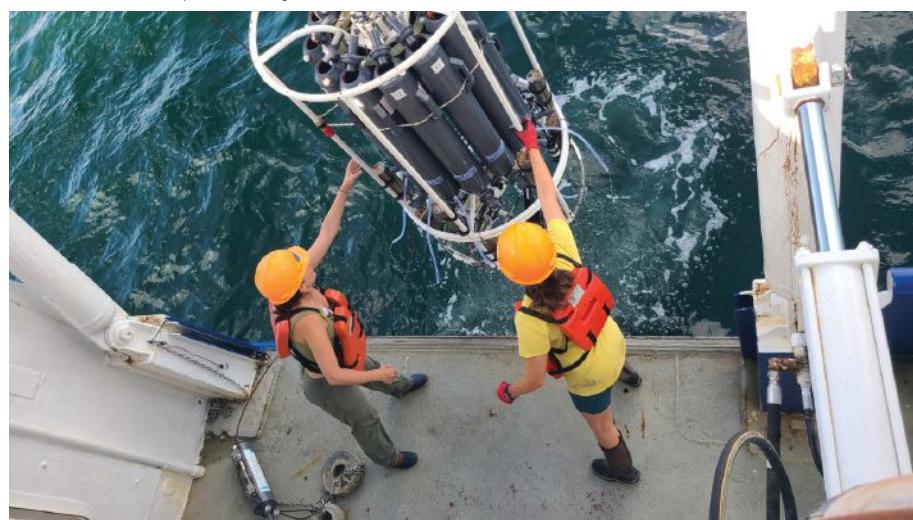
fish and bottom species, an area roughly the size of New Jersey.

Scientists at Louisiana State University and the Louisiana Universities Marine Consortium (LUMCON) led the annual dead zone survey July 21–26 aboard LUMCON research vessel Pelican. This annual mea-

surement is a key metric that informs the collective efforts of the Mississippi River/Gulf of Mexico Hypoxia Task Force, a state/federal partnership which has set a long-term goal of reducing the five-year average extent of the dead zone to fewer than 1,900 square miles by 2035.

While the NOAA-supported research surveys provide a one-time snapshot of the dead zone, the five-year average captures the dynamic and changing nature of the zone over time. The five-year average size of the dead zone is now 4,298 square miles, more than two times larger than the 2035 target.

In June, NOAA predicted an above-average sized dead zone of 5,827 square miles, based primarily on Mississippi River discharge and nutrient runoff data from the US Geological Survey. The measured size fell within the uncertainty range for NOAA's ensemble forecast, demonstrating the overall accuracy of the underlying models and their ability to be applied as tools for nutrient reduction strategies.



▲ Collecting near-bottom water aboard RV Pelican to obtain oxygen measurements. (Credit: LUMCON/LSU, Cassandra Glaspie)

OPT FILES PATENT FOR INNOVATIVE DOCKING AND RECHARGING BUOY TECHNOLOGY

Ocean Power Technologies, Inc. (OPT), a leader in innovative and cost-effective low-carbon marine power, data, and service solutions, has filed a patent pending for its groundbreaking docking and recharging buoy technology, specifically designed for the Wave Adaptive Modular Vessel (WAM-V) unmanned surface vehicle (USV). This advanced system has already been successfully demonstrated, showcasing its potential to revolutionize the operational efficiency of autonomous marine vessels.

The patent-pending docking and recharging buoy technology represents a significant step forward in the capabilities of USVs, offering a reliable solution for extended missions and operations in remote ocean environments. This technology enables OPT's WAM-V USV to autonomously dock and recharge at sea with various charging stations (including, OPT's PowerBuoy®), significantly increasing its operational range

and endurance. The innovation is particularly valuable for applications in oceanographic research, environmental monitoring, and defense sectors, where long-term, autonomous deployment is critical.

"The development of this docking and recharging buoy technology is a testament to OPT's commitment to advancing sustainable and innovative ocean technologies," said Philipp Stratmann, CEO of Ocean Power Technologies. "By enabling our WAM-V USVs to operate autonomously for extended periods, we are providing a cost-effective and environmentally friendly solution for a wide range of maritime applications."

The demonstration of the docking and recharging buoy technology underscores OPT's dedication to providing comprehensive solutions that address the growing need for persistent maritime presence

and data collection. This development also aligns with OPT's broader strategy to enhance the functionality and versatility of its Merrows Platform, bringing artificial intelligence capable solutions to the ocean, thereby expanding its market reach and supporting a variety of customer needs.



↑ Wave Adaptive Modular Vessel (WAM-V) USV. (Credit: OPT)

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WORLD'S FIRST ONENET PRODUCT CERTIFICATION AWARDED TO AIRMAR

Airmar Technology Corporation, a world leader in ultrasonic transducers and Chirp technology, recently revealed that their SmartBoat® Solution has achieved OneNet certification, the third generation NMEA Standard for marine data interfacing and networking. SmartBoat is the only marine electronics solution that integrates devices using current, future, and legacy standards including NMEA 0183, NMEA 2000®, and OneNet.

In addition to utilizing Ethernet technology for a more robust and faster data exchange platform than the widely adopted NMEA



▲ SmartBoat module. (Credit: Airmar)

2000, OneNet's advantages include easier integration of marine electronics with onboard and internet-based systems via IP networking, enhanced security with encrypted features, and improved interoperability and compatibility among different manufacturers' marine electronics.

"Airmar's SmartBoat Solution is a leading example of innovative technology that is designed to simplify the management of onboard systems, improve navigation and safety, and enhance the overall boating experience," stated Mark Reedener, NMEA President & Executive Director.

"As the industry adapts to the new OneNet standard, the benefits of more integrated, efficient, and advanced marine systems will become increasingly apparent," continued Reedener.

"Airmar is a longtime supporter of the NMEA standards. Having the first product to achieve OneNet certification demonstrates our commitment to advancing the capabilities of marine electronics," added Jennifer Matsis, Vice President, Sales & Marketing at Airmar.

Airmar's SmartBoat is a universal vessel monitoring and control solution that integrates various sensors and data sources to provide real-time insights and automation for vessels.

ULTRA MARITIME TO SUPPLY US NAVY WITH Q62G SONOBUOYS



Ultra Maritime has been awarded a \$49 million sole-source contract for the AN/SSQ-62G sonobuoys for the US Navy in support of annual training, peacetime operations, and testing expenditures.

"Ensuring the safety of our sailors and maintaining a robust deterrent against our adversaries is paramount in today's maritime landscape. As the only qualified provider of the cutting-edge Q-62G and Q-53 sonobuoys, we at Ultra Maritime are honored to play a pivotal role in advancing anti-submarine warfare capabilities for the US Navy and our allied nations," said Edward Cook, Vice President and General Manager of Ultra Maritime US.

▲ Ultra Maritime's first qualified and deployed next-generation AN/SSQ-62 and AN/SSQ-53 sonobuoys. (Credit: Ultra Maritime)

ARCTIC RAYS ACQUIRED BY INKFISH

Arctic Rays, a pioneering leader in subsea imaging technologies, has announced its acquisition by Inkfish, a newly established organization dedicated to providing services to support marine researchers globally. This strategic acquisition is set to combine Arctic Rays' innovative product offerings with Inkfish's ability to connect with scientific partners and causes around the world.

Founded in 2015 on a commitment to manufacturing turnkey custom imaging solutions with superior responsiveness, Arctic Rays has consistently delivered patented lighting packages, still and video capture payloads, and other integrated systems for subsea vehicles operating as deep as 6,000 meters.

Inkfish was founded in 2021 to support marine researchers by planning and executing research expeditions, providing resources, and developing new technologies to further research initiatives.

With this acquisition, Inkfish recognizes the value of Arctic Rays' market position and its dedication to quality engineering design, manufacturing processes, and post-deployment support.

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Nortek excels in the development and manufacture of acoustic Doppler instrumentation. Doppler Velocity Logs (DVLs) are used for subsea navigation. Acoustic Doppler Current Profilers (ADCPs) are used to understand physical processes in the ocean, rivers, lakes, and laboratories. We pride ourselves on being innovative in product development and production processes. Nortek provides solutions to engineers and scientists by offering real-time data collection and support from our responsive technical team.

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Since 1977, Subsalve USA has been America's #1 manufacturer of standard and custom flotation devices and we are the innovators in buoyancy and engineered inflatables. Our products include: Professional, Commercial, Standard, Shallow Water, Enclosed Flotation Bags, Cable & Pipeline Floats, Water Load Test Bags, Rapid Recovery & Mark V/ ORCA EOD Systems.

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For over 40 years, DeepSea Power & Light has provided high-quality and innovative products to the oceanographic community. This extensive portfolio includes underwater cameras, video systems, lighting solutions, pressure relief valves and lasers along with pressure-testing services. Products are rigorously tested in both the initial design process and manufacturing stage to consistently perform in the harshest environments—from wet/dry surface applications to full ocean depth deployments. From offshore oil fields to oceanographic exploration, DeepSea delivers ease of service, reliability, high performance and cost effectiveness to meet the challenging demands of any subsea application worldwide.

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Inkfish was founded in 2021 to support marine researchers by planning and executing research expeditions, providing resources and developing new technologies to further research initiatives. With a fleet of research vessels and specialized equipment, Inkfish supports research through ocean expeditions and engineering development.



REMOTE OCEAN SYSTEMS

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Remote Ocean Systems has been an industry leader in the design and manufacture of reliable, high-tech equipment and systems for the most severe subsea, oceanographic, shallow water, industrial, commercial and military environments since 1975. Our product line includes high accuracy and robust positioners and rotators and a wide variety of lighting including: halogen and LED technology offering 10,000+ lumens, flood, spot, dimming and non-dimming types. Our cameras offer exceptional sensitivity in low light conditions, high definition color, ethernet control, compact size rated to 6,000-meter depth. We also have a fully staffed engineering department to help with your special requirements.

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SIDUS Solutions LLC, 'SIDUS' is a worldwide company that designs, manufactures and installs systems in the most extreme of environments. SIDUS products include Cameras, Pan & Tilts, Lights and Lasers for use in hazardous areas, and Subsea Applications. SIDUS serves the energy, scientific, military, nuclear, and shipping industries. Engineering experience makes us the perfect choice for application specific surveillance systems to provide end to end safety and security. SIDUS provides complete integration, design, documentation, and commissioning for all systems. From sea-floor observation platforms, to surveillance systems on drilling rigs, or sonar deployment systems—SIDUS is a field proven solution.



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We provide SMART Cable hardware, software, and data management solutions. SMART (Sensor Monitoring and Reliable Telecommunications) Cables are submarine telecommunications cables equipped with sensor packages inside their repeaters (amplifiers). SMART Cables will enable transformative advancements in Tsunami and Earthquake Early Warning monitoring, global climate monitoring, and network integrity, providing substantial societal benefits through enhanced protection of life, property, and global telecommunications infrastructure.



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For nearly six decades, Winchester Interconnect has been a key supplier and a solution provider to the oceanographic and maritime industries supporting a wide range of subsea applications. We design and manufacture high performance cables for use in harsh and demanding environments. Our rugged Xtreme Cables are known and preferred worldwide for superior reliability and durability in commercial and military projects. Innovative cable solutions for ROVs, instrumentation, towed array and many others, ranging from high flex miniature cable designs to rugged EOM steel cables incorporating high performance optical fibers and Ethernet pairs. Visit our website: winconn.com



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SubC Imaging pioneers cutting-edge subsea imaging solutions for marine research, offshore energy, aquaculture, fisheries, and more. Our globally acclaimed equipment includes complete camera systems, cameras, LEDs, and lasers. Committed to innovation, we also offer DVRs and remote operations solutions, enhancing efficiency and accessibility. With clients in over 30 countries, SubC Imaging leads in advancing technology for intelligent and high-performance subsea inspections and surveys.

CABLES



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Established in 1957, South Bay Cable designs, manufactures and tests specialized Electro-Optical-Mechanical Cables for use in demanding marine environments. Our cables tackle stringent customer requirements which include ROV Tether and Umbilical Cables, Towed Array Cables, Mux BOP Control Cables, Video Inspection, Fairied Cables and a host of other customer-specific applications.



BIRNS, INC.

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BIRNS has served the subsea industry since 1954, and is an ISO 9001:2015 certified global leader in the design and manufacturing of high performance connectors, cable assemblies and lighting systems. With a NAVSEA PRO-020 certified molding facility, it offers sophisticated connector lines, including 6km-rated electrical, electromechanical, coaxial, electro-coax, optical, electro-optical and electro-opto-mechanical hybrids. BIRNS provides the industry's highest volume of cost-effective hydrostatic and helium pressure testing, and has a wide range of ABS Product Design Assessment (PDA) certified fiber optic and electrical penetrators. BIRNS' LED and tungsten-halogen marine, chamber, security and commercial diving lights are trusted in the world's most extreme environments.

OCEAN INDUSTRY DIRECTORY



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Birns Aquamate designs and manufactures 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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The EdgeDVR is currently used worldwide by most of the major ROV and Diving contractors. With our present Version 4 software, we have six models. The EdgeDVR has become an essential part of any ROV and Diving system offshore, easy to use and reliable. The system is capable of recording simultaneous High Definition and Standard Definition video, together with auto creation of Dive, Video, Photo and Anomaly logs. Multi channel digital overlay is also available for all recorded channels, logos and realtime survey data can be displayed. With around 500 systems now offshore, we have a proven record of reliability.

Our version 5 software is currently in development and full details will be released soon...

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Oceanus Science & Technology is an established market leader for field-proven deck handling systems, including an exclusive series of winches, LARS, and A-frames. Whether we are custom-fitting a heavy pull multi-purpose winch or developing a prototype sample collector for deep-sea exploration, we have the industry expertise, marine engineering experience, and technological know-how to deliver failproof, mission-critical assets. Oceanus also owns an expanding portfolio of rapidly mobilized rental equipment and instrumentation to manage your operations with optimal flexibility. Oceanus has offices in Houston, TX and Houma, LA.

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Ocean Specialists, Inc. (OSI) is a system development and advisory firm for underwater cable projects and technology with global capabilities. OSI works with clients during all project phases of subsea network development, from planning and design to procurement and implementation. Our customers, primarily representing Oil and Gas, Telecommunications and Ocean Observing, recognize the value of fiber optic networks to their field and services solutions, and look to OSI to deliver the skills and experience that developing these networks require.

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Bluefield Geoservices was established in 2018 to provide the ocean industries with a fresh approach to offshore geotechnical survey. Our mission: to leverage the team's 100 years of combined offshore geotechnical engineering and geosurvey experience to devise and deliver innovative solutions to the most persistent problems in offshore developments. We develop and deploy progressive in situ seabed investigation methods and custom technologies that deliver best-quality geotechnical and related site data and analysis.

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Kongsberg Discovery develops, manufactures and delivers innovative technology to enhance knowledge, surveillance and sustainability in the ocean space. From the deepest sea to outer space, our unique offering allows our customers to understand complex environments, mitigate risk and achieve ambitious objectives. The Kongsberg Discovery portfolio spans hydro acoustics with sonars and echo-sounders, marine robotics, inertial navigation, communication, and underwater and above surface position reference systems using laser, radar and GNSS technologies. Our technology, combined with deep application knowledge and software expertise, provides significant value for our customers.

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CSA Ocean Sciences Inc. brings more than five decades of experience in marine environmental assessments in the US and internationally, with offices in the United States, the Eastern Mediterranean, Trinidad, Suriname, Brazil, and Australia. CSA's expertise in coastal, marine, and deep ocean surveys is built on the integration of science, operations, and an understanding of environmental data collection, management, and analysis within geospatial domains.



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EvoLogics, founded in 2000, focuses on pioneering maritime technologies. Specializing in underwater smart robotics, sensor systems, acoustic communication and positioning networks, EvoLogics integrates advanced engineering with bionic principles.

The company's development strategy centers on an underwater "Internet of Things" for intelligent vehicle and sensor cooperation. Smart underwater networks build on EvoLogics' S2C spread-spectrum communication technology that combines underwater acoustic data networks with integrated real-time positioning. The company designs highly capable underwater solutions for complex mission scenarios with advanced sensor systems, AI-based object recognition and analytics, diver navigation systems, and autonomous subsea and surface vehicles for survey and support operations.



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Cortland designs, manufactures, and delivers technologically advanced synthetic fiber braided ropes and other custom high-performance solutions. Examples include deep water synthetic fiber ropes, oceanographic mooring systems, coring lines, synthetic reinforcing over braids, in-line attachments/lifting points (cable grips), and thermoplastic extrusions over high-performance rope.

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IMAGENEX

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



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SUBSEA TECHNOLOGY



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DEVELOLOGIC is a German-based company founded in 2000 with a focus on the development, manufacturing, and testing of turn-key customized data-acquisition and telemetry solutions for subsea monitoring applications. To be able to supply cost-efficient systems within a short delivery time, DEVELOLOGIC developed a modular system containing all the necessary elements for transporting data from the depths of the ocean to the Customers' office. Ad-hoc technologies range from acoustic recording and communication solutions, Dataloggers and pressure housings for Seafloor Landers, Instrument Moorings, and Telemetry Buoys.



EVOLOGICS GMBH

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SeaRobotics Corporation, headquartered in Stuart, Florida, specializes in the design and manufacture of intelligent marine robotics, including a line of Autonomous Surface Vehicles (ASVs) for commercial and defense markets around the world. Applications for SeaRobotics vehicles range from bathymetric and hydrographic coastal surveys to, harbor, and riverine inspection and surveillance. From ground-breaking ASV design through to custom manufacturing for theme parks, SeaRobotics designs, engineers and manufactures smart solutions for complex marine challenges. In addition to our ASV line, SeaRobotics also designs and builds hull and tank bio-inspired underwater grooming and cleaning systems.

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| ADVERTISERS INDEX |

| | | | |
|---|----|---|----|
| ACP Offshore WINDPOWER | 55 | MacArtney A/S | 3 |
| https://cleanpower.org/offshore-windpower | | www.macartney.com | |
| Aero Tec Laboratories..... | 37 | OCEANS Halifax | 59 |
| https://atlinc.com | | https://halifax24.oceansconference.org | |
| AIRMAR/MSI Transducers | 15 | Ocean Specialists..... | 51 |
| www.airmar.com www.msitransducers.com | | https://oceanspecialists.com | |
| Anchor Logistics Solutions | 49 | PyroScience | 19 |
| https://anchorslog.com | | www.pyroscience.com | |
| BIRNS | 23 | SAAB Seaeye..... | 68 |
| https://birns.com | | www.saabseaeye.com | |
| Blueprint Subsea..... | 25 | Sea Tech Week..... | 57 |
| www.blueprintsubsea.com | | www.seatechweek.eu | |
| CSA Ocean Sciences | 67 | SEAmagine Hydrospace Corporation | 7 |
| www.csaocean.com | | www.seamagine.com | |
| Digital Edge Subsea..... | 47 | SeaRobotics..... | 2 |
| www.digitaledgesubsea.com | | www.searobotics.com | |
| EdgeTech..... | 5 | South Bay Cable | 39 |
| www.edgetech.com | | https://southbaycable.com | |
| EvoLogics | 9 | SubCtech..... | 35 |
| https://evologics.com | | https://subctech.com | |
| Greene Tweed..... | 29 | SubSalve USA | 43 |
| www.gtweed.com | | https://subsalve.com | |
| Imagenex..... | 4 | World Submarine Organization..... | 33 |
| https://imagenex.com | | www.mtsmuv.org | |
| International Work Boat Show | 54 | | |
| www.workboatshow.com | | | |

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