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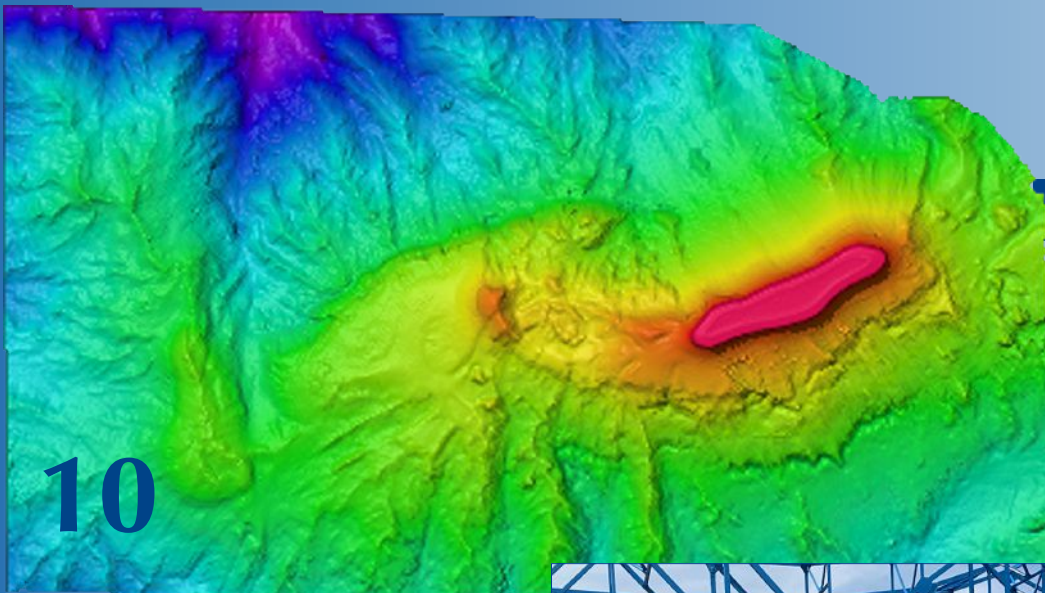
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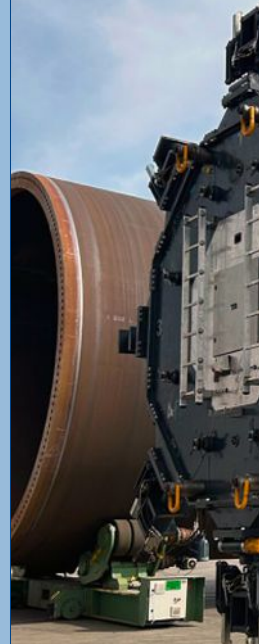


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High-quality hydrographic data are achieved by integrating position and orientation data from the Applanix POS MV OceanMaster with Trimble RTX, alongside sonar data collected from a multi-beam system. See story on page 18.

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)) Investment Report on Maritime Energy Transition. S2G Investments, a multi-stage investment firm focused on scaling solutions across food and agriculture, oceans, and energy, has released a new report: Invested at the Seams of the Maritime Energy Transition, www.s2ginvestments.com/insights/maritime-energy-transition. It examines shifting market dynamics, investment strategies, and near-term solutions that can accelerate emissions reductions while unlocking competitive advantage in the maritime sector. Maritime emissions account for 3 percent of all global emissions and have risen 20 percent in the past decade as trade volumes have increased. With regulations tightening and companies pushing for more surety across the supply chain, S2G believes maritime companies that are early adopters of energy-efficient technologies stand to gain a competitive edge. Near-term solutions are available today that can help improve capital efficiency, bolster supply chain resilience, and help companies future-proof their operations in an increasingly volatile global trade environment. AI-enabled voyage optimization, air lubrication systems, wind-assisted propulsion, and battery integration are currently offering both economic and environmental returns. Regulatory and market tailwinds include the International Maritime Organization's 2025 draft regulation introducing a global price on carbon, creating a major incentive for energy efficiency adoption. Geopolitical uncertainty, volatile fuel markets, and mandates such as the EU Emissions Trading System further amplify the need for innovation. An estimated \$1.4 to \$1.9 trillion in investment is needed to decarbonize the maritime industry by 2050. Financing strategies from hardware-as-a-service to long-term vessel leasing models can unlock capital efficiency and scale deployment.

)) UK Funding for Maritime Upskilling Project. A cross-sector consortium comprising the marine fuels training, conference, and publishing firm ship.energy; the shipping and logistics company DFDS; the International Bunker Industry Association; and the University of Plymouth has received funding in the sixth round of the U.K.'s Clean Maritime Demonstration Competition. The Skills 4 Future Maritime Fuels project will be funded by the U.K. government through the U.K. Shipping Office for Reducing Emissions (UK SHORE) program in the Department for Transport. Innovate UK, part of UK Research and Innovation, is the main delivery partner for UK SHORE interventions. UK SHORE is focused on developing a more sustainable maritime sector while driving economic growth. The program brings together projects throughout the U.K., each taking a different approach to decarbonization. Drawing on the expertise and extensive industry experience of the project partners, the Skills 4 Future Maritime Fuels initiative will address a key challenge in shipping's energy transition: the upskilling of the workforce at sea, at port, and across the fuel supply chain to enable the use of low- and zero-carbon fuels safely and in accordance with national and global regulatory frameworks. The three-phase project will include a skills gap analysis, the development of modular training programs covering a range of skill competencies, and real-life pilot testing.

)) Tidal Power Advances. SKF's tidal turbine-related systems have reached a milestone with continuous operation for over six years at 1.5 MW with no unplanned or disruptive maintenance. Going forward, SKF will supply fully integrated 3-MW powertrains to Proteus Marine Renewables. SKF will help provide at least a 59-MW addition to the current 6-MW pilot array at MeyGen, operated by SAE Renewables and standing as the world's largest tidal stream array, located in Scotland's Pentland Firth. SKF has ambitions to scale in line with further investment and innovation through 2025 and beyond. Tidal energy is one of the most predictable renewable resources on the planet, complementing solar and wind power. The U.K. aims to deploy 1 GW of tidal energy by 2035, enough to power 829,000 homes. With the cost of tidal energy declining, it's expected to become cost-competitive with nuclear energy by 2035. Overall, the global tidal energy market, valued at \$1.3 billion in 2023, is poised to grow to approximately \$8.1 billion over the next seven years.

)) Study Shows Outdated Ship Data Practices Cost Millions. A new report, supported by Danelec, has revealed that outdated ship data practices may cost the global fleet millions of dollars in fuel waste and missed efficiency gains. The study, "From Data to Action," shows that more than 70 percent of vessels still depend on once-a-day "noon reports" as their primary source of performance data, despite the availability of technology that enables second-by-second insights. The consequences of this data gap are significant. One real-world case cited found that a crew operating without real-time data overlooked an inefficiency that caused an unnecessary fuel burn worth \$4,300 on a single voyage. Continuous high-frequency data (HFD) can enable vessels to save up to 29.7 metric tons of fuel per month, equal to roughly 8,967 MT over the ship's lifetime. At current fuel prices, this translates to several million dollars in savings, along with a substantial cut in emissions. Beyond cost, there's a growing strategic imperative for adopting HFD. Charterers are increasingly demanding proof of efficient vessel performance. By relying solely on noon reports, shipowners risk losing their competitive edge. Fleets leveraging live data are better positioned to command higher time-charter rates and demonstrate transparency, both of which are key factors in reducing disputes and ensuring operational accountability. As the maritime sector continues to embrace digital transformation, real-time data are becoming a business necessity, within easy reach and scalable at a pace that suits diverse end-users. **ST**

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The Important Work Of Salvage

The marine salvage industry is something of a niche within a niche, yet for shipowners, insurers and wider society, it is a vital industry.

The International Salvage Union (ISU) is the trade association that represents marine insurers globally. Its members are professional salvors with the equipment, personnel, and experience to safely handle vessels that are in distress and, if necessary, to remove wrecks and pollutants from the seabed that pose a threat to navigation.

The work of the salvor is critical to saving life, protecting the environment, protecting property and maintaining the flow of trade. The practice of marine salvage is governed by ancient legal principles, modern international conventions and various contractual models, typically on a commercial basis. As the maritime industry evolves, so too does the work of salvage.

In nearly all heavy industries, environmental, social and governance (ESG) measures are playing a greater role in the heart of decision making and operations, and shipping is no exception. In recent years, carbon reduction and future fuels have tended to dominate the debate.

While shipping has generally become safer in recent decades, the threat from marine casualty and the possibility of adverse environmental impact has not diminished. As vessel sizes have increased, for example, because of the growing amount of bunker fuel carried by the largest vessel classes, the reputational impact for shipowners and insurers is potentially more damaging, especially in a more connected world.

One of the key priorities in a emergency response is to prevent pollutants from entering the sea. This could involve working at depth and on the seabed when dealing with wrecks that still contain pollutants. Wrecks may sometimes have been on the seabed for decades.

ISU members have frequently shown great technological innovation in executing this kind of operation, with saturation dive teams using ROVs, often with "hot tapping" (underwater drilling through the vessel's plating). In the historic case of the *Kyung Shin*, a tanker that sank off the coast of South Korea in 1988, ISU member Smit Salvage engineered a technologically challenging solution involving hot tapping, boilers and heat exchangers (to reduce the viscosity of the heavy fuel oil remaining in the wreck), and special pumps and hoses, all at a depth of 100 m. A crucial success factor was producing the correct temperatures for optimum pumping of the various fuel oil grades. This was achieved by warm-water heating to the required temperature for pumping. Spiral heat exchangers were inserted into each tank, by means of the hot-tap system. During the operation, a total of 12 tanks were emptied.

Another historic case was the raising of the Russian submarine, *Kursk* in 2001. This involved not only dealing with potentially dangerous ordnance but also nuclear materials, and required a highly engineered solution to raise the vessel, with recognition that it was the grave of more than 100 sailors.

Each year, the ISU's pollution prevention statistics show the total quantity of potential pollutants involved in its members' operations. In 2024, among 160 operations, there were some 2.4 million tonnes of potential pollutants: bunker fuel, refined and crude oils and chemicals, and dirty bulk cargo. Technological innovation and bold action prevents such pollutants from causing environmental damage.

Professional salvors can be proud of their contribution to industry and society: combining heavy engineering, traditional methods and technological innovation in their interventions. **ST**

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Annual Review & Forecast

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

***Undersea Defense Technology (UDT), March 25-27, Oslo, Norway*

MARCH

Electronic Charting/Vessel Management/
Ports & Harbors/Dredging/Homeland Security

***Ocean Business, April 8-10, Southampton, U.K.*

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

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Communications, Telemetry, Data Processing

***OCEANS 2025 Brest, June 16-19, Brest, France*

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Seafloor Mapping/Sonar Systems/Vessels

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Deck Gear, Cable, Connectors, Power Systems & Salvage

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Ocean Resources Development & Coastal Zone Management

****MAST AUKUS 2025**, September 3-4, Glasgow, Scotland, U.K.

****OCEANS 2025 Great Lakes**, September 29-October 2,
Navy Pier, Chicago, Illinois

SEPTEMBER

Geophysical Exploration/Seafloor Engineering

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

****CLEAN GULF**, November 18-20, New Orleans, Louisiana

****Offshore Energy**, November 25-26, Amsterdam, The Netherlands

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Global Ocean Community Since 1963

Evolution of Remote Ocean Mapping

USV Technology Advances for Autonomous Bathymetry

By Kitch Kennedy • Brian Connon

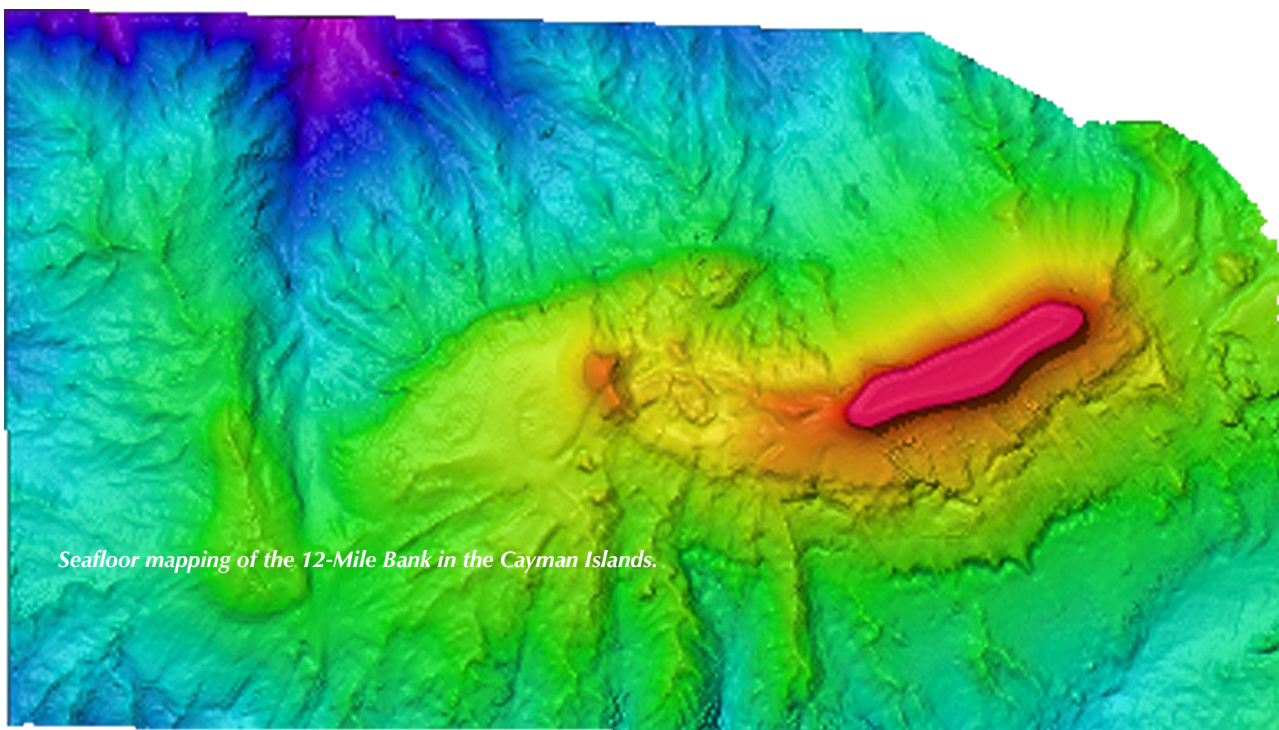
The journey of remote ocean mapping using USVs has accelerated rapidly over the past decade, driven by necessity and innovation. Ocean mapping is critical for managing marine resources, ensuring safe navigation and understanding climate change. Yet, vast areas of the seafloor remain uncharted. USVs are exponentially expanding our understanding of the ocean floor.

At the forefront of USV innovation is Saildrone, a company that began with a vision of sustainable maritime data collection and has since become one of the world's premier providers of autonomous ocean mapping vehicles. From the initial development of the solely wind-powered Explorer to the more sophisticated

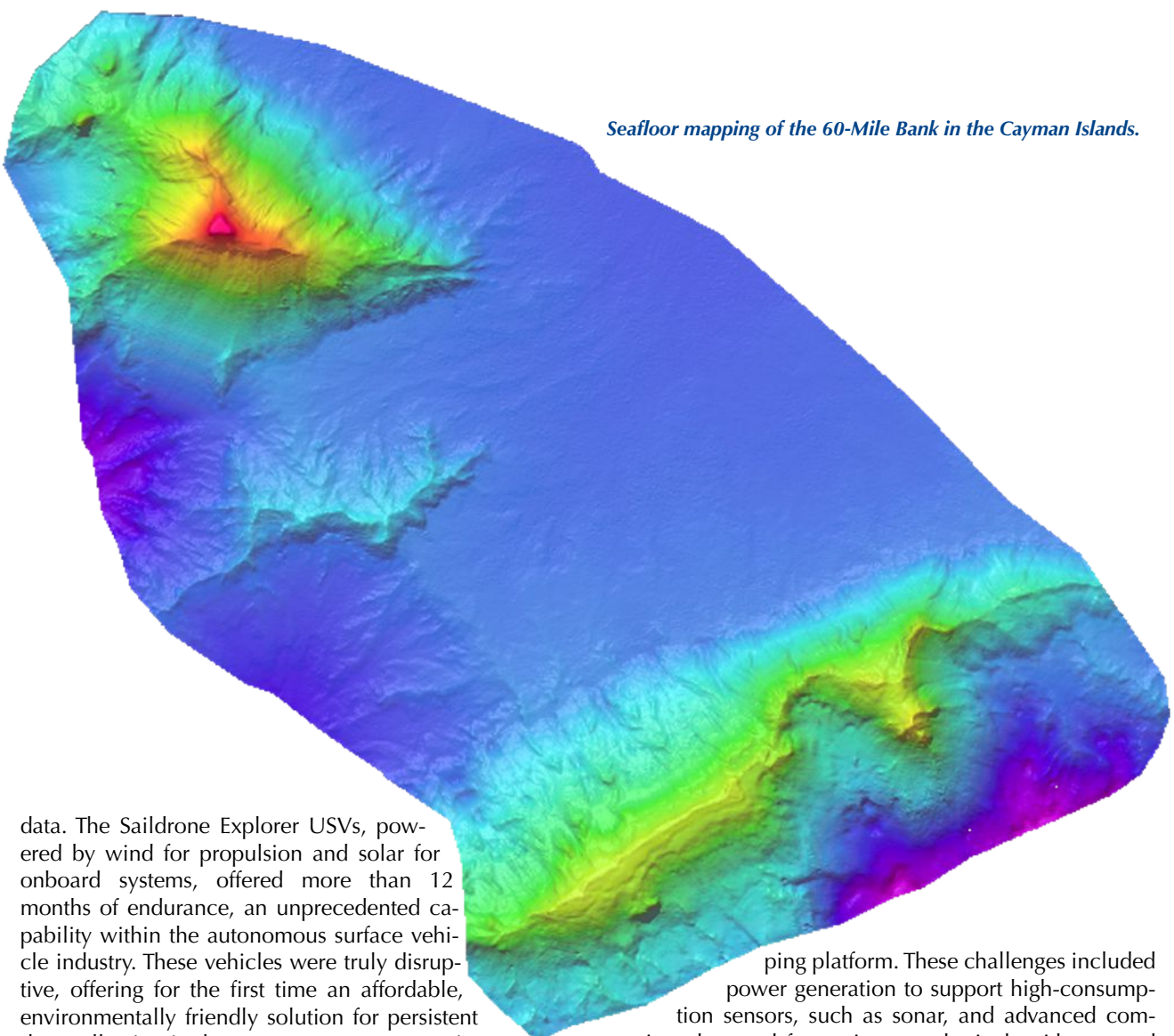
fleet of Surveyor- and Voyager-class vehicles, Saildrone has continually adapted to challenges, integrated cutting-edge technologies and reshaped the ocean mapping landscape. This article highlights the evolution of remote ocean mapping through the lens of Saildrone, detailing how the company addressed the inherent challenges of autonomous bathymetry and steadily developed into a trusted partner for defense, commercial, and scientific stakeholders.

Mission History

Saildrone began building and deploying small USVs in 2013 to collect critical ocean, weather, and climate



Seafloor mapping of the 12-Mile Bank in the Cayman Islands.



Seafloor mapping of the 60-Mile Bank in the Cayman Islands.

data. The Saildrone Explorer USVs, powered by wind for propulsion and solar for onboard systems, offered more than 12 months of endurance, an unprecedented capability within the autonomous surface vehicle industry. These vehicles were truly disruptive, offering for the first time an affordable, environmentally friendly solution for persistent data collection in the most remote ocean regions. From the Arctic to the Antarctic, the Mediterranean Sea to the Pacific Ocean, the Saildrone Explorer provided a unique capability for researchers around the world.

Saildrone's early success, especially on missions for NOAA, resulted in a project at the University of Southern Mississippi to evaluate a Saildrone Explorer as an ocean mapping platform. Explorers had conducted some single-beam sonar mapping, but this proof of concept was focused on a Saildrone USV outfitted with multibeam sonar to provide high-quality bathymetric data.

In order to prove the concept, a Saildrone Explorer would need to conduct a series of offshore mapping projects demonstrating the ability to collect high-quality data, drive straight survey lines, determine power limitations and management techniques, and integrate a system to collect sound velocity profiles.

Over two years, Saildrone successfully conducted a number of mapping demonstrations off the coasts of Mississippi and California that proved the concept and identified a number of challenges to be addressed in order for a Saildrone USV to be considered a viable ocean map-

ping platform. These challenges included power generation to support high-consumption sensors, such as sonar, and advanced computing; the need for an integrated winch with a sound velocity profiler (SVP); and improved communications to the systems on board.

Surveyor: Purpose-Built for Hydrography

Building on lessons learned, Saildrone set out to design a purpose-built USV capable of supporting high-quality ocean mapping in both deep and shallow waters. Enter the Saildrone Surveyor, a 22-m autonomous vehicle equipped with a full suite of hydrographic instrumentation, including Kongsberg EM 304 and EM 2040 multibeam sonars and the Seapath 330+ positioning and motion reference system.

The working prototype Surveyor featured satellite communications, a profiling CTD winch built in-house for seamless integration with onboard software, and a marine engine designed to provide power and alternative propulsion for the USV.

The development of the Surveyor was made possible through generous philanthropic funding, a testament to the growing recognition of the ocean's importance and the value of persistent, cost-effective data collection.



Saildrone co-develops

To test the Surveyor platform, a roundtrip mapping transit was carried out between California and Hawaii, followed by a three-month deployment to the Aleutian Islands. The success of these missions showcased the potential of uncrewed systems to reach remote and challenging survey regions with minimal human risk and at a fraction of the cost of traditional vessels.

Building on lessons learned during these real-world deployments, Saildrone updated the design of the Surveyor with an improved sensor suite and manufactured five USVs in 2025. One of the highlight missions for the new Surveyor took place in the Exclusive Economic Zone of the Cayman Islands, where the vehicle conducted deepwater mapping of 90,000 km² in previously uncharted areas.

Ocean Mapping Innovation

As Saildrone Surveyor operations matured, new technical hurdles emerged. One significant limitation was the reliance on SVP systems, which require regular data collection to ensure accurate multibeam measurements. Traditional SVP systems, while effective, were constrained by battery life and manual data retrieval. To overcome this, Saildrone partnered with AML Oceanographic to codevelop a solution that would match the operational endurance and autonomy of the Surveyor. The result was a novel, inductively charged SVP instrument with Bluetooth communications, enabling remote operation and hands-free data acquisition. This evolved into a more robust unit featuring Wi-Fi capabilities and automated data transfer, a tool that is now commercially



autonomous survey technologies along with its USVs.

available and used widely outside the Saildrone fleet as well. This collaboration marked an inflection point: Saildrone wasn't just integrating existing tools; it was helping to advance the ocean mapping technology itself.

Autonomy depends on robust and reliable communication. In early missions, Saildrone used Iridium satellite communications to exchange data with its USVs. While sufficient for basic command and control, the narrow bandwidth created bottlenecks in transmitting large volumes of sonar data or monitoring sonar data collection in real time.

These limitations became especially apparent during high-latitude missions, such as Saildrone's pioneering work in the transits between Alaska and Hawaii and subsequent survey around the Aleutian Islands. The need for

broader, more consistent and robust data transmission pathways became clear.

Saildrone responded by integrating a global, high-bandwidth satellite communications system into its vehicles. The result was a transformative leap in capability—the team could offload low-latency data in near real time while remotely monitoring and troubleshooting systems, running diagnostics, and even executing software updates from mission control. This advancement opened new possibilities for live mission planning, adaptive survey strategies and rapid customer engagement, all essential for modern ocean mapping operations.

With the Surveyor successfully addressing deep- and mid-shelf-water mapping, a smaller, more agile platform was needed for coastal environments. Customers sought high-resolution coastal bathymetry and sub-bottom profiling for offshore wind development, habitat mapping, and coastal undersea infrastructure planning and monitoring.

Saildrone answered with the Voyager-class USV, a 10-m vehicle equipped with a NORBIT multibeam echosounder and an integrated sub-bottom profiler. The Voyager was designed for containerized transport, enabling it to be shipped globally in standard 40-ft. containers and launched with minimal shoreside infrastructure. The compact Voyager provides unparalleled flexibility for nearshore survey operations, with applications ranging from critical infrastructure mapping to coastal resilience planning.

Optimizing Autonomous Survey Workflows

One of Saildrone's most important evolutions is evident in the development of enhanced mission planning and data visualization tools. As autonomous survey operations became more common, the need for intuitive tools to support planning, monitoring and client interaction grew. Saildrone invested heavily in the user interface and data visualization of its Mission Portal, a web-based platform for planning, tracking, and visualizing survey missions in near real time. Mission Portal enables internal operators and external clients to view tracklines, sonar coverage, environmental overlays, and system status through an intuitive interface. More than a simple dashboard, Mission Portal has become a vital part of the workflow for clients and operators alike. It supports remote mission adjustments, real-time quality control, and collaborative planning, enabling customers to feel connected and in control even when the vehicle is thousands of miles away.

A critical challenge Saildrone faced in its evolution was adapting existing hydrographic data acquisition software for fully autonomous operations. Most commercial acquisition systems were designed with the assumption that a trained human operator would be on board to start lines, monitor data quality and respond to anomalies in real time. This paradigm proved inefficient in a USV context. To overcome the legacy approach to survey operations, Saildrone worked closely with leading sonar manufacturers to streamline and reconfigure acquisition software to support remote operation, autonomous con-

“One of the most novel aspects of utilizing USVs is the use of remote watchstanders.”

trol, and integration with mission planning tools, ultimately enabling watchstanders to monitor multiple platforms simultaneously with confidence in data quality.

Another significant challenge encountered during operations was the biofouling of the SVP sensor, particularly from seaweed and debris. This issue, often difficult to detect without human oversight, was amplified during recent, unprecedented Sargassum blooms in the Caribbean. To address the problem, Saildrone developed enhanced operating procedures and engineered a mechanical solution, an onboard device designed to automatically clear obstructions from the SVP. This innovation eliminated the need for manual intervention and, together with improved software tools, has markedly increased the reliability and quality of data collected during long-duration, fully autonomous missions.

Traditionally, hydrographic data processing required manual retrieval, large file transfers and significant post-mission work. With the advent of Starlink and expanded cloud infrastructure, Saildrone has moved toward real-time data processing as standard. Sonar data collected by the Surveyor and Voyager platforms can be uploaded and processed in near real time using cloud-based tools. This enables early detection of data quality issues, faster project delivery and reduced post-mission workload. Saildrone's cloud processing pipelines not only provide basic quality assurance but also support customer-defined processing workflows and deliverables. As a result, clients receive preliminary data products during the mission itself, shortening timelines and increasing the agility of hydrographic campaigns.

One of the most novel aspects of utilizing USVs is the use of remote watchstanders. Traditionally, hydrographic surveys required onboard personnel to monitor systems, adjust settings and ensure data quality. In contrast, hydrographers and survey technicians can now operate from anywhere with internet access. They monitor multiple USVs simultaneously, ensuring system health, validating sonar performance and adjusting mission parameters as needed. This remote operations model not only increases efficiency but also expands workforce opportunities. By decoupling operations from physical presence, Saildrone has created roles for hydrographers, data analysts, and technicians who might otherwise be excluded from fieldwork due to geography, caregiving responsibilities, or physical limitations. It's a model that blends technical excellence with social equity, a rare but powerful combination in the maritime domain.

A Sustainable, Autonomous Mapping Future

As ocean mapping continues to grow in importance for resource management, offshore development, climate science, and national security, the need for persistent, scalable, and sustainable data collection platforms becomes more urgent. Saildrone has demonstrated that with the right mix of innovation, partnerships, and mission focus, it's possible to overcome technical barriers and build a new kind of mapping fleet: one that's autonomous, environmentally responsible, and operationally efficient.

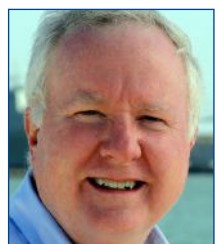
A prime example is Saildrone's recent groundbreaking deep-sea cable route survey for Meta, which proved that USVs can deliver high-quality data for subsea infrastructure planning in the most remote ocean environments. The company's roadmap includes further integration of AI for adaptive mission planning, expansion of its cloud-based analytics platform, and increased collaboration with government and industry to push autonomous hydrography into the mainstream.

Saildrone's evolution, from a single proof-of-concept multibeam test to a global fleet of advanced USVs, is more than a technology story. It's a vision realized, and a clear signal that the future of ocean mapping is here, driven by wind, guided by satellites, and built for a changing world. **ST**

Kitch Kennedy is the director of ocean mapping at Saildrone. He is a certified U.S. Navy hydrographer and graduate of the University of Southern Mississippi's FIG/IHO/ICA Category A hydrography program, with 28 years of experience. He manages survey operations and leads the integration of advanced mapping capabilities across Saildrone's USV fleet.



Brian Connon is VP of ocean mapping at Saildrone. He is a certified U.S. Navy hydrographer and a graduate of the University of Southern Mississippi's FIG/IHO/ICA Category A hydrography program, with 31 years of experience. He has been instrumental in designing the Surveyor and Voyager USV architectures.



Precision MBES Surveying

USV + Multibeam Echosounder Enhances Safety in Critical Waterways

By Taxiya Wang

CHCNAV's Apache 4 USV paired with the HQ-400 compact multi-beam echosounder is a combination that provides advantages over traditional vessel-based survey by delivering high-quality data with exceptional deployment flexibility.

Waterways are critical for global maritime transport, and ensuring their safety is vital for vessel operations, crew welfare, and maintaining economic flow. The underwater terrain is constantly reshaped by natural forces, such as sediment buildup, shifting seabed, and geological hazards, which introduce uncertainty and risk, especially in busy or remote navigation channels.

Traditionally, these areas have been monitored using manned survey vessels equipped with multibeam echosounders (MBES). While effective, these operations are costly and require complex deployment procedures. They also have limited access to shallow or constrained zones.

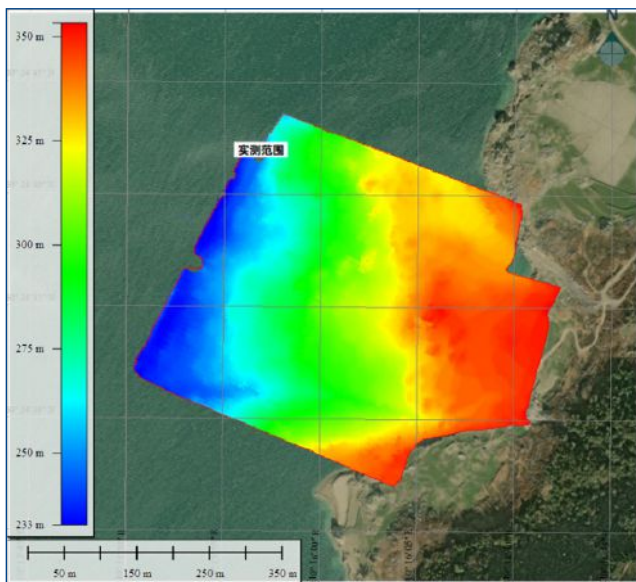
To overcome these challenges, the maritime industry is increasingly turning to intelligent, unmanned systems that provide accurate, efficient and adaptable solutions, especially for high-resolution hydrographic mapping in dynamic aquatic environments.



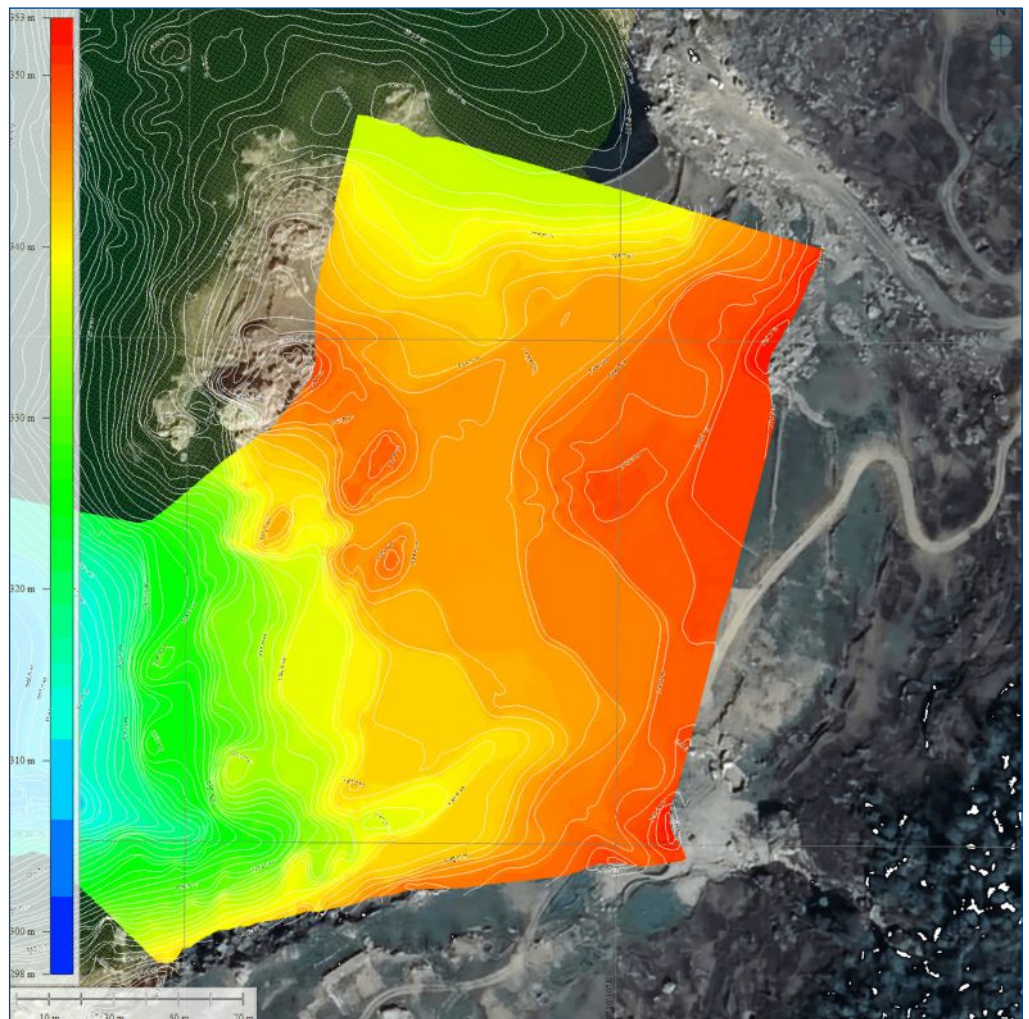
Breaking the Boundaries of Traditional Hydrographic Surveys

Manned survey vessels encounter operational limitations in confined or shallow environments. In narrow channels, ports, and complex river junctions, submerged structures, limited space, and other vessel traffic often hinder their maneuverability.

More critically, traditional vessels have difficulty accessing nearshore and ultrashallow zones, which are essential for assessing sedimentation, scouring, and potential navigational hazards. Without data from these areas, effective waterway management becomes difficult,



The Apache 4 USV and HQ-400 MBES used for the Yangtze River tributary survey gathered data that revealed valuable information about shoreline sedimentation and scour dynamics.



resulting in reactive rather than proactive dredging or infrastructure reinforcement.

A Modern Solution to Complex Hydrographic Conditions

In a recent survey of a Yangtze River tributary, CHC-NAV overcame the challenges posed by the environment

with a fully integrated system: the Apache 4 USV paired with the HQ-400 compact multibeam echosounder. This combination provided a compelling alternative to traditional vessel-based methods by delivering high-quality data with exceptional deployment flexibility.

In just 3 hr., the system mapped 0.7 km² of complex underwater terrain and produced detailed contour maps,

“The ability to capture centimeter-accurate underwater terrain data in shallow, restricted areas while meeting international standards demonstrates the real-world value of the integrated unmanned USV-MBES approach.”

terrain point clouds, and digital elevation models. Compared to conventional approaches, the integrated solution tripled operational efficiency while maintaining centimeter-level accuracy across the entire data set.

Accurate Positioning in Remote Environments

Remote and topographically challenging waterways often result in communication and GNSS correction disruptions. During the Yangtze River project, network limitations and terrain interference disrupted real-time kinematic (RTK) corrections, jeopardizing the reliability of live data.

To address these issues, CHCNAV used post-processed kinematic (PPK) positioning technology. The HQ-400 MBES and the Apache 4 USV captured high-quality raw GNSS and IMU data that were later corrected using post-processing software. This approach bypassed the need for real-time RTK corrections, ensuring precise positioning even in environments with limited connectivity.

The result was a dependable, uninterrupted workflow capable of capturing dense, high-accuracy bathymetric data in real-world conditions.

Streamlined Surveying with Intelligent Automation

CHCNAV's EasySail control software is an Android-based platform that simplifies mission setup. It allows users to import CAD files (.DXF) to define survey boundaries. Operators can configure route plans, set line spacing, swath overlap (typically greater than 20 percent), and course direction with a few taps for full area coverage.

During operation, the system dynamically adjusts to environmental changes. Parameters such as beam angle, ping rate, and depth gates automatically adjust to match depth and bottom conditions. This smart automation reduces the operator's workload, ensures optimal sensor performance, and enhances data integrity without requiring constant manual adjustments.

Thanks to its ultrashallow 0.15-m draft, the Apache 4 excels in narrow and nearshore environments. Meanwhile, the HQ-400's 150-m depth range and 120° swath angle provide comprehensive coverage at various depths, ideally suited for high-resolution bathymetric surveys.

Efficient Post-Processing for Reliable Deliverables

After data collection, it is essential to transform raw sonar returns into actionable insights. CHCNAV's Multibeam Suite (CMS) software offers an intuitive interface for efficiently managing extensive bathymetric data sets.

Built-in automated filters quickly remove noise, outliers, and false echoes caused by environmental or sensor

interference. This reduces the need for manual cleaning and ensures that only soundings with a high degree of confidence are kept, speeding up post-processing while ensuring data quality.

Proven, Accurate Results

The integration of CHCNAV's Apache 4 USV and HQ-400 MBES yielded impressive results during the Yangtze River tributary survey. The team mapped 0.7 km² of the riverbed in just 3 hr., which is three times more efficient than traditional survey methods. The accuracy was equally impressive: 99.96 percent of the recorded depth points met the International Hydrographic Organization's stringent standards.

The resulting data set supported the creation of detailed contour maps, dense underwater point clouds, and accurate digital elevation models. These deliverables revealed valuable information about shoreline sedimentation and scour dynamics. This information aided in the development of targeted plans for dredging, bank stabilization and long-term waterway management.

Even under fluctuating water levels, the data remained consistent with satellite imagery, confirming the system's reliability and resilience in the field.

The Future of Waterway Monitoring

The Yangtze River tributary project highlights the potential of unmanned hydrographic solutions. Replacing traditional manned surveys with a high-resolution, agile USV-MBES platform substantially improved the project's data quality, efficiency and operational safety. The ability to capture centimeter-accurate underwater terrain data in shallow, restricted areas while meeting international standards demonstrates the real-world value of the integrated unmanned USV-MBES approach. As waterways continue to shift due to natural forces and human impact, advanced unmanned systems are poised to become essential tools for managing, maintaining, and protecting these vital infrastructure lifelines. **ST**

Taxiya Wang joined CHC Navigation in 2017 and serves as product manager for USV solutions in bathymetry and unmanned water exploration. With extensive industry experience, she possesses deep insight into sector challenges, user needs, and cutting-edge technologies, driving innovation and advancement in hydrographic survey and unmanned systems.



The Synergy of Sonar and Sensors

Advanced Workflows for Survey, Dredging Operations

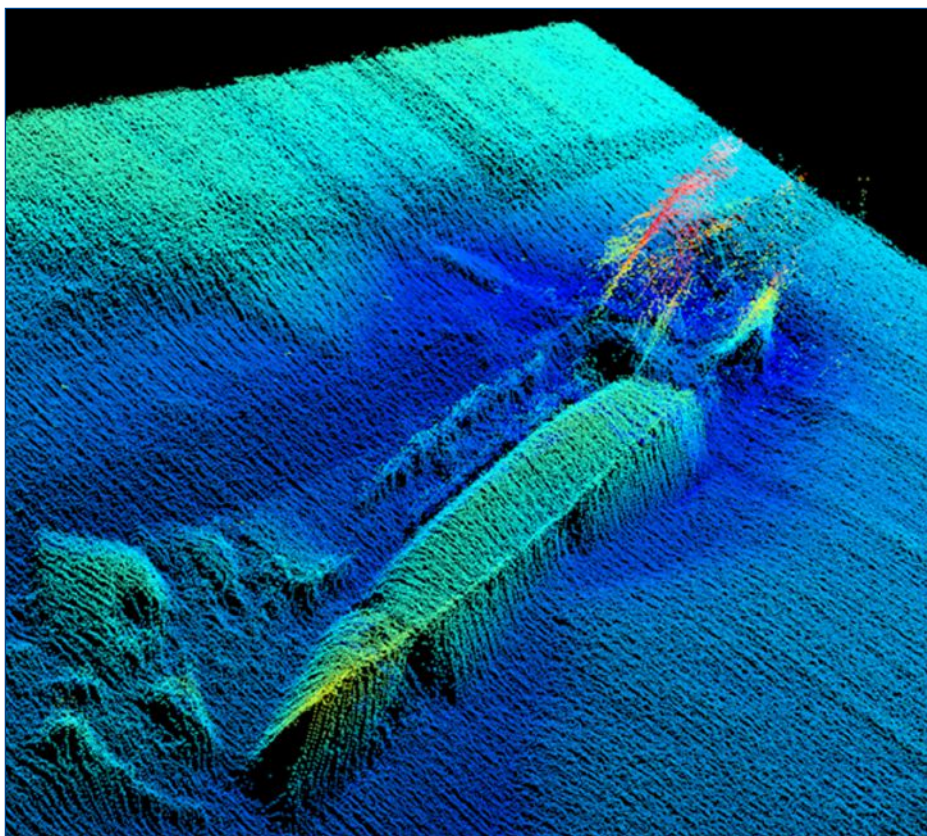
By Peter Stewart

Whether surveying seafloor or dredging port sediment, acquiring continuously accurate, high-quality data in underwater conditions has long been a challenge for marine contractors.

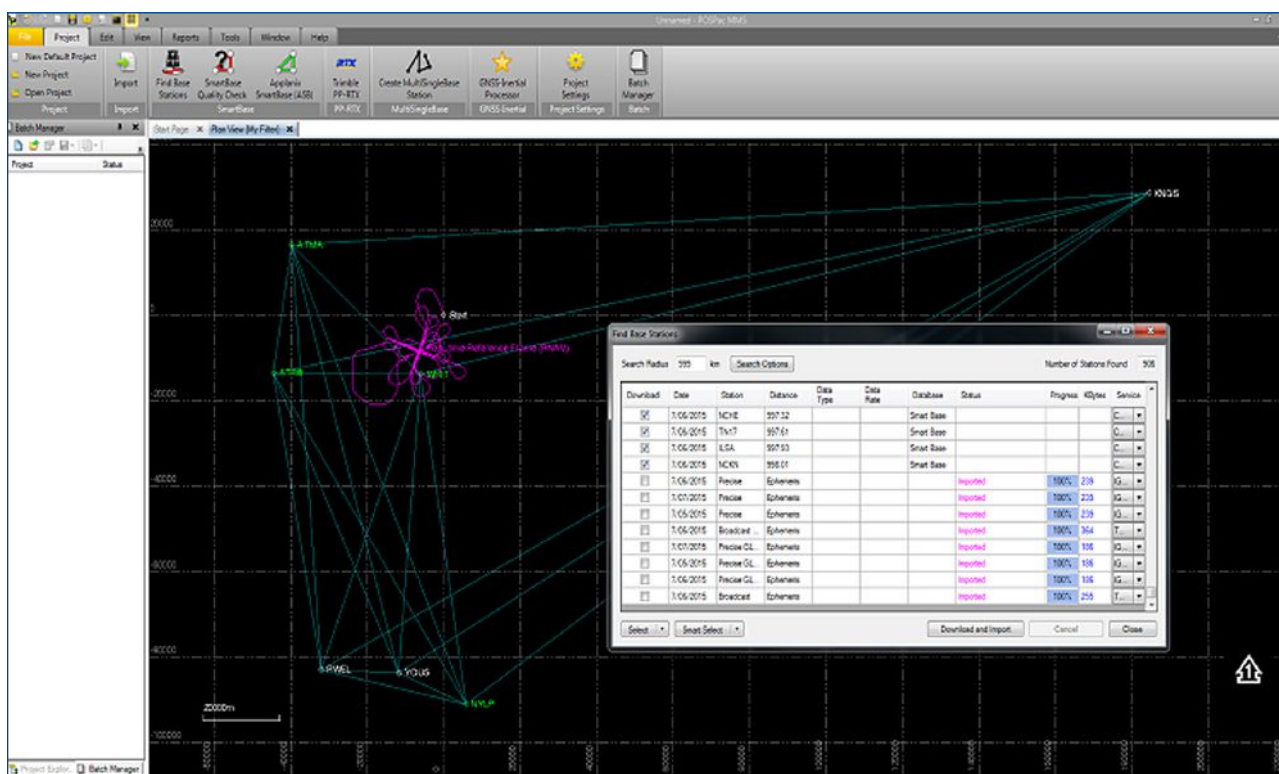
Although technology offers immense potential to support these endeavors, the complexity has often posed significant challenges. For years, these advanced systems required a deep level of expertise to implement effectively, largely due to the intricate interplay of various components.

Take, for example, the process of seafloor mapping. This task typically involves an array of equipment such as multibeam sonar, positioning and orientation systems (POS), laser sensors, speed-of-sound devices, and cutting-edge software to process and interpret data. Ensuring these tools operate in perfect harmony is no small feat, yet it is essential for producing the precise, high-quality underwater data that marine operations necessitate.

As James Dunkley, senior manager of hydrographic surveys at Brownsville, Wisconsin-based Michels Corp.,



High-quality hydrographic data are achieved by integrating position and orientation data from the Applanix POS MV Ocean-Master with Trimble RTX, alongside sonar data collected from a multibeam system.



POSPac MMS (mobile mapping sensor) includes a database of thousands of GNSS base stations worldwide that can be automatically downloaded for SingleBase or Smart-Base processing.

a global power, pipeline, energy and infrastructure construction company, notes: “One of the things people in our industry may not realize until they’ve already invested in technology is the time and cost required to install sensors and integrate systems. Too many times, we must sort these things out on our own.”

More recently, there’s been greater emphasis by developers on prioritizing usability and data quality. The solutions are more intuitive and user-friendly, making it easier for professionals, whether on a boat or in an excavator, to effortlessly access and interpret data without needing to grapple with the intricate mechanics of system configurations.

A POS Perspective

The evolution of POS provides some insights into the ease-of-use evolution of undersea technology. Today’s advanced POS-based marine systems are uniquely suited to the requirements of precision marine motion sensing, hydrographic surveying and charting. They can deliver precise position, heading, attitude, heave, and velocity data for a marine vessel and remote sensing equipment. By combining global navigation satellite system (GNSS) data with angular rate and acceleration derived from an

inertial measurement unit (IMU), along with GNSS azimuth measurement system heading, these systems offer an accurate 6 degrees of freedom POS.

When combined with multibeam sonar, hydrographers can generate very precise, georeferenced seafloor mapping data. Manufacturers have devoted considerable time helping customers integrate and configure system components at the factory and during commissioning. The key innovations developers have focused on include improving data availability and quality through the deployment of a seamless GNSS solution that integrates sensor calibration and correction technologies with multibeam sonar.

The Port of London project provides one such example of how these integrated solutions support the all-important hydrographic aspects of a project.

No Limits with Lidar

The Port of London Authority is charged with ensuring navigational safety and port security along the River Thames, a complex survey area with several bridges, considerable river traffic and other obstructions that block GNSS line of sight.

Tasked with collecting survey data, the Port of London Authority Hydrographic Service equipped its vessel with a GNSS-aided inertial navigation system for georeferencing a multibeam sonar and a lidar sensor.

With a fully integrated solution, the team was able to capture lidar and multibeam sensor data at the same time to map both the structural elements on the underside of a bridge and the underwater view, providing complete, accurate information in areas where the GNSS environment makes it most difficult to do so, but where, conversely, the need for accuracy is at its highest.

In the near future, complete multibeam solutions with more seamless integration of GNSS, inertial, and other technologies such as lidar will make the technology more accessible to a wider audience beyond just expert hydrographic surveyors to construction, environmental monitoring, search and rescue, and more.

The integration of a real-time correction service, such as Trimble CenterPoint RTX, or post-processing techniques as well as sonar technology also helps to deliver more efficient and accurate dredge operations.

Resolving the Dredge Dilemma

Much like multibeam sensor integrations for hydrographic surveying, the technological advances to support activities such as dredging are also emphasizing ease of use and quality data with simpler setups. For instance, while sonar was once only the realm of large-scale specialized companies, recent advancements have significantly reduced the cost of sonar systems, making them accessible to a broader range of marine construction projects.

When combined with GNSS systems, advanced sonar-driven 3D visualization tools enable operators to have live feedback on a project's progress. It eliminates all-too-familiar lags in production while waiting for post-survey results. With this combination, operators have immediate confirmation of grade alignment, object placement, or debris clearance, thus driving improved precision and productivity.

The data in the cab are continuously updating to changing conditions as debris is removed while track-

(Right) An excavator equipped with the Trimble Marine Construction system removes rock from the Missouri River. (Below) Screenshot of Trimble Marine Construction software showing the bucket's position relative to the design depth specification.

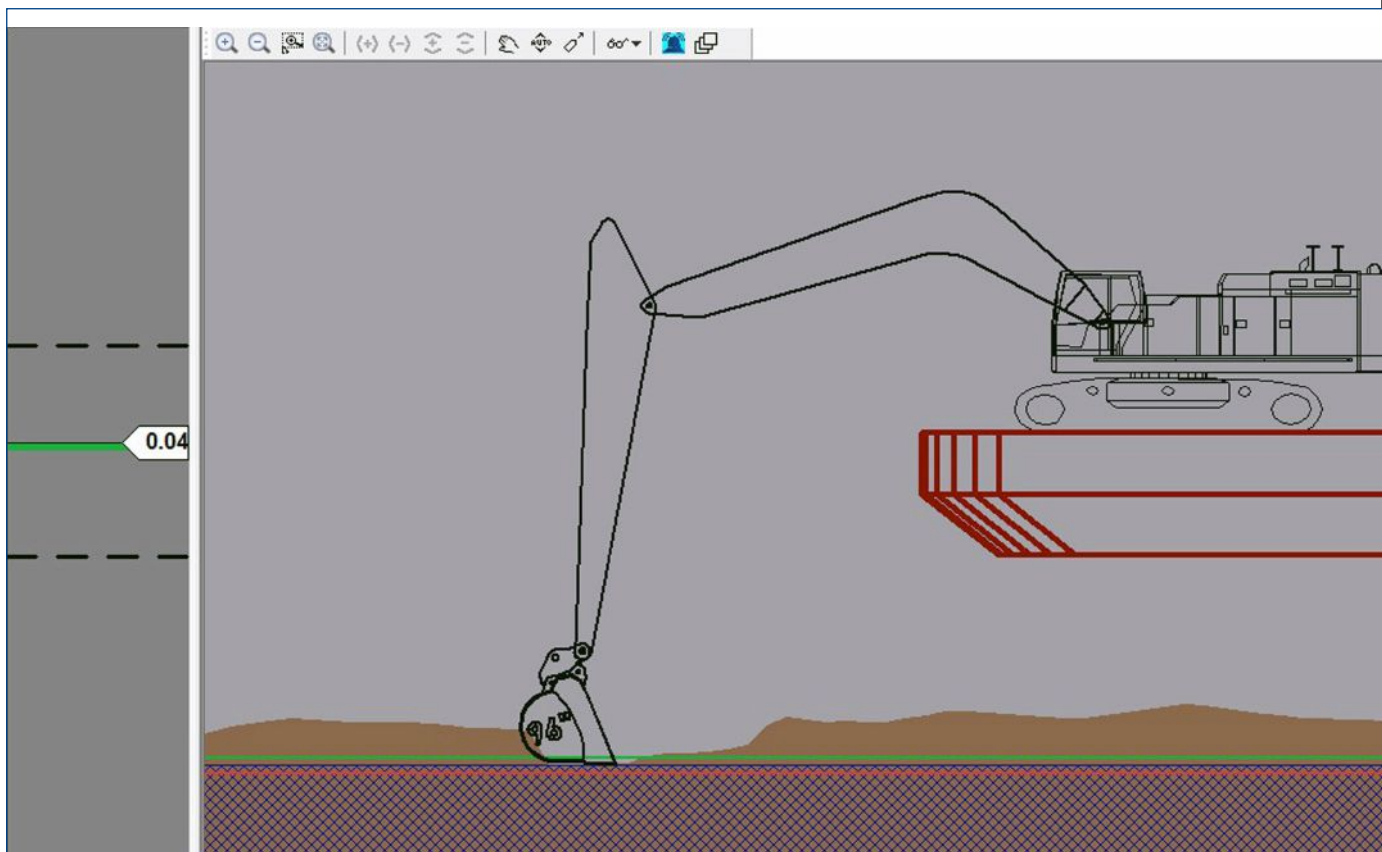
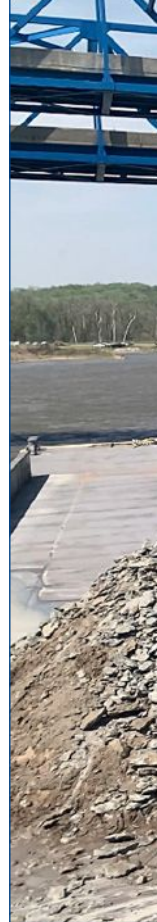
ing the precise position and heading of dredging/construction equipment operating underwater. An added benefit is that project teams no longer need a diver to verify underwater conditions, greatly improving job site safety and productivity.

For Michels, it's a development progression that has forever changed the way the company navigates and excavates underwater projects.

Managing Underwater Parameters

One of the first projects in which Michels was able to take advantage of fully integrated systems was the Missouri River Bedrock Removal Project for the U.S. Army Corps of Engineers, Omaha District. The goal of the project was to excavate a minimum of 120,000 cubic yards of material and restore adequate channel parameters to provide safe navigation of river boat traffic on the Missouri River. The area of concern spanned a little over 2 mi.

"We were basically breaking rock underwater and





then removing it,” said Dunkley. “These are pretty inhospitable conditions—and many machine and sensor systems would not work in these harsh conditions.”

The Michels team mounted a 95-ton Cat 395 excavator on a barge that was tugged into the area of work and equipped with sensors to measure everything from pitch and roll to the movement of excavator attachments. A monitor connected to the Trimble Marine Construction real-time positioning system was used to display survey and design information and provide a visual of the equipment as it moved underwater. Data on the monitor included hydrographic surveys of the river bottom and the dredge prism defining the channel that needed to be cleared: all in 3D, plan and profile views. The pre-dredge/construction hydrographic survey data were collected using a multibeam echosounder with an embedded Applanix GNSS-INS.

The positioning data became particularly crucial for navigating and guiding the excavation work safely, accurately, and efficiently according to project specifications and survey. Even when working

underwater, the system continued to provide an accurate real-time depiction of the bucket or other attachment locations, the position of the boom and stick, and their relationship to both the hydrographic survey data and the design layers defining the dredge prism/channel that needed clearing.

“The positioning system performed continuously throughout the entire project duration without any downtime caused by issues with the electronics, components or software,” said Dunkley. “That equates to improved efficiency in the field and successful project execution.”

The firm’s technology-enabled solutions have been deployed on multiple projects, including those that require mobilization of amphibious excavation equipment.

The streamlined integration of technologies such as GNSS and multibeam sonar into marine construction and dredge operations is setting a new standard for efficiency and precision. Solutions blending real-time sonar data with advanced machine guidance systems are no longer reserved for niche projects—they are rapidly becoming industry staples. By pairing hydrographic surveys with coordinated equipment workflows, operators can achieve an unmatched level of situational awareness, optimizing every phase of their operation. **ST**

Peter Stewart is the director of marine products at Trimble Applanix, where he oversees product development and business strategies for marine technology solutions.

Power Supply in Antarctica

Wireless Devices for Polar Research Rely on Small Battery Packs

By Brett Baker

Formed through the recent merger of IRIS and UNAVCO, EarthScope Consortium assists the research community in procuring, deploying, and maintaining scientific instruments used in geophysics and other Earth sciences, as well as related data archiving and distribution services.

As the operator of the U.S. National Science Foundation's GAGE and SAGE Facilities for geoscience, EarthScope often works in harsh environments, ranging from the polar regions to scorching deserts to deep drilled holes and more. Most applications are off the grid, requiring the use of battery-powered devices. Harsh environments such as these present challenges for batteries, perhaps none more extreme than the polar regions, the solutions for which provide valuable insight applicable to other remote deployments.

Wireless Challenge in Polar Climate

Among the most desolate regions on Earth, the Antarctic has temperatures that can reach -90°C during winter. Despite being so inhospitable, this frozen continent attracts researchers from around the globe who seek to unlock the secrets of Earth's structure and formation, including plate tectonics, earthquakes, volcanoes, glacial ice movement, and more. Many polar projects require highly specialized batteries that are capable of performing reliably in extreme cold. These batteries power wireless devices.

EarthScope and Tadiran Batteries have collaborated to develop the TLP-93101E battery pack, which is assembled by EVS Supply and designed to withstand the extreme environment at the poles.

The TLP-93101E battery pack incorporates 50 Tadiran TL-4930 D-size bobbin-type LiSOCl_2 cells along with five HLC-1550A hybrid layer capacitors (HLCs) that deliver the high pulses required for





Battery packs power seismometers that surround Mt. Erebus, an active volcano in Antarctica. (Credit: Earth-Scope)

wireless communications. Based on average current draw requirements, each pack is designed to last one to two years while delivering 190 Ah of energy at 18.57 V with up to 15-A pulses. This pack is inherently safe and environmentally friendly. It is also ruggedly constructed using Schottky diodes, positive temperature coefficient (PTC-200) thermistors (thermally resettable fuses), 18-gauge wire, a weather pack shroud-style (WPS) connector, PVC jacketing, and shrink enclosure.

While most battery chemistries perform poorly in extreme cold, bobbin-type LiSO-Cl₂ chemistry stands apart, remaining stable down to -55° C, modifiable to withstand -100° C.

Another key feature is miniaturization. Compared to an equivalent pack using cold-rated lithium iron phosphate (LiFePO₄) batteries, TLP-93101E packs fit within a 93 percent smaller footprint (13.62-by-2.59-by-6 in. versus 28-by-14-by-7.4 in.), with an 85 percent weight reduction (11 versus 70 lb.).

This difference becomes even greater when compared to lead-acid batteries. By reducing size and weight, shipping costs from New Zealand to Antarctica are significantly reduced while also meeting UN and International Air Transport Association guidelines for transporting hazardous goods.

In addition, the small footprint of the TLP-93101E permits greater numbers of battery packs to fit into the cargo holds of small planes and helicopter slings used to transport this equipment to remote sites.

The Value of Lower Self-Discharge

Self-discharge results from internal chemical reactions that occur even when there is no connection between the electrodes or to any external circuit. As a result, many low-power devices lose more energy annually due to self-discharge than is exhausted while operating the device, resulting in premature battery failure.

Bobbin-type LiSOCl₂ cells have a unique ability to limit self-discharge by harnessing the passivation effect. Passivation involves a thin film of lithium chloride (LiCl) that forms on the surface of the anode to separate it from the electrode, thereby reducing the chemical reactions that cause self-discharge. When a continuous current load is applied to the cell, the passivation layer causes initial high resistance and a drop in voltage until the discharge reaction begins to dissipate the passivation layer, which is a continually repeating process.

By effectively harnessing the passivation effect, the self-discharge rate of certain cells can be reduced to just 0.7 percent per year, thereby permitting wireless devices to operate for up to 40 years without having to replace the battery.



Field Examples

A common example of this type of battery pack being deployed in Antarctica involves a seismometer installed in the ground, with power supplies and data recording equipment enclosed in above-ground cases. Reliance on lead-acid batteries during dark winter months would necessitate overbuilding the power supply, which would further exacerbate the size/weight issue.

TLP-93101E battery packs are being deployed to power seismometers that surround Mt. Erebus, an active volcano located approximately 20 mi. from the McMurdo Station, the U.S. Antarctic research facility operated by the National Science Foundation. This wireless network provides real-time data and aids in the study of the volcano's dynamics. While this particular application is located within reasonable proximity of the McMurdo Station, which is rare for Antarctic deployments, industrial-grade LiSOCl_2 battery packs are still required in order to withstand high altitude and katabatic winds.

Another prime example involves a network of seismometers that monitor the Thwaites Glacier. These instruments detect seismic signals produced by cracking or lurching movement of the ice along the bottom. They also provide data used to map and characterize the bedrock beneath the ice.

Custom Solutions

In the harsh climate of Antarctica, hybrid power supply solutions are often utilized for wireless devices. For example, during summer months, certain instruments can be powered by energy harvesting by combining solar arrays with lead-acid batteries. In winter months, the power source switches over to bobbin-type LiSOCl_2 battery packs that also provide emergency backup.



(Top and left) Seismic station near a camp at the ice flow divide on the West Antarctic Ice Sheet. (Credit: EarthScope) (Bottom right) Seismic station on Thwaites Glacier. (Credit: EarthScope)

Every remote wireless application is unique, demanding individualized power management solutions. As a result, careful due diligence is required to identify the most cost-effective solution that will prevent premature battery failure, lower the cost of ownership, and protect data integrity. **ST**

Brett Baker is the president of EVS Supply.

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Milling Flanges for Wind Turbines

Goliath Machine Meets Tighter Tolerance Demands

By Dr. Malene Conlong

Headquartered in Vejle, Denmark, CNC Onsite designs and delivers high-precision mobile machining for wind turbines, including offshore foundations. Machines built by CNC Onsite are designed to be flexible using its proprietary “building blocks” approach, which means machinery can be built to match a range of tasks.

CNC Onsite serves the onshore and offshore wind energy sector delivering as standard solutions: machining of large-diameter steel flanges and blade root ends; specialized repair services covering yaw ring, inserts in blade root, rotor lock, generator shaft, bearing housing, and threaded holes; and removal and replacement of worn and broken bolts.

The company has recently delivered its custom-built “Goliath” machine to the wind tower manufacturer Welcon, which is now using the machine to mill 97 bottom tower flanges for Vestas’s 15-MW V236 turbines destined for projects in Germany and the Netherlands. Production began in April, and the first flanges have already exceeded flatness specifications, ensuring a perfect fit with the transi-

tion piece—enhancing reliability and design flexibility and significantly reducing costly post-production checks.

The milling process ensures that the tower and transition piece align perfectly, forming a flat, stable connection between the two flanges, a critical mechanical



CNC Onsite machine prior to mounting onto the flange.



joint held together with bolts. By implementing CNC Onsite's machining process, industry-leading tolerances are achieved, which eliminates the need for heat straightening, a common post-production step to correct flatness issues, while optimizing the maintenance of bolts during operation.

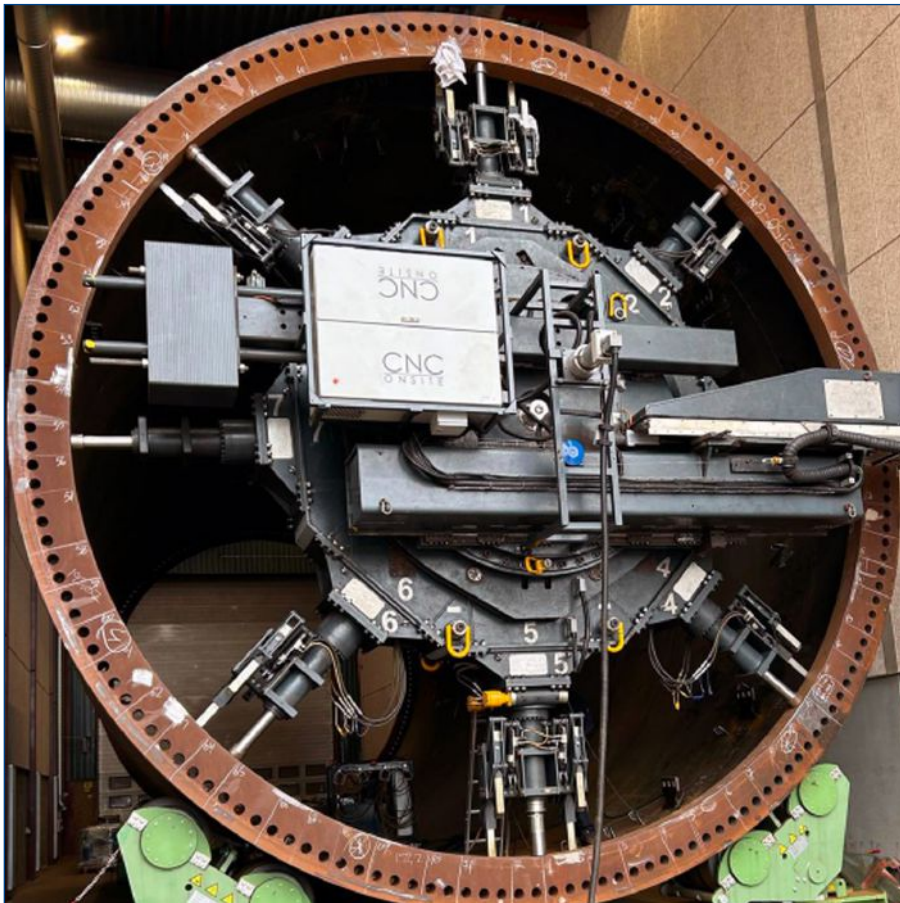
The precision machine Goliath is custom-built by CNC Onsite, specifically designed to ensure flat flanges for structural strength and fatigue resistance.

Bolted Connections With Long-Term Benefits

On the first flange, CNC Onsite has achieved a global flatness tolerance of 0.21 mm. The required 1 mm for this project is already well below the common industry standard of 2.5 mm, proving the machine's performance.

Ensuring a tolerance of 1 mm or better is a significant benefit when it comes to ensuring correct bolt tightening. With 160 bolts in a flange, this is a considerable cost-saver by reducing maintenance and downtime due to loose bolts.

Welcon will integrate the flange-facing process as a standard manufacturing step, replacing the traditional heat straightening method, a controlled heating and cooling process used to correct flatness distortions after welding in metal components, such as wind turbine flanges. By employing Goliath on the 97 bottom flanges, the tower manufacturer can ensure a faster, more uniform method.



(Above) Goliath mills Vestas flanges with 7.5-m diameter. (Below) The first flange achieved 0.21-mm tolerance after precision milling.

Added Value for Vestas

The consistent flatness across all flanges will provide Vestas, the customer of Welcon, with greater flexibility in flange designs and dimensions, as well as a broader choice of bolt sizes.

"The industry demand for fine tolerances is increasing," said Johnny Hauggaard Skov, vice director of Welcon. "To meet flatness requirements, we need a machine-based process, as heat straightening cannot achieve the necessary precision."

He added: "We also expect this to improve health and safety by eliminating manual work."

"If applied throughout the industry on all flanges, from tower to transition piece, I believe this precision milling will offer a range of benefits," said Peter Sigfred Mortensen, a senior specialist in offshore tower structure in Vestas's Towers R&D department.

"When all flanges are completely flat, it eliminates the costly measurements we have seen both at sea and prior to shipping. It will also provide design freedom, including the option of smaller and even maintenance-free bolts."

Meeting New Challenges in Large-Diameter Flanges

As wind turbine tower flanges grow in diameter—now reaching 7.5 m for Vestas's new 15-MW turbines, the demand for even finer tolerances increases.

It is a challenge to achieve the required precision for 4- to 5-m-diameter flanges. Given today's 7-m (and larg-

er) flanges, the tolerances are even tighter. This combination of larger diameter and stricter tolerances makes it nearly impossible to meet standards with traditional methods.

Designed for efficient operation, the machine is mounted directly onto the flange. Using adjustable legs with hydraulic cylinders or optional electric actuators, the machine is securely positioned, allowing easy switching between different flange diameters.

Powerful electric motors enable fast, high-precision milling. The machine handles flanges from 6.5 to 10 m in diameter in the standard configuration and can be adapted for larger sizes. Fully CNC-controlled, the machine can mill flat, tilted and double-tilted flanges, as well as features such as gasket grooves.

Goliath is the result of CNC Onsite's more than 12 years of expertise in machining flanges for the wind energy industry. Developed and built based on this extensive experience, the new machine sets novel standards for precision and efficiency.

The machine for Welcon is the third custom-built Goliath machine since its launch in 2022, designed for large-diameter flanges. It is currently in use by offshore customers in Denmark and Spain. It is available for lease or purchase. **ST**

Dr. Malene Conlong manages media for CNC Onsite: www.cnconsite.dk.

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EV Fire Suppression System

Developed by Skansi Offshore in close cooperation with KNUD E. HANSEN, a new brine-based fire suppression system for EV fires is installed on *Norröna*, operating the world's longest RoPax route between Denmark, the Faroe Islands and Iceland. The system will also be installed on a new RoRo vessel.

The concept is simple: penetrate one window and flood the cabin with ice-cold, saturated saltwater. It cools the battery casing, suppresses flames and smoke, prevents thermal runaway, and deactivates the battery using only natural ingredients and standard fire hoses.

A full-scale test proved its effectiveness by extinguishing a fully developed EV fire in less than an hour.

Facility to Prevent Microfiber Ocean Pollution

The world's first microfiber filter hub, microplastic recycling lab, and return and recycle center is now set up in the U.K., on a path to save up to 86 tonnes of microfibers from polluting the ocean annually. The new center brings together Cleaner Seas Group's innovative microfiber filter technology with a groundbreaking closed-loop recycling system. Applications could include construction components, packaging and battery materials.

Microplastics are now found in the deep ocean, the air and the food that humans consume. A 2022 study found microplastics in the blood of 80 percent of people tested. The UN Environment Programme estimates that 13 million metric tonnes of plastic enter the ocean yearly.

SOLUS LARS for USVs

Argeo of Norway has become the first commercial customer for the new Henriksen SOLUS launch and recovery system (LARS) for USVs. Argeo employs a range of unmanned and autonomous vehicles for advanced offshore survey and inspection services.

The new SOLUS system now makes it possible for an uncrewed USV to be recovered by the mothership even in unfavorable sea conditions. The Henriksen SOLUS system achieves this by enabling the 9-m Argeo Argus USV to be brought alongside and reconnected to the mothership's lifting wire by means of its telescopic mast.

Pollution Prevention Precedent

The parties to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) have decided to ban the discharge of exhaust gas cleaning systems' wash water in internal waters and port areas throughout the North-East Atlantic by July 2027. This is a landmark in regional shipping regulation.

In their statement, discharges from open-loop scrubbers, which use seawater to extract sulphur from exhaust gases before discharging the waste along with contaminants, including polycyclic aromatic hydrocarbons and heavy metals, back into the sea, will be prohibited by July 2027. Discharges from closed-loop scrubbers, which re-

sult in lower volumes but more concentrated waste, will be banned by January 2029. This marks the first time a regional regulation on scrubber discharges has been agreed on. It will address marine pollution in the waters of OSPAR member governments, setting a precedent for other regional seas.

Merger for Integrated IT Services

Marlink, offering managed services for business-critical IT solutions, has signed a definitive agreement to merge its fully owned subsidiary Telemar Group with TNL Group, the Athens-based maritime specialist in high-quality technical, navigation and safety services to the Greek shipping industry.

The merged entity aims to be a top three player in the maritime and superyacht OT/IoT service market, with more than 250 employees providing managed and professional services.

The combined entity will allow customers to accelerate digital transformation, with smart maintenance and bridge OT security forming part of an integrated managed services ecosystem designed to support smarter, safer, and more sustainable maritime operations.

Collaboration for Deepwater Services

In conjunction with the launch of the Mariner XL ROV, DOS has entered a memorandum of understanding to collaborate with the U.S. company Deep Sea Vision (DSV).

DSV is a deepwater survey company using AUVs, such as the Kongsberg Hugin 6000 rated to 6,000-m depth, with a long track record in the deep-ocean space.

Through combined efforts to common clients, DSV and DOS can offer AUV and ROV services from the same platform with shared personnel. This compact spread reduces mobilization costs, supports vessel specifications and lowers carbon footprint, with less risk.

The Argus Mariner XL is a light work-class ROV designed for ultradeep operations, inspection, sampling, object recovery, imaging and data acquisition.

DOS offers survey services for oil and gas applications, such as geophysical acquisitions, photogrammetry, metrology, sampling, rig move, and construction.

Geospatial Collaboration for Sustainability

Fugro will collaborate with Esri to provide integrated geospatial solutions that empower climate resilience decision making and sustainable development.

Initially, the joint effort will focus on tackling the environmental challenges of small island developing states (SIDS), starting with SIDS in the Caribbean. Nearly 22 million people in SIDS live less than 6 m above sea level, placing communities and infrastructures at high risk from coastal hazards. Data gaps remain a challenge. Many countries don't have access to timely, user-friendly and coordinated environmental data systems, especially at the land-sea interface.

Fugro and Esri will help SIDS confront urgent coastal and marine threats while building the foundation for long-term resilience and sustainable development. The

integrated solutions from Fugro and Esri are designed to be scalable and adaptable to other sectors, such as off-shore wind, maritime security, sustainable infrastructure, and conservation. They will also be applicable to other regions.

Rhode Island Innovation Campus Grant Awards

The recipients of Innovation Campus Grant awards to advance ocean technology commercialization and job creation in Rhode Island have been announced.

The Blue Robotics Lab will receive \$4 million. This new Rhode Island nonprofit lab-to-market incubator will accelerate the testing, prototyping and commercialization of undersea robots, operated by the successful nonprofit MassRobotics.

The Ocean Technology Innovation Center at the University of Rhode Island (URI) Bay Campus, Narragansett, will receive \$5.7 million. The center is a collaboration and maker space for ocean technology companies operated by the URI Research Foundation to support companies spinning out of URI and non-affiliated companies leveraging URI's best-in-class testing facilities on its Bay Campus, such as wave tank, tow tank, and testing pier.

These grants are part of the Innovation Campus Initiative, launched through a \$20 million voter-approved bond in 2016, that aims to bring together leading industry, academic and research partners.

The \$9.7 million awarded in grants is expected to leverage at least an equal amount in private and federal investments.

The two innovation campuses are projected to generate 425 new jobs over the next decade.

New ClassNK Survey Office

ClassNK has opened a new survey office in Jacksonville, Florida. Jacksonville serves as the state's largest container port and ranks among the leading U.S. vehicle-handling ports, playing a vital role as a logistics hub.

Bahamas Maritime Authority Turns 30

The Bahamas Maritime Authority celebrates its 30th anniversary this year.

By 1998, The Bahamas had become the world's third-largest fleet, and just a year later, it secured a seat on the International Maritime Organization (IMO) Council, a position it has continuously held.

Today, the Bahamas registry is the world's fourth largest flag by the commercial value of fleet.

Teledyne Acquires Maretron's Assets

Teledyne Technologies Inc. has acquired the assets of Maretron, including the brand's Octoplex, MPower and MConnect product lines, from Littelfuse Inc. The purchase will enable Teledyne's Raymarine business to deliver deeper integration and automation for boat builders as a one-stop-shop; greatly expand product functionality for consumers; and create new business opportunities for Raymarine and its partners. Raymarine intends to maintain Maretron's trade name and product lines to ensure a seamless transition for existing Maretron customers. **ST**

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Subsea Navigation



With bottom tracking ranges from 0.15 to 500 m, in up to 6,000-m water depth, the Tasman DVL applies to small ROVs, large-diameter AUVs, USVs and crewed surface ships. The phased-array transducer design is field-swappable, eliminating the need for speed of sound correction, enhancing position accuracy, and reducing drag on the vehicle. Navigation is enabled in open water even when the bottom is out of range. The DVL ensures highly accurate coupling with an INS. It was designed as a drop-in replacement for the previous-generation Workhorse Navigator. It can be upgraded to include ADCP capability. Teledyne RDI.

Hydrogen Fuel Cell System

Marine System 225 is type approved by Lloyd's Register and can be deployed on a wide range of vessels, enabling shipowners and operators to confidently adopt hydrogen electric technology. It delivers 225 kW of efficient and vibration-free power. Its modular and compact structure allows for seamless integration into both newbuild and retrofit applications, making it ideal for ferries, workboats, patrol vessels, and offshore support ships. PowerCell Sweden AB.

Autopilot for Small Vessels

VOYAGER AI SMARTPILOT is an intelligent and cost-effective software autopilot delivering effective dynamic positioning and station-keeping for integration with

traditional engines and electric propulsion systems for smaller commercial craft and recreational boats. Removing the limitations of traditional hardware autopilots that manage steering and course only, the VOYAGER AI SMARTPILOT integrates with propulsion for speed control for single and double in-board engines, and single, double, triple, and quad outboards. Robo-sys Automation.

Marine Weather Services

Advanced marine weather forecasting and navigation tools are available with new weather map animations in the SailTimer chartplotter app. Weathernews forecasts inform map animations of waves and swell (and soon, temperature, precipitation, currents, and tides) in offshore, coastal, and inland waters. The app includes crowdsourced wind map animations, using data SailTimer receives from its wind sensors and other brands. Weathernews Inc. and SailTimer Inc.

Ship Engine Room Pump



This new compact design optimizes onboard liquid handling. Because of its lower weight, fewer components, and just a single wear part, the NCM pump will enhance efficiency, simplify system integration, and reduce operational complexity. The pump reduces weight by up to 15% compared to other engine room pumps on the market. Designed with fewer components, it is faster to assemble, disassemble, and maintain. Only the mechani-

cal seal is subject to wear, ensuring more consistent performance, fewer disruptions during operations, and a reduced need for spare parts. Svanehøj.

Advanced Berth Monitoring



The Smart Docking Aid System (SmartDAS) provides port operators with comprehensive, objective data that transform traditional berthing operations from subjective processes into precise, data-driven decisions. SmartDAS detects approaching vessels up to 200 m away and captures critical metrics, including vessel distance, velocity, and longitudinal angle. The system stores all data securely in the cloud with remote access capabilities and integrates with AIS technology to automatically match vessel identification with berthing information. Trelleborg Marine and Infrastructure.

Electric Propulsion Systems

Deep Blue 200i is a fully integrated inboard motor that delivers up to 200 kW at 900 rpm and can be flexibly incorporated into electric or hybrid propulsion systems. It is ideal for powerful thrust applications in commercial shipping and opens up new performance classes. The Deep Blue 100 azimuth thruster is a 360° electrically rotatable thruster that requires little maintenance. It improves the maneuverability of heavy inland waterway vessels. Torqueado.

Low-Carbon CFD Simulation

DNV has released a new version of its advanced computational fluid dynamics (CFD) simulation software, developed through three joint industry projects with major energy companies. The software enables

safer and more effective implementation of key low-carbon solutions, which are vital for achieving net-zero targets. KFX software models the behavior of liquid or gaseous materials and predicts their potential consequences in real environments in the event of accidents. The latest KFX release introduces specialized consequence modeling of carbon dioxide, ammonia and hydrogen. DNV.

Uninterruptible Power Supply

The 10- to 50-kW NEDM Series True Online UPS is fully convertible and can be ordered in free-standing or rack-mount configurations. Its modular design allows for three-phase input and output; single-phase input and output; three-phase input and single-phase output (with derating to 60%); and single-phase input and three-phase output (with derating to 60%). Advanced features include input active power factor correction, Smart Sleep function, Self Aging mode, and a 6.75-in. color touchscreen.

Nova Electric Div. Technology Dynamics Inc.

Predictive Maintenance

CMAXS LC-A is an engine monitoring system and service that comprises condition analysis and a technical support system for machinery devices. Endorsed by ClassNK, this solution offers enhanced prediction for preventive maintenance. Early detection of root causes is enabled through the automatic troubleshoot function. MITSUI E&S Co. Ltd. and Mitsui E&S DU Co. Ltd.

Vessel Pitch and Roll Control

Zipwake PRO, distributed exclusively by IMTRA in the U.S., is an upgrade to Zipwake's Dynamic Trim Control System. Available for new installations and as an enhancement to existing Zipwake Series S or Series E systems, Zipwake PRO brings active pitch control, improved active roll, balanced and coordinated turning, and wake-shaping functionality for trim stability. Zipwake AB. **ST**

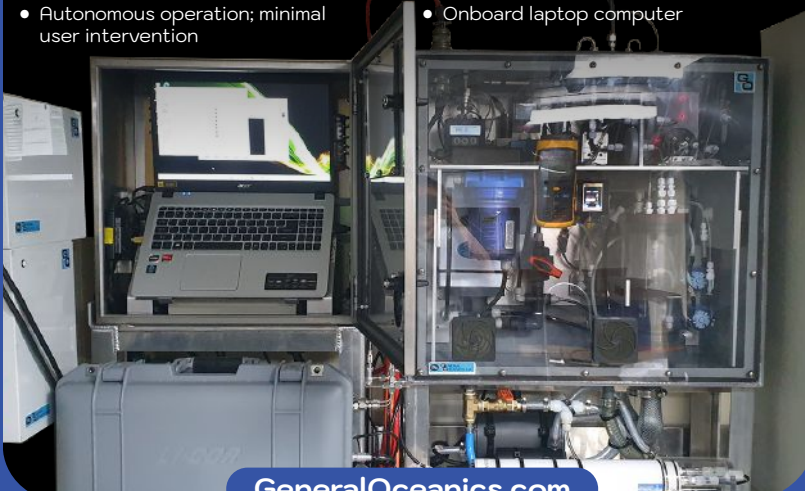


General Oceanics, Inc. introduces its new 2nd Generation model 8060 autonomous pCO₂ monitoring system.

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GeneralOceanics.com

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\$9 Billion Cut for Public Broadcasting

The U.S. government has cut \$9 billion in funding for public broadcasting.

Some local public broadcasters rely on federal funding for more than 70 percent of their financing of content, interconnection, and support services. Support through the Corporation for Public Broadcasting is critical for many local stations, with the most vulnerable in rural and remote communities. Public radio and television stations serve as the primary—often sole—source of local news, educational content, and emergency alerts.

Nearly 13 million Americans live in communities under threat of losing local public broadcast stations because of federal funding cuts. Many of these stations serve large swaths of the Western, Midwestern, and Southeastern U.S. at risk of wildfires, tornadoes, hurricanes, and other public safety emergencies.

Coast Guard Authorization Act

The Coast Guard Authorization Act of 2025 has been approved by the U.S. House of Representatives. The bill authorizes appropriations for the service through fiscal year 2029. The U.S. Senate approved its version of the bill earlier this year.

These authorizations will support Coast Guard operations and the continued recapitalization of its historically underfunded cutter fleet, aviation assets, shoreside facilities, and IT capabilities. The bill is intended to modernize the Coast Guard's acquisition process, increases transparency and accountability in the service's recapitalization efforts, and opens a pathway to the adoption of next-generation autonomous technologies.

The bill also aims to create greater parity with the other armed services, including the establishment of a secretary of the Coast Guard and stronger protections for members from sexual assault and harassment.

The legislation also strengthens U.S.-build requirements to support the domestic shipbuilding industry.

US, Norway Extend Water Power Collaboration

The U.S. Department of Energy (DOE) has extended a commitment to collaboration in water power research and development with Norway's Royal Ministry of Energy. This is an extension of a previously established memorandum of understanding (MOU).

In 2020, DOE and Norway's Royal Ministry of Energy signed a five-year MOU annex that brought together DOE's Water Power Technologies Office and the Norwegian Research Centre for Hydropower Technology to collaborate on hydropower research and development.

The latest MOU annex expands the scope of this collaboration to include marine energy, which has the potential to provide locally sourced energy to millions of Americans in the most densely populated regions of the country.

Under the extended MOU, the two parties will share foundational information, tools, and technologies that

reduce barriers to the development, testing, and advancement of both marine energy and new hydropower technologies.

US Marine Highway Program Expands

The U.S. Department of Transportation's Maritime Administration (MARAD) has designated 848 new miles of navigable waterways and approved 14 new sponsors for the U.S. Marine Highway Program (USMHP). The network, which now covers 27,139 mi. across 35 designated routes, supports U.S. supply chains, critical infrastructure, and maritime workforce development.

A key highlight of this expansion is the strengthening of the M-90 route, which runs 2,345 mi. through the Great Lakes, connecting Minnesota to New York. Seven new sponsors have joined M-90: the State Departments of Transportation for Wisconsin, Illinois, Minnesota, Michigan, and New York, as well as the Ports of Indiana and the Erie-Western Pennsylvania Port Authority.

Funding for Beach Safety

The U.S. Environmental Protection Agency will provide to the states of Delaware, Maryland, Pennsylvania, and Virginia a total of \$962,000 in grant funding to monitor water quality at coastal and Great Lakes beaches and to notify the public if elevated levels of illness-causing bacteria make swimming unsafe.

This funding is authorized by the Beaches Environmental Assessment and Coastal Health (BEACH) Act.

Three New Survey Vessels for USACE in Georgia

Silver Ships Inc. has delivered three new survey vessels to the U.S. Army Corps of Engineers (USACE) Savannah District. The additions to the district's fleet will support navigation efforts in Georgia waterways, particularly to survey channel conditions, monitor dredging activities and detect underwater obstacles in the waterways.

The vessels are also designed to transport staff and equipment to various project sites, including the Savannah Harbor, Brunswick Harbor and the 161-mi. stretch of the Atlantic Intracoastal Waterway along Georgia's coast.

DOE Chooses New Lab-Embedded Entrepreneurship Fellows

The U.S. Department of Energy has selected 27 innovators and entrepreneurs to join the latest cohorts in its Lab-Embedded Entrepreneurship Program (LEEP). Selectees will be embedded within four U.S. national laboratories, where they will work with an extensive network of mentors and experts to develop transformative energy technologies.

Since the program's inception in 2015, 182 LEEP start-ups have attracted \$4.2 billion in follow-on funding and created more than 3,800 jobs.

During their two-year fellowship, LEEP participants perform critical research and development to hone their startup technologies from lab to market. The program also provides them training in business development, networking opportunities, and access to the resources and expertise of the U.S. national laboratories. **ST**

Damen Updates Oman Tall Ship Training Vessel

Damen has completed an extensive maintenance program on the Royal Navy of Oman's sail training vessel *Shabab Oman II*. The work provides the tall ship with a series of upgrades to prepare for duties in the coming decade.

Sending a team from its United Arab Emirates-based service hub to Oman, Damen executed a full refit of technical spares, renewal of standing rigging and three generators, as well as overhaul and maintenance of all critical systems on board on the vessel. This included work to the vessel's propulsion line, bilge, firefighting equipment, cooling water and power generation systems. The project execution was assisted by Damen Services' familiarity with the vessel, having previously provided parts and services to the *Shabab Oman II*.

Submarine Surveillance for Germany

LANQ, a German-based maritime defense solutions provider, and MetOcean Telematics, a specialist in end-to-end telemetry solutions and maritime security technologies, will cooperate on advancing persistent submarine surveillance in Germany's maritime theater. This will strengthen NATO-aligned undersea situational awareness through intelligent, distributed sensing and data fusion. Together, FLANQ and MetOcean will supply and support commercial-off-the-shelf (COTS) surveillance systems designed to detect, classify, and track submerged threats across contested and congested German waters.

At the core of this initiative is NiKA, MetOcean's new ASW surveillance instrument, engineered for long-endurance acoustic sensing. Deployed from USV or ship, NiKA autonomously dives to programmed depths to perform real-time passive acoustic surveillance, detecting and classifying adversary signatures across the water column. Depending on mission parameters or when anomalies are detected, NiKA surfaces to transmit data to commanders via Iridium satellite before resubmerging to continue its surveillance cycle.

FLANQ will supply and support the integration of these systems into standalone and integrated maritime

security systems-of-systems. Leveraging FLANQ's autonomous surface platforms and Q-MIND technology stack, the combined system will deliver persistent, wide-area submarine detection and classification capabilities.

RINA Acquires Foreship

RINA, a multinational engineering consultancy, inspection, and certification group, has acquired the entire share capital of Foreship, a Finnish company specializing in naval architecture and marine engineering, from Vaaka Partners and the company's managers.

Foreship, with 2024 revenues of €15.2 million, is headquartered in Helsinki and employs more than 90 professionals in eight offices globally, including the U.S., U.K., and Estonia. Its experience in naval architecture offers high synergies within RINA Consulting and opportunities to increase market share in the maritime consultancy sector, particularly in complex retrofits, new fuel integrations, and digital transformation. Foreship operations will be part of RINA Consulting.

3D FLS for DARPA USV

Through Serco Inc., FarSounder's Argos 3D forward-looking sonar (FLS) has been included in the navigation system on the U.S. Defense Advanced Research Projects Agency's (DARPA) recently completed No Manning Required Ship (NOMARS) demonstration vessel. The project is the development of *Defiant*, a first-of-its-kind USV designed to operate autonomously for extended durations at sea without any onboard crew.

FarSounder's Argos FLS (*Sea Technology*, January 2025) was integrated into the vessel's navigation suite to enhance situational awareness and support the ship's real-time obstacle avoidance capabilities.

Saildrone Demo for NATO in Baltic Sea

Saildrone has detected and tracked hundreds of vessels daily and successfully identified "red forces" for NATO Task Force X Baltic. Saildrone also identified real-world dark targets, including numerous Russian "shadow fleet" and military vessels. NATO's focus is to trial and integrate uncrewed systems into a networked operational environment. The objective is to deliver unmanned systems to NATO's Standing Naval Forces with speed and scale, in the most relevant operational environments. **ST**

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Renewal of Ultradeepwater Construction Vessel

Gibdock has completed work for Technip, which entrusted the Gibraltar yard with the repair and renewal of *Deep Blue*, the flagship in its specialized pipelay and subsea construction fleet.

Repeat customer Technip relocated *Deep Blue* from the U.S. Gulf for the work, then redeployed the asset outside Europe following completion of the work.

Specializing in ultradeepwater field developments, *Deep Blue* includes an array of reel-lay, J-lay, and flexi-lay technologies. Featuring twin 2,800-MT capacity reels, the vessel lays pipes and cables at depths of up to 3,000 m.

In the scheduled drydocking, Gibdock undertook steel and piping renewal works, hull and tank surface blasting and recoating, and machinery overhauls to ensure

Deep Blue remains in peak condition for the next five years.

EPCI Collaboration

GATE Energy and HD Hyundai Heavy Industries (HHI) have signed a memorandum of understanding (MOU) to collaborate on offshore energy infrastructure projects. The two companies will jointly pursue engineering, procurement, construction, and installation (EPCI) opportunities in the offshore oil and gas sector, targeting global markets. HHI and GATE Energy will work together to deliver seamless project execution, with roles defined according to project-specific needs.

The MOU provides a framework for future cooperation and information sharing, with the flexibility to align on specific tenders as opportunities arise. It also includes provisions for joint planning, resource integration, and the potential de-

velopment of execution models tailored to developer requirements.

Site Characterization for Gas Field off Southeast Asia

Fugro has signed a letter of award to perform a site characterization program for a deepwater gas field development in Southeast Asia.

This award represents the largest geotechnical and geophysical survey project for Fugro in the Asia-Pacific region to date, reflecting the positive momentum of deepwater developments in the region.

This complex project builds on a combination of Fugro's onshore, nearshore, and offshore geophysical and geotechnical survey services.

Geodata acquisition is scheduled to commence in the third quarter of 2025, with fieldwork estimated to last approximately one year. Detailed testing and consulting deliverables will continue into 2027.

Supporting site planning and engineering design, the resulting ground model will be available to

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project owners in near real time to facilitate faster decision making by project engineers and improved collaboration with stakeholders, including regulatory agencies.

Environmental, Compliance Services Joint Offering

Ashtead Technology has entered into a collaboration with Ocean Science Consulting Ltd. (OSC) to streamline the delivery of environmental monitoring, mitigation solutions and compliance services across the global offshore energy sector.

Ashtead Technology and OSC will provide fully integrated environmental monitoring and mitigation solutions to oil and gas and offshore wind developers operating in complex and regulated marine environments.

Ashtead Technology will manage and deliver the subsea technology and solutions to monitor and mitigate the environmental impact of subsea operations, while OSC will provide key compliance strategies, underwater noise monitoring, data analysis, and effective regulatory reporting.

Offshore energy projects, including decommissioning legacy infrastructure, laying subsea cables, and installing wind turbines, must address subsea noise and its potential impact on marine life. Through this collaboration, clients can meet environmental requirements more

confidently, with a single provider supporting the entire offshore asset life cycle.

REAV-47 USV for Surveys In Nigeria

HydroSurv (*Sea Technology*, July 2025) has sold a REAV-47 USV to Geodetic Offshore Services Ltd. (GOSL) for hydrographic and geophysical survey operations. The sale marks the company's first delivery to Nigeria.

The battery-hybrid REAV-47 will be integrated with an advanced payload comprising a Ping DSP 3DSS-IDX interferometric sonar alongside Innomar's compact parametric sub-bottom profiler. This payload configuration will enable concurrent wide-swath bathymetric mapping and high-resolution sub-bottom imaging for comprehensive landfall survey capability in offshore infrastructure projects.

GOSL will operate the multipurpose REAV-47 USV as a standalone survey system and a mothership force-multiplier. The vessel can sustain survey operations for up to 72 hr., with a battery-hybrid system consisting of a 12-kW Mastervolt battery system and a 4-kW Fischer Panda generator.

The REAV-47 uses HydroSurv's advanced Virtual Watchkeeper vessel control system, alongside trusted autopilot technology from Dynautics and an advanced navigation and situational awareness spread

from Furuno and TimeZero. The vessel's 5.0-kW, rim-driven electric propulsion from RDT minimizes entanglement risk.

GOSL will station the new USV at the company's operating base in Port Harcourt. The company's experienced survey team has delivered survey projects for ExxonMobil, Shell, Chevron and Total Energies.

In addition to the REAV-47, GOSL has also acquired a REAV-28 inland multipurpose USV. This smaller, battery-electric vessel complements the longer-endurance capabilities of the REAV-47. **ST**

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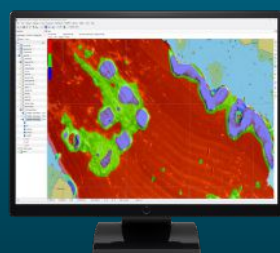
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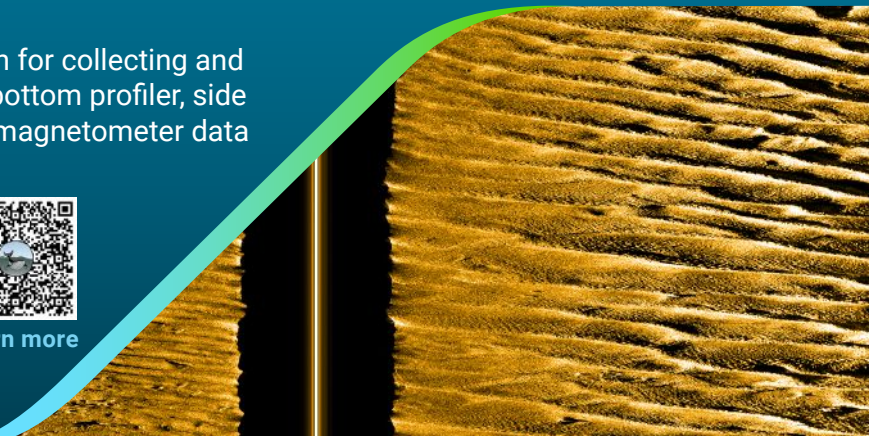
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Tech Integration for Boat Autonomy

Avikus, HD Hyundai's specialized autonomous navigation technology subsidiary, has signed a memorandum of understanding with Emerson to integrate its NEU-BOAT CONTROL autonomous system with Emerson's Aventics marine controllers.

Avikus will use Emerson's open protocol for its Aventics marine controllers to integrate with its NEU-BOAT CONTROL system to provide safety and convenience features, such as collision avoidance, adaptive cruise control and auto docking. Following integration, Avikus will be completely compatible with Emerson's Aventics marine controllers across all OEMs, dealers and customers.

AI Scheduling for Shipping

Seaber's AI-assisted scheduling solution has been expanded across Neste's shipping operations in Europe. Since 2021, Neste, the world's leading producer of sustainable aviation fuel and renewable diesel, has successfully used Seaber to optimize its products shipping out of Finland, improving vessel scheduling, reducing port wait times, and enhancing fleet utilization. Following such improvements, Neste is now rolling out Seaber across all its European shipping operations, with a long-term vision of enabling global fleet transparency and efficiency through digitalization.

Beyond providing technology, Seaber contributes its domain expertise and advanced algorithms to actively identify opportunities for optimization and cost savings. Each of Neste's shipping units is participating in joint studies to support the shared goal of maximizing fleet utilization. Through improved fleet utilization, Seaber enabled up to a 4 percent reduction in bunker and port-related costs and a 4 percent cut in emissions. By comparing different scenarios, Seaber is helping Neste's teams identify new ways to reduce costs across fleet scheduling

and port operations. Aiming for a global virtual position list through the work of scheduling and chartering teams, Neste is achieving a clear, transparent, and centralized view of its shipping operations.

Seaber's validated data model for planning and optimization adapts to the unique needs of each shipping division regardless of operational differences.

Wilhelmsen Joins MBF

The Maritime Battery Forum (MBF) welcomes Wilhelmsen Ships Service as the newest member of the global community of maritime battery enablers. As a global leader in maritime products and services, Wilhelmsen Ships Service brings decades of operational expertise and a deep commitment to sustainable innovation.

Wilhelmsen's journey into maritime battery integration reflects a deliberate and strategic expansion of its sustainability efforts. In 2023, Wilhelmsen partnered with Yinson GreenTech to support the development and trials of Hydromover, Singapore's first fully electric cargo vessel. This was followed in 2024 by the company joining the Coastal Sustainability Alliance, a collaborative initiative aimed at accelerating the adoption of clean energy in regional maritime logistics.

In 2025, Wilhelmsen Ships Service launched an electric vessel charging station at its Pandan Loop facility. This station is designed to support next-generation electric vessels such as Hydromover 2.0 and Hydroglyder, reinforcing the company's infrastructure capabilities in supporting maritime electrification. Also in 2025, Wilhelmsen Port Services entered a memorandum of understanding with Yinson GreenTech and R W Marine Services to coordinate the deployment and integration of electric vessels within Singapore's port ecosystem, supporting national goals for maritime decarbonization.

Wilhelmsen's innovation agenda extends beyond local projects.

In 2017, the group took a majority stake in NorSea Group AS, a specialist in shore power infrastructure, laying the foundation for port-side electrification and clean energy logistics in Northern Europe. In 2018, Wilhelmsen and Kongsberg Maritime launched Massterly, the world's first company dedicated to the operation of autonomous, remotely controlled, and battery-integrated vessels.

Wilhelmsen Ships Service is actively investigating several avenues to support and expand the use of maritime batteries in vessel operations. This includes the development of specialized operational treatments and chemical solutions designed specifically for battery-powered systems. Additionally, the company is exploring the use of advanced sensor technologies and data analytics to monitor and optimize the performance of batteries during operations.

Further, Wilhelmsen is positioning itself as a life cycle partner for maritime battery systems by offering advisory, technical support, and service solutions that ensure safety and efficiency, from installation through to end-of-life management.

By joining MBF, Wilhelmsen aims to gain early insights into emerging battery technologies, regulatory trends, and deployment strategies—while also contributing its practical knowledge in retrofitting vessels and building charging infrastructure. The company's global service network will support MBF's efforts to scale up safe and effective battery adoption.

AI, Data Analysis Skills Needed

The maritime industry's digital transformation means seafarers must develop skills in data literacy and AI interaction to navigate emerging technologies effectively, according to the maritime training provider OneLearn Global, part of OneCare Group.

Training programs must teach crew how to work with AI-driven tools, interpret large volumes of data, and remotely monitor increasingly complex onboard systems to use AI and data effectively. **ST**

environmental monitoring

US Sea Level 'Report Cards'

William & Mary's Batten School and the Virginia Institute of Marine Science (VIMS) have released their 2024 U.S. sea level "report cards," providing updated analyses of sea level trends and projections for 36 coastal communities. Encompassing 55 years of historical data, the report cards aid planning and adaptation efforts by analyzing rates of sea level rise and acceleration at each locality and forecasting 2050 water levels.

The report cards are consolidated in an interactive dashboard, www.vims.edu/research/products/slrc, and add data from tide gauge stations in Annapolis, Maryland; Solomons Island, Maryland; Yorktown, Virginia; and Fort Myers, Florida.

Most sea level projections are based on an understanding of average global sea level rise. However, sea levels do not rise uniformly around the world. Factors such as geological uplift, land subsidence, ocean currents and other processes all impact regional sea level trends.

The annual release of the report cards enables coastal regions to examine if past trends are changing and to alter their planning accordingly. The reports group localities into East Coast, Gulf Coast, West Coast and Alaskan Coast regions. Each report card shows values for monthly sea level averages, along with high- and low-water levels caused by storms and other transient events, as well as a decadal signal showing the influence of longer-term climate patterns, such as El Niño. Observed rates of acceleration are factored into future projections and displayed in comparison to a linear trend line that does not account for acceleration.

Most locations continue a trend of accelerating sea level rise. However, projections have remained mostly uniform since reporting began in 2018, apart from a few notable exceptions.

Acceleration is occurring in southeastern states such as South Carolina and Georgia. The fastest

rates of sea level rise are occurring in Gulf states such as Texas and Louisiana. Many of the East Coast stations are accelerating quickly as well, likely due to patterns of water distribution related to glacial melt from the Greenland ice sheet.

Most West Coast localities have been fairly stable, despite past predictions that they would increase rapidly.

HAUV Documents Reef

Advanced Navigation (*Sea Technology*, August 2025), in collaboration with the marine consultancy O2 Marine, has revealed an explicit visual depiction of Hall Bank, a small, nearshore reef off Fremantle in southwest Australia, located well beyond the typical latitudinal range for coral reefs.

Using Hydrus, a micro-hovering AUV, the teams conducted a detailed survey of the reef, capturing georeferenced high-resolution imagery and 4K video in parallel. The data show severe coral bleaching and fragmentation, laying bare a hidden yet escalating crisis at one of the world's southernmost reefs.

Three Hydrus units were simultaneously deployed, each executing coordinated transects and lawnmower survey patterns across different sections of the reef. The data were used to generate a 3D digital twin of the Hall Bank seabed. The model documented the shrinking coral formations.

This comes at a time when both of Australia's two World Heritage-listed reefs—Ningaloo and the Great Barrier Reef—were simultaneously hit by coral bleaching in March 2025, driven by an intense marine heatwave that drove sea surface temperatures up to 4° C above the summer average.

The Hall Bank site is regarded as a rare and valuable example of high-latitude reef resilience, able to support extensive coral cover in cold, turbid waters, which makes it a vital natural lab for studying climate adaptation. Hosting a unique mix of tropical, subtropical, and

temperate coral species, it offers critical insights into species range shifts and reef development under changing ocean conditions.

Wetlands Conservation Tool

Each year, billions of dollars go toward wetland restoration and protection. Scientists with Texas A&M AgriLife Research are leading a NASA-backed effort to develop a predictive tool that could transform how the U.S. approaches wetland conservation. The study is a three-year, \$897,000 grant project funded by NASA's Ocean Biology and Biogeochemistry program, with collaborators from Pennsylvania State University.

Together, the researchers are analyzing big data sets, including satellite imagery and 25 years of weather data, to detect early warning signs of decline in tidal wetlands across the country. The goal: identify ecological "tipping points" before they become irreversible.

Study Reveals More Extensive Ocean Acidification

Damage to coral reefs, loss of habitats and a threat to survival for shell-building marine creatures are among the impacts of ocean acidification. Until now, ocean acidification had not been deemed to have crossed its "planetary boundary" (defined as a 20 percent aragonite saturation state change compared to pre-industrial times); however, a major new study, led by the U.K.'s Plymouth Marine Laboratory, NOAA, and CIMERS at Oregon State University has found that this "boundary" was actually reached around five years ago.

Using the latest physical and chemical measurements in the upper ocean, combined with advanced computer models and studies of marine life, the research team has concluded that by 2020 the average ocean condition worldwide was already very close to, and in some regions beyond, the "danger zone" for ocean acidification.

The study suggests that conservation measures should focus on the regions and species most vulnerable to acidification. **ST**

contracts

Fugro, Leidschendam, Netherlands, has been awarded a contract to run a comprehensive site characterization program for an Eni-operated development of a deepwater gas project in the Eastern Mediterranean to support Cyprus's goal of becoming a regional gas producing and exporting country. Eni.

ABB, Helsinki, Finland, will equip a fleet of shuttle tankers with ABB's Onboard DC Grid power system platform. Engineered to optimize fuel efficiency, reduce emissions and enable a flexible integration of energy sources, the technology will be the heart of the integrated power system specified for nine newbuild vessels. Samsung Heavy Industries Co. Ltd.

HII, Pocasset, Massachusetts, will deliver more than a dozen REMUS 300 small UUVs, building on a longstanding relationship with Japan, an important U.S. ally in the Pacific region. Hitachi Ltd.

Damen Shipyards Group, Gorinchem, Netherlands, will deliver an ASD Tug 2312, to operate in Pictou Harbour, where it will provide towage services for the more than 3,000 500 GT+ vessels to call annually. Port Marlborough, New Zealand.

Wärtsilä, Helsinki, Finland, has signed a five-year life cycle agreement with an Athens-based LNG management company. The agreement covers two LNG carriers, which each have four Wärtsilä 34DF engines. Alpha Gas.

Kongsberg Maritime, Kongsberg, Norway, will supply integrated technology packages for nine new dynamic positioning shuttle tankers being constructed for the Greek shipowner Tsakos Group, for a bare-boat charter by the Brazilian energy logistics company Transpetro. The vessels will support offshore operations in Brazil's pre-salt oil fields. Samsung Heavy Industries.

Mammoet, Utrecht, Netherlands, will support the offshore installation of two giant topsides for TenneT's 2-GW offshore wind program. Heerema Marine Contractors.

Tototheo Global, Limassol, Cyprus, has signed a new four-year agreement to enhance its capacity to deliver scalable, high-speed VSAT services worldwide by leveraging a commercial maritime service and advanced high-throughput GEO satellite infrastructure. SES. **ST**

meetings

OCTOBER

October 6-8—AAPA Annual Convention, Québec City, Canada. <https://aapa.getregistered.net/2025-annual-convention>.

October 7-9—Indo-Pacific Robotics, Autonomy, AI and Cyber Conference and Exhibition, Perth, Australia. <https://indopacificroboticsconference.com>.

October 7-9—International Boat-Builders' Exhibition and Conference, Tampa, Florida. www.ibexshow.com.

October 15-16—Decarbonisation in Shipping: Europe, Hamburg, Germany. www.wplgroup.com/aci/event/decarbonisation-ship-ping-europe.

October 22-24—NOIA Fall Meeting, Dove Mountain, Arizona. www.noia.org/event/noia-2025-fall-meeting.

October 22-24—WISTA International AGM & Conference, Barcelona, Spain. <https://wistainternational.com>.

October 27-28—Ocean Action Forum, Jeddah, Saudi Arabia. <https://oceanactionforum.com>.

NOVEMBER

November 4-6—Deepwater Operations and Topsides, Platforms

& Hulls Conference and Exhibition, Galveston, Texas. www.offshore-event.com.

November 4-6—Sustainable Ocean Summit and Global Blue Finance Summit, Barcelona, Spain. www.oceancouncil.org.

November 4-7—Europort, Rotterdam, Netherlands. www.europort.nl.

November 5-6—European E-Fuels Conference, Hamburg, Germany. www.wplgroup.com/aci/event/european-e-fuels-conference.

November 12-14—Marine Renewables Canada Conference, Halifax, Canada. <https://marinerenewablesconference.ca>.

November 19-21—Vietnam International Marine & Offshore Expo, Ho Chi Minh, Vietnam. marine-vietnam.com and offshorewindviet.com.

November 25—Maritime Security & Defence Conference, Hamburg, Germany. www.smm-hamburg.com/msd-conference.

November 25-26—Offshore Energy, Amsterdam, Netherlands. <https://oeec.biz>.

DECEMBER

December 3-5—International WorkBoat Show, New Orleans, Louisiana. www.workboatshow.com.

2026

FEBRUARY

February 3-5—EUROMARITIME, Marseille, France. www.euromaritime.fr.

February 16-18—Geo Week, Denver, Colorado. www.geo-week.com.

APRIL

April 14-16—UDT, London, U.K. <https://udt-global.com>.

For more industry meetings, visit sea-technology.com/meetings. **ST**



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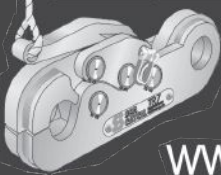
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The LNG Sector Must Modernize Procurement—Carsten Schmidt

Carsten Schmidt is vice president of sales at Athens-based Procure-ship. He is a 40-year veteran of the marine procurement market, having worked previously at some of the biggest vessel operators in the world. With his background in marine procurement, he is helping shipowners throughout Europe, the Americas and Asia to optimize their procurement needs in the modern maritime age.



As global demand for LNG surges and the market faces ongoing volatility, operators of LNG carriers continue to fine-tune their core operational processes. Procurement, traditionally a cumbersome, arduous, and back-office function, is under the spotlight as shipowners recognize its potential for cost savings and improved fleet readiness.

The LNG shipping sector faces unique challenges. LNG carriers are not only highly specialized and capital-intensive, they also operate in a tightly balanced market where small inefficiencies can cascade into costly delays. With supply-demand dynamics tightening and operational margins narrowing, maintaining vessel performance without compromising safety or compliance is more critical than ever.

Demand for LNG has been accelerating, driven by energy security concerns in Europe and rapid industrialization in Asia. This has reshaped global LNG flows, with long-haul voyages becoming more common and new trade routes emerging. While this growth presents opportunity, it also puts mounting pressure on shipowners to ensure that fleets remain operationally agile and cost-efficient.

At the same time, LNG vessel design and equipment requirements are far more sophisticated than conventional cargo ships. Maintaining cryogenic conditions, managing

complex cargo-handling systems, and upholding stringent safety and environmental standards are strict requirements for modern LNG carriers, meaning that any downtime is costly for the owner and operator.

As a result, LNG shipping companies are taking a fresh look at how their procurement processes and supply chains function. Increasingly, they seek modern systems and practices that reduce administrative burden, enhance transparency, and enable faster decision making to keep their vessels moving.

Traditionally, marine procurement has been a slow-moving, fragmented process involving copious amounts of paperwork, manual invoicing and a high risk of human error. Recently, however, more LNG operators have begun to enhance their processes with new technologies, automation, and cloud-based approaches to improve visibility and transparency, reduce rogue spending, and enable procurement decision makers to have more control over purchasing.

A more agile procurement process can reduce costs, shorten sourcing timelines, and improve access to specialized components and services, most notably in ports with limited traditional supplier relationships. Streamlining procurement workflows also enables LNG shipowners to respond more quickly to emerging operational needs, avoiding delays.

For LNG fleets, which require complex systems such as pumps, compressors, and heat exchangers to manage cargo temperature and safety, the ability to rapidly source specialized parts and skilled services is vital. This demand for precision and reliability makes effective procurement a core part of today's operational needs. Unlike bulk carriers or containerships, LNG vessels cannot afford extended downtimes or last-minute fixes. Their systems demand continuous monitoring

and preventive maintenance to operate safely and efficiently. A single fault in a critical component can halt an entire voyage or require a service delay for extensive repairs.

Given these stakes, many LNG operators are moving toward more proactive procurement strategies. These include building broader supplier networks, creating standardized sourcing criteria, and utilizing real-time performance data to anticipate maintenance needs before failures occur. The result is not only fewer unplanned outages but also better long-term cost control.

Modern procurement processes highlight how interwoven ship performance is with its supply chain. Whether in drydock or underway, an LNG vessel's ability to access the right part, at the right time, from a qualified vendor is central to both safety and profitability.

While modernization in procurement continues to gain momentum, a lack of industry standardization remains a challenge for owners. For LNG carriers, this complexity is compounded by stricter safety norms and evolving environmental regulations. A lack of standardization in vendor requirements, product specifications, and quality benchmarks can lead to inefficiencies, slower onboarding of new suppliers, and even incompatible parts being sourced in error.

Common standards for procurement practices could facilitate better supplier performance tracking, simplify compliance checks, and enable closer collaboration across supply chains, all of which would boost LNG fleet optimization.

With LNG critical to the global energy transition, and as routes diversify and environmental regulations tighten, maintaining a responsive and reliable fleet is the advantage. Enhancing procurement capabilities by activating key digital procurement platforms is an essential step toward this resilience. **ST**

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