

Smart Subsea Solutions

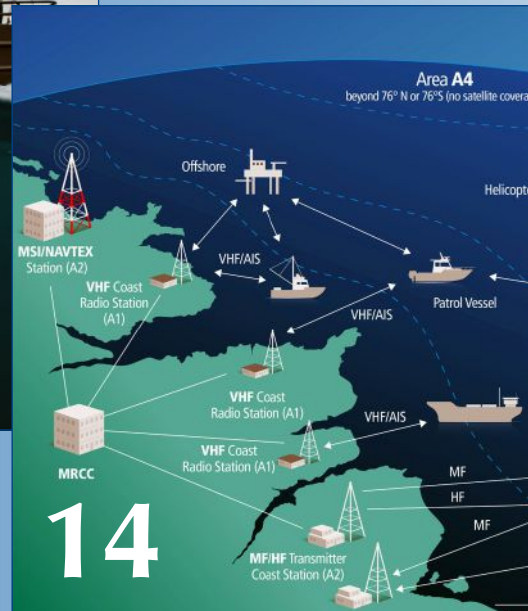
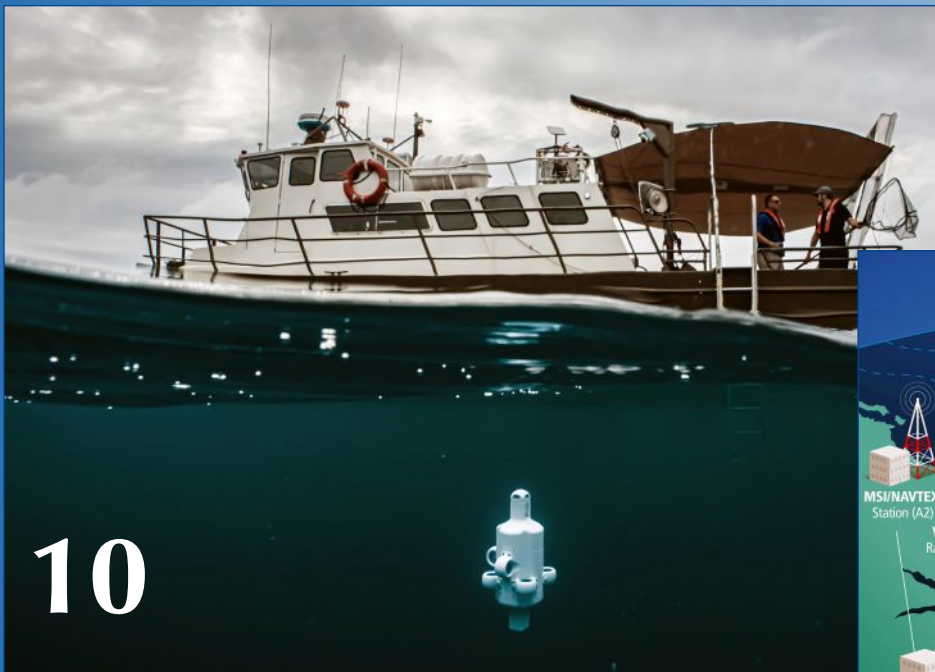
- intelligent vehicles
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- diver navigation systems

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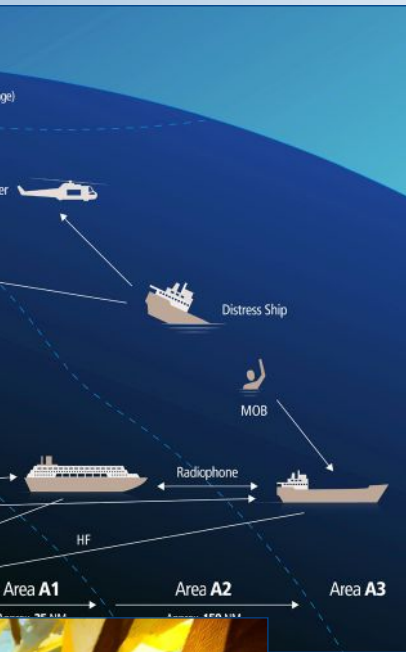
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)) Global Maritime Tech Startup Trends. The venture studio Flagship Founders has published the “Global Maritime Tech Startup Map 2025,” offering an overview of the current global landscape of independent maritime tech startups and scaleups based on publicly available data. This is the third edition of the map, which now features 176 startups, up from 149 the year before. Some new startups have been added, while others were removed after no longer meeting the selection criteria, including six that merged with or were acquired by other companies. The listed startups are no older than 10 years, and their core offering is software, not hardware. The 2025 analysis reveals that AI integration is growing rapidly: 45 percent of all featured startups report using AI in their offering, up from 27.5 percent the previous year. Maritime tech startups have raised around \$234 million in disclosed funding rounds in 2025; an increase of about 73 percent compared to the previous year. Singapore, the U.K., Germany and the U.S. continue to dominate the global maritime startup landscape, accounting for more than half of all listed companies. One standout trend is the growth in Greece: the number of Greek startups on the map increased from nine to 14, potentially signaling a strengthening innovation ecosystem in the Mediterranean. Taken together, Greece and Cyprus now rank third in terms of total number of startups, behind only Singapore and the U.K. The U.K. continues to confirm its position as a global finance hub: nearly half of all startups in the finance and insurance category are based there, along with about one-third of all startups in the chartering and trading categories. Continental Europe leads in green tech and decarbonization: 80 percent of the startups in this category are based there. This is likely due to the region’s strong leadership in emissions reduction legislation. Singapore hosts the highest overall number of startups: 30.

)) CCS Investment to Reach \$80 Billion in Near Future. Cumulative investment in carbon capture and storage (CCS) is expected to reach \$80 billion over the next five years, according to DNV’s new Energy Transition Outlook: CCS to 2050 report. DNV forecasts that capture and storage capacity is expected to quadruple by 2030. Growth has been limited and largely associated with pilot projects, but a sharp increase in capacity in the project pipeline indicates that CCS is at a turning point. The immediate rise in capacity is being driven by short-term scaleup in North America and Europe, with natural gas processing still the main application for the technology. CCS is crucial for addressing sectors that are challenging to decarbonize, such as steel and cement production. These hard-to-decarbonize industries are forecast to be the main driver of growth from 2030 onward, accounting for 41 percent of annual CO₂ captured by mid-century. Maritime onboard capture is expected to scale from the 2040s in parts of the global shipping fleet. As the technologies mature and scale, the average costs will drop by 40 percent by 2050.

)) Fully Remote Ecology Survey. The BeWild project, led by Fugro, has successfully completed the world’s first fully remote ecology survey at CrossWind’s Hollandse Kust Noord offshore wind farm, marking a significant shift in marine ecosystem monitoring. This innovative approach enables more efficient and less disruptive monitoring, which is crucial for protecting marine life and the sustainable growth of offshore wind energy. BeWild partners integrated computer vision and environmental DNA (eDNA) sampling into Fugro’s Blue Volta electric ROV (eROV). This system was deployed from Fugro’s Blue Essence USV, with both USV and eROV controlled from Fugro’s remote operations center in Aberdeen. This survey marks the first of four research and development assessments at CrossWind under the BeWild project, supported by a subsidy from the Dutch Enterprise Agency.

)) UNESCO Calls for More Engagement in Ocean Science. UNESCO has called for an unprecedented surge in scientific engagement for the ocean and unveiled new initiatives for seabed mapping and the creation of a global network for ocean observation. “To this day, we know less about the ocean floor than we do about the surface of the Moon,” said Director-General of UNESCO Audrey Azoulay. “Learning from the ocean is the greatest scientific adventure of our time. To succeed, the international community can no longer ignore scientists’ warnings and must invest massively in oceanographic research, which currently represents less than 2 percent of national research budgets.” Mapping the seabed and its biodiversity is the foundation of all marine knowledge. It is essential to understand the effects of climate disruption, protect ecosystems, forecast disasters, and guide the management of marine spaces. The Seabed 2030 project, led by UNESCO and the International Hydrographic Organization, aims to map the global seafloor. Understanding the ocean also requires continuous observation. UNESCO is equipping ships with scientific measuring instruments that transmit real-time data to the Global Ocean Observing System (GOOS), which is coordinated by UNESCO. More than 2,000 vessels are already equipped, including those from the Vendée Globe sailing competition and commercial fleets. UNESCO has announced its target to involve 10,000 commercial vessels by 2035, calling upon member states and leaders among the shipping industry to join this unprecedented global ocean observation network. Ships will be equipped with meteorological and oceanographic instruments that transmit real-time data, helping to better assess the effects of climate disruption, anticipate extreme weather events, and improve maritime safety. In addition, UNESCO has developed a standardized environmental DNA (eDNA) sampling method to identify thousands of marine species rapidly and cost-effectively. The program now aims to collect 2,500 samples across 25 marine sites designated by UNESCO, five times more samples than the pilot phase. **ST**

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Waze for Water: The NMEA Cloud Initiative

Imagine a 31-ft. Contender center console entering a familiar inlet when the onboard transducer suddenly shows a depth far shallower than expected, shallower even than the latest chart updates. Then, envision a larger vessel following behind: A fully loaded 74-ft. Viking coming in hot from a successful trip receives a shoaling alert and adjusts course to a different inlet to avoid dangerous grounding that could have caused extensive damage.

In the not-too-distant future, such quick navigation alerts will be enabled by anonymous upload of a vessel's NMEA 2000 data to the NMEA Cloud in real time for the maritime community's enhanced situational awareness.

The NMEA Cloud Initiative is a bold new effort by the National Marine Electronics Association to bring standardized, anonymous, real-time marine data to the cloud, helping mariners, manufacturers, and researchers work smarter and stay safer.

For decades, NMEA has developed standards supporting interoperability between marine electronics from different manufacturers, including widely adopted protocols, such as NMEA 0183 and NMEA 2000. The recent rollout of OneNet, a high-speed, IPv6-based marine networking standard, has laid the groundwork for bandwidth-intensive applications such as video, radar, and multi-sensor sharing.

As vessel data become richer, faster, and more critical to navigation and decision making, the next logical step is to share data securely beyond the local network. The NMEA Cloud is designed to aggregate, standardize, and anonymize data from NMEA-certified devices worldwide: a new approach to sharing marine data that builds on the foundation of existing standards. Much like aviation has embraced public ADS-B data and terrestrial drivers rely on Waze, this initiative aims to give mariners access to dynamic, real-time insights, powered not by a single device but by a global community of connected vessels and platforms.

The NMEA Cloud will gather data such as: time stamp, vessel speed, vessel position, engine RPM, water temperature, water depth, wind speed and direction, wave height, barometric pressure, images (camera, sonar, radar), AIS, and events (floating objects, marine mammals).

Data will be captured from NMEA 0183, NMEA 2000, and OneNet sources, giving both legacy and modern systems the ability to contribute. Participation is entirely opt-in, and data will be anonymized at the source.

The utility is broad. Recreational boaters gain earlier warnings of hazards. Commercial operators can optimize fuel efficiency based on shared current and wind data. Researchers can access a dynamic, crowdsourced environmental data set. Safety agencies can spot emerging risks.

In an increasingly connected marine environment, cybersecurity and data privacy are fundamental. The NMEA Cloud is designed with privacy-first security architecture, with encrypted data pipelines and no vessel-identifying information transmitted. Vessel owners and operators maintain complete control over whether and what data are shared.

Government agencies, including NOAA, have already engaged with the NMEA Cloud, and innovative marine electronic companies are eager to participate to enable smarter apps, better alerts, and more meaningful analytics. NMEA seeks more manufacturers and developers to contribute.

This is more than a tech upgrade. It's a culture shift in how we think about marine data: as a resource that can inform, protect, and connect the entire community. **ST**

SEA TECHNOLOGY® 2025

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Annual Review & Forecast

FEBRUARY

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

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

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

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

MAY

Communications, Telemetry, Data Processing

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

JUNE

Seafloor Mapping/Sonar Systems/Vessels

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****IMAGE 2025**, August 24-29, Houston, Texas

AUGUST

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

NOVEMBER

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Global Ocean Community Since 1963

Technology Ecosystem

Single-Supplier Model Facilitates Operations Above, Below Water

By Chris Sundstrom

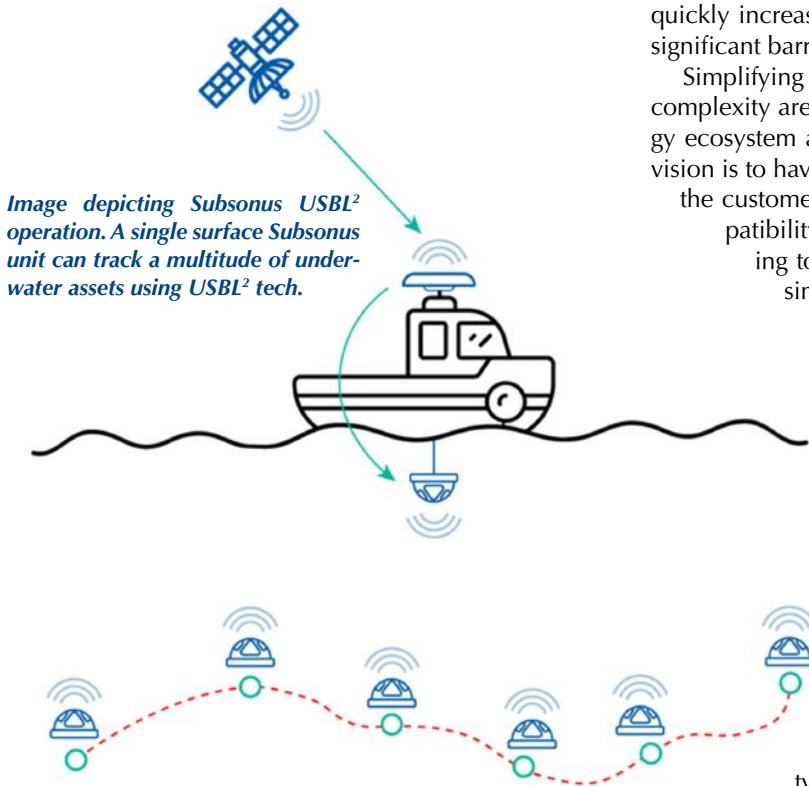


Image depicting Subsonus USBL² operation. A single surface Subsonus unit can track a multitude of underwater assets using USBL² tech.

quickly increase costs, lead to inefficiencies and create significant barriers when entering new industries.

Simplifying integration and reducing operational complexity are key motives that empower the technology ecosystem at Advanced Navigation. The ecosystem's vision is to have everything automatically configured for the customer with one supplier. This allows for compatibility at a much tighter integration level, leading to better performance via a process that is simpler and, thus, more efficient.

USBL²: Filling A Crucial Gap in Subsea

A compelling case on the power of the technology ecosystem can be demonstrated via Advanced Navigation's Subsonus USBL² technology.

Historically speaking, obtaining crucial underwater data, such as determining a precise heading, has presented challenges to subsea operations. Traditional methods often relied on fiber-optic gyroscopes (FOGs) or magnetic heading devices. FOGs, while highly accurate, are typically expensive, heavy and complex to

set up, limiting their application in certain scenarios. By comparison, magnetic heading devices offer lower accuracy, are prone to drift and errors, can be severely affected by magnetic interference from structures, and struggle with accuracy due to degradation at high latitudes.

Consequently, the USBL market itself has long featured a gap between high-end, complex, and expensive systems and less reliable, prone to instability, low-end options. Combined with the complex and costly setup process, users would struggle to get useful data out of these products.

The drive for efficiency and accuracy in marine, including subsea, operations is often hampered by the challenge of system integration. Each piece of equipment, for example, a sonar or INS, often runs its own unique protocols and configurations. Marrying these varied components into a cohesive, functional system requires significant time and expense.

Over the years, I have seen organizations integrating disparate systems from various manufacturers, struggling with the complex custom engineering and integration issues, with no guarantee they will work together. This can



Subsonus USBL underwater.

Subsonus was developed to bridge this gap by offering a high-accuracy positioning sensor that overcomes issues with magnetic interference at high latitudes while being cost-effective. Subsonus provides a unique USBL configuration option called “USBL-squared” (USBL²). The primary difference from traditional configurations, such as classic USBL or inverted USBL, is having a transducer on both the surface vessel and the tracked object.

Each Subsonus unit contains a high-specification INS alongside its hydrophone array and acoustic sounder. The INS provides 6 degrees of freedom (DOF) data: roll, pitch, magnetic and gyroscopic headings, heave, and acceleration. Data from the inertial sensors is fused using Advanced Navigation’s proprietary algorithms.

The hydrophone array is used to measure the speed of sound through water at the transducer head. Acoustic signals exchanged between units are encoded with data and include inherent multipath rejection filters, allowing information sharing beyond simple ping response.

This multi-pronged approach offers a multitude of benefits. By performing USBL calculations at both the tracked object and surface vessel, each Subsonus unit forms part of a single, highly accurate positioning system. Unlike methods requiring FOGs, USBL² resists magnetic interference, has higher noise tolerance than traditional USBL, and avoids degradation at high latitudes. The high sensitivity and fine granularity of angular measurement from the USBL² architecture help overcome difficulties in

precise positioning when dealing with acute slant range, such as in shallow-water conditions, and when attached to more dynamic vessels. USBL² measures the speed of sound at each Subsonus transducer, which is then shared between units for greater precision in range approximation. A single surface Subsonus unit can manage an unlimited number of remote Subsonus transducers.

Additionally, Subsonus introduces modern user-friendly upgrades, including a web-browser-based interface and ethernet connection. The result is a solution that improves heading accuracy, reduces complexity and calibration time, and introduces faster integration into vessel designs.

Subsonus Tag and Hydrus Micro-AUV

Within Advanced Navigation’s technology ecosystem, Subsonus is a critical component working seamlessly with the rest of the company’s subsea product portfolio, including the Subsonus Tag and the Hydrus hovering micro-AUV. Through real-time data fusion, cross-platform interoperability, and effortless integration of new and legacy products, the whole ecosystem allows for compatibility at a much tighter integration level, delivering practical benefits for customers.

The Subsonus Tag is an acoustic positioning transponder that works with the Subsonus USBL² system. Its purpose is to actively respond to a Subsonus unit, allowing its position to be identified and displayed. The tags are

small, battery-powered, easy to use, and require no connectors and minimal maintenance. They also feature an electronic paper screen displaying battery life and other user-friendly features. A single surface Subsonus unit can track multiple tags simultaneously, which is particularly useful for maintaining awareness of divers and subsea operational objects.

Hydrus is a hovering micro-AUV designed for cost-effective benthic and habitat monitoring and underwater surveying. Hydrus is distinct because it features a full navigation and positioning suite that includes an INS, DVL, high-resolution camera, USBL positioning, and acoustic communications, all integrated as standard, rather than as aftermarket options.

Hydrus excels at collecting georeferenced high-resolution imagery and 4K video, enabling the post-processing and creation of detailed digital twins. Its minimal logistics footprint allows for deployment by a single person without large support vessels, making it significantly faster and more affordable for data collection below 50 m. Although Hydrus is an end-user product, it is built to take full advantage of the ecosystem to bring down the cost of complexity. It is compatible with the Subsonus, with no

need for additional hardware as Hydrus can leverage the existing capabilities of the Subsonus system.

Some Advanced Navigation customers were already using Subsonus Tags for diver tracking before later purchasing Hydrus, which they then tracked using the same Subsonus system. In these cases, Hydrus was able to take on some of the diving crews' tasks by optimizing subsea surveying and data collection. This shows how easily operations can expand within a single supplier's tech ecosystem.

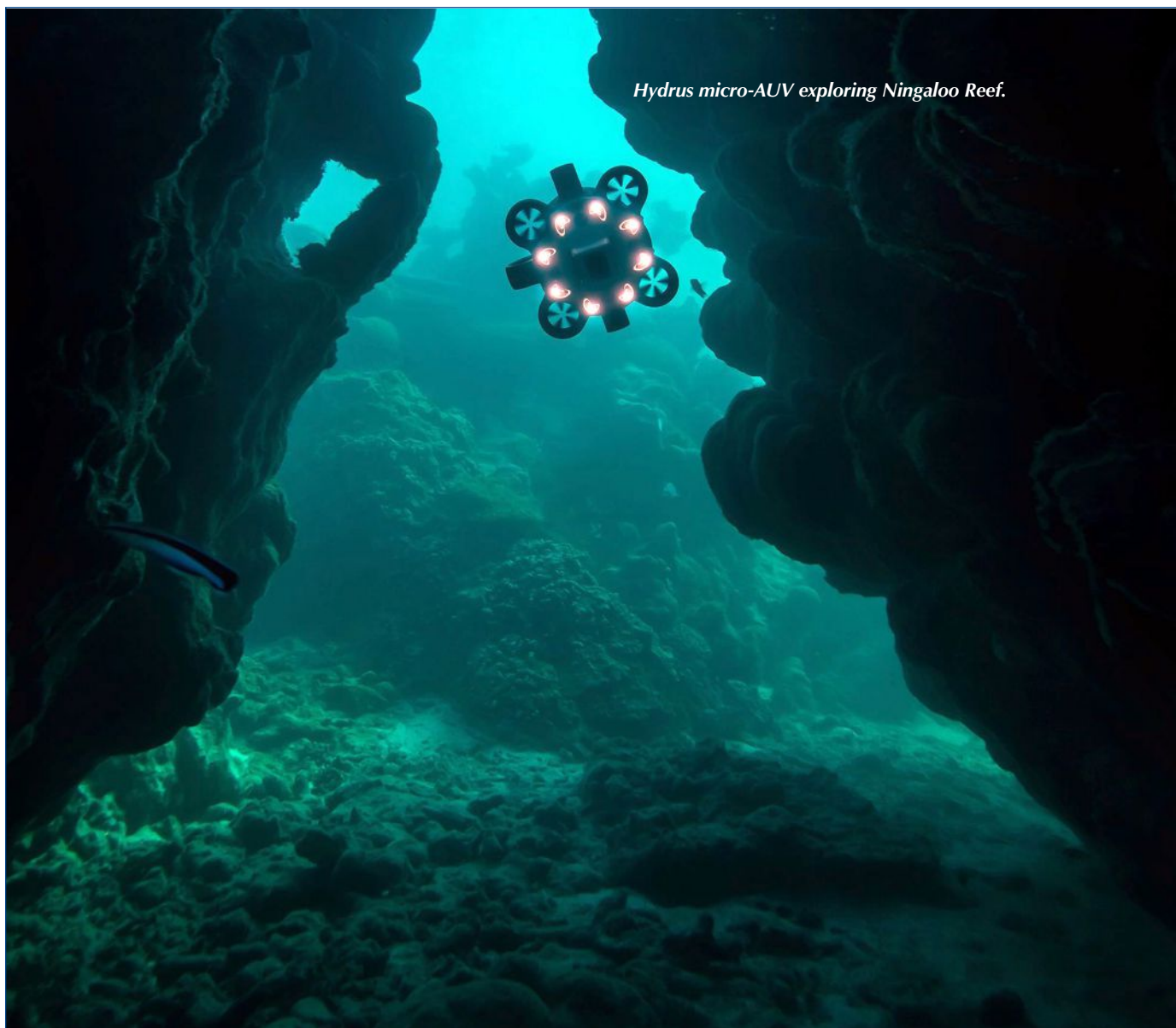
Small-Scale ROV Program

Subsonus's capabilities have been demonstrated recently with JM Robotics, one of Scandinavia's largest suppliers of small, robust ROV systems. JM Robotics was in need of an ultracompact, lightweight heading solution for a small ROV. The task was to inspect buried submarine pipelines in challenging shallow-water conditions near busy areas, with difficulties such as magnetic interference from ferrous pipelines, noise from boats, poor visibility, strong currents and underwater obstacles.

Traditional FOGs were too large, heavy and expensive, while magnetometers were unusable due to inter-



Hydrus is a hovering micro-AUV designed for cost-effective benthic and habitat monitoring and underwater surveying.



Hydrus micro-AUV exploring Ningaloo Reef.

ference. This particular application also required complex ROV piloting, using 6 DoF of movement, to follow the hidden pipelines and successfully battle currents and avoid various obstacles.

Subsonus was identified as the best solution due to its small size and minimal weight. It provided an “acoustic compass” function, delivering accurate heading without relying on magnetometers or FOGs. The system was integrated with a DVL for acoustic velocity and altitude reference, leading to a straightforward installation and easy connectivity setup for the team.

The result was a success. JM Robotics found that using Subsonus immediately provided the additional navigation functions and accuracy required. ROV piloting was also improved when visibility became difficult, as Subsonus provided continuous position and acoustic heading data regardless of water turbidity.

A Cohesive Solution

The basic task of navigating underwater is complex and compounded by the challenges of integrating dis-

parate systems from various suppliers. The cost and difficulty associated with such integration continues to be a major hurdle for industry. But it doesn’t need to be.

Advanced Navigation’s technology ecosystem can provide performance benefits derived from tighter system coupling, including enhanced navigational certainty, increased resistance to interference, and adaptability. This approach can empower industry leaders to overcome technical and integration hurdles, enabling them to focus on operational goals, access new market opportunities, and position themselves for success. **ST**

Chris Sundstrom is the subsea product manager at Advanced Navigation.



Global Maritime Safety

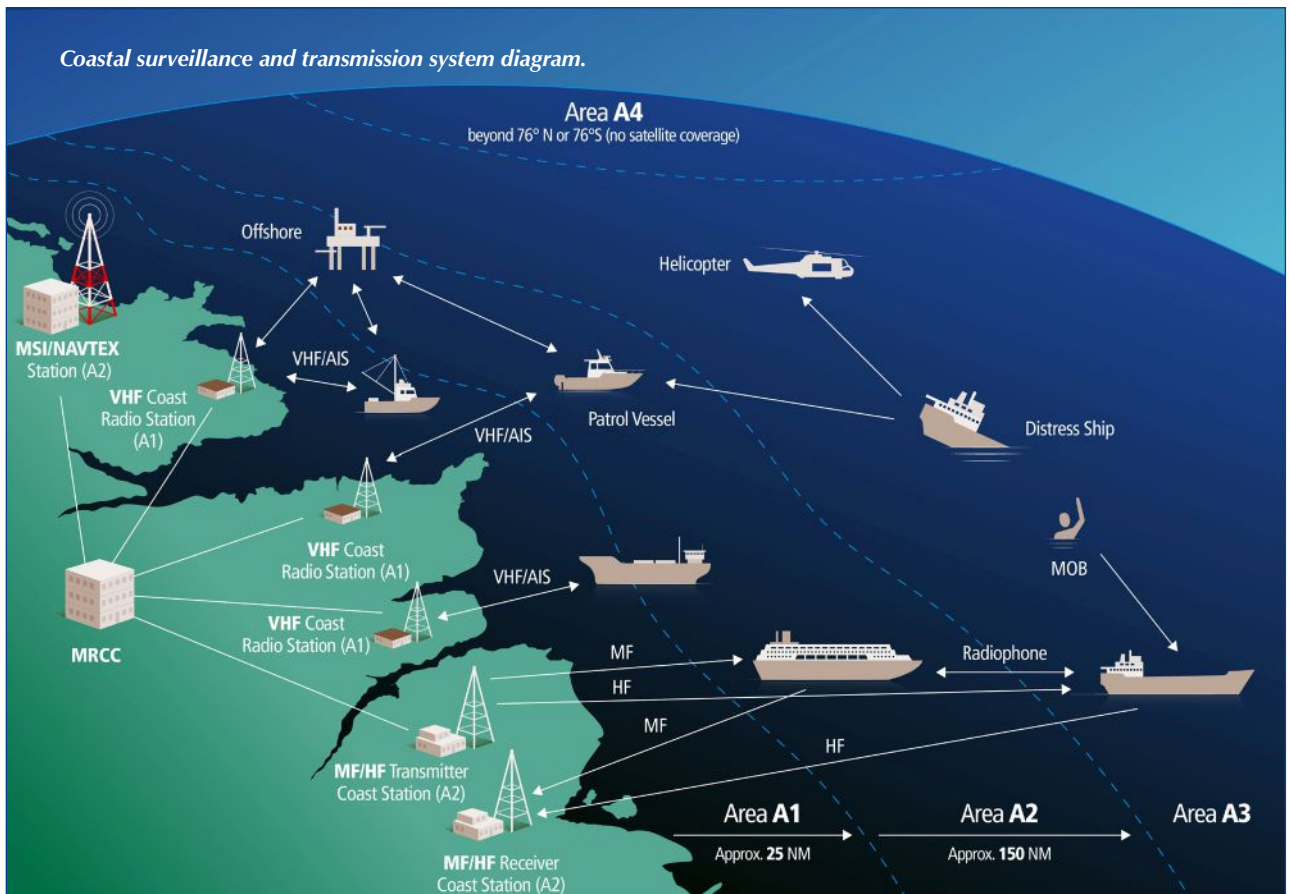
Evolving Tech Standard for International Communication Network

By Pierre Vergé

Managing coastal zones has become increasingly complex in recent years. Global maritime traffic has surged, demanding faster, more coordinated decision making from maritime authorities. Critical to this evolution is the rapid collection, transmission, and interpretation of data—and at the center of this challenge lies communication between people and systems.

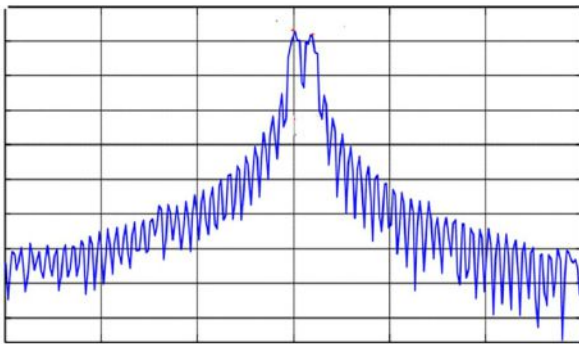
Communication as Operational Infrastructure

Modern maritime operations hinge on the speed and clarity of information exchange. Whether coordinating pilotage services, managing vessel traffic systems, or responding to emergencies, the quality of decisions often depends on how effectively voice, sensor, and alert data are transmitted and interpreted. This need has moved in-

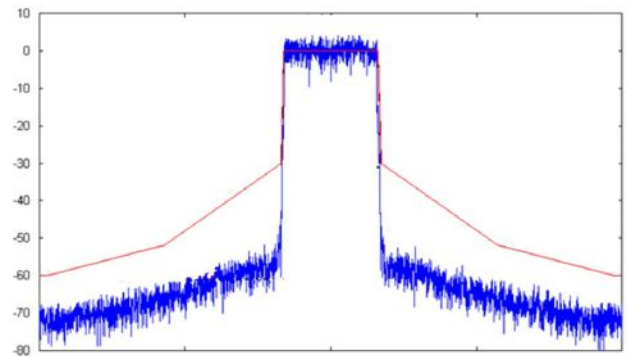


Typical Spectra: NAVTEX and NAVDAT

300 Hz NAVTEX



10 kHz NAVDAT



Existing NAVTEX infrastructure may be challenged to pass the higher bandwidth and peak power of NAVDAT, which can occupy as much as 10 kHz of bandwidth.

tegrated communication systems into the realm of critical infrastructure.

Traditionally, voice and digital selective calling systems have served as the backbone of coastal radio communication. Today, these systems must interconnect with radars, AIS, weather stations and evolving sensor arrays. Maritime operators now have the challenge of creating a cohesive, reliable environment where all inputs contribute to a shared operational picture.

Integration Over Isolation

A growing number of solution providers now specialize in systems designed specifically for these complex, integrated environments. One such firm, Kenta Technologies, focuses on radio communication systems tailored for coastal and maritime use, bringing VHF, MF/HF, and NAVTEX capabilities together with support for sensor integration and centralized control. While not a producer of radar or AIS hardware, Kenta uses these technologies to build systems that act as connective tissue across mission-critical environments.

From supporting distributed control rooms to facilitating long-range safety communications, companies such as Kenta are working to ensure that operational awareness is maintained, regardless of geography, topology or bandwidth.

Toward a Smarter Broadcast Future: NAVDAT

As communication standards evolve, maritime safety broadcasts are entering a new era. The NAVDAT standard—poised to complement or succeed NAVTEX—promises richer, more flexible data dissemination for coastal authorities.

Kenta Technologies, a designer and manufacturer of coastal maritime radios, has been actively involved in the development of the NAVDAT standard. The company's approach reflects a broader industry shift toward flexible, operationally aligned solutions.

Kenta is working on hybrid systems capable of broadcasting both NAVTEX and NAVDAT formats. The goal is not only to preserve compatibility for existing users but also to provide a pathway to more advanced messaging formats without requiring complete infrastructure overhauls.

Stakeholders across national administrations, port authorities, and research institutions may soon play an important role in validating and deploying these next-generation systems. Early collaboration could help accelerate real-world testing and set best practices for future deployments.

Designing for Real-World Operations

Industry experts agree that technology design must begin with operational needs, with the recognition that understanding decision cycles, user profiles and existing infrastructure is critical. Companies that prioritize consultative engagement early in the project life cycle tend to deliver solutions that are both technically sound and operationally transformative.

The most effective communication platforms are those that: align with existing vessel traffic and infrastructure monitoring systems; scale with increasing data inputs and evolving mission profiles; provide intuitive interfaces that reduce cognitive load for operators; and support compliance with international safety and GMDSS standards.

A Life Cycle Mindset

Beyond the equipment itself, long-term reliability often hinges on support and adaptability. The value of life cycle services—from system design and training to ongoing upgrades and maintenance—is especially evident in coastal zones, where conditions and regulations shift over time.

Providers such as Kenta are increasingly adopting full life cycle models, engaging with clients through initial



A Kenta installation for the Bulgarian GMDSS coastal radio service.

consultations, integration efforts, operational training, and future-proofing strategies. This approach acknowledges that maritime operations are dynamic and that communication systems must be adaptable, not just robust. In order to achieve the goals of current and future maritime operations, close collaboration is required.

Examples of collaboration include Kenta's partnership with GC Co. Ltd., which entered the GMDSS sector in Korea with the establishment of multiple shoreline sites in the country, and another NAVTEX project in Singapore. The Korean installation involved the design, manufacture, installation, and commissioning of five MHF transmission sites, five MHF/VHF reception sites, and two NAVTEX transmission sites. In Singapore, the Kenta replaced the Maritime and Port Authority's NAVTEX transmission system and is now providing system maintenance services.

"Kenta's willingness to transfer all necessary technical knowledge has been fundamental to our success," said GC Co. Ltd. Sales Department Manager Jae Bong Lee. This partnership "has served both Kenta and GC exceptionally well in the global GMDSS market."

As another example of collaboration, in Bulgaria, the Vessel Traffic Monitoring and Management System (VT-MIS) and GMDSS systems were put into operation over an 18-year span, with current systems in place for the past 12 years. Kenta transmitters are used for MF/HF and NAVTEX communications. Scortel Ltd., a representative and technical partner of Kenta, was recently awarded a maintenance contract on Kenta transmitters for the Bulgarian Ports Infrastructure Company.

"We have been working with Kenta for more than 10 years, providing implementation, commissioning and

maintenance of their MF/HF/NAVTEX transmitters for the Bulgarian GMDSS coastal radio service," said Ivaylo Simeonov, director of maritime and satellite systems for Scortel. "Kenta brings competent service, flexible technical solutions and maximum efficiency to its projects with us."

Navigating Complexity with Confidence

As coastal zones become more congested and more technologically complex, the importance of integrated communication will only grow. Future systems are likely to include: smarter automation of alerts and coordination messages; cloud-based management and monitoring tools; interoperability across national and regional authorities; and secure, distributed architectures for continuity in crisis situations.

The maritime community—engineers, regulators, operators, and technology providers alike—must continue working together to ensure that communication systems are as agile and reliable as the operations they support. Real progress will come not just from innovation but from understanding: listening first, designing with intent, and deploying with long-term needs in mind. **ST**

Pierre Vergé is the general manager of Kenta Technologies, a Nautel company (nautelnav.com). He directs product strategy, business development and the design of radio communication solutions for the maritime sector. He has an extensive background in manufacturing engineering and product management and has been leading operations at Kenta since 2023.



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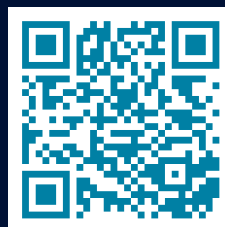
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Offshore Cable Management

Modular Energy Chain System Offers Alternative to Service Loops

By Tim Schneebeck



Operating in some of Earth's most unforgiving environments, offshore oil and gas operations represent the front line of maritime resource development, where equipment reliability isn't just preferred; it's critical. If a single component fails, the consequences can quickly spiral, halting production, driving up costs, and putting both workers and the environment at risk.

One important yet often overlooked component is cable management for the top drive systems, which provide the torque that drives the drill string into the seabed. Until recently, service loops have been the go-to, yet imperfect solution for cable routing in these systems, prone to snagging on equipment in windy conditions, as well as strain-related damage.

The igus e-loop technology is a compelling alternative to traditional service loops.

Their design also creates a vulnerability. These assemblies, which comprise cables and hoses bundled within a large outer hose, are secured by potting with epoxy at both ends. If an individual cable fails or catches on equipment, the entire service loop assembly must be replaced, driving costly downtime and maintenance efforts.

The igus e-loop technology represents a game-changing response to these challenges. This modular energy chain system reimagines cable management for sus-



igus e-loop technology successfully addressed the service loop issues once installed on Seadrill's West Polaris drillship.

pending applications in harsh environments, including the top drive systems in many offshore drill rigs. For operators pursuing sustainable and efficient ocean resource development, this technology transforms a chronic point of failure into a source of operational confidence.

e-loop

Addressing the limitations of service loops, the igus e-loop is a modular energy chain system that combines the flexibility of a polymer energy chain with the strength of a high-performance composite rope. This rope, which is 15 times stronger than steel, lies at the core of the e-loop design. It absorbs the tensile forces exerted on the cables, relieving them from strain and significantly extending their service life. The rope is also made of a synthetic plastic fiber, creating a shatter-proof, weather-resistant, flexible and corrosion-free solution.

The e-loop incorporates chain links made from high-performance plastic that are designed to be replaceable at any time, including during operation. This feature ensures the system can be easily maintained and adapted to changing requirements without the need for a complete overhaul. In addition, durable polyurethane foam bumpers, located on the outside of the e-loop, absorb impacts and further protect the system from damage caused by swinging or bumping into equipment. Like the other components in the system, these bumpers are replaceable, ensuring any damage can be quickly repaired without much downtime.

Thanks to this innovative design, the e-loop offers offshore operators many benefits. The e-loop's modular construction and defined bend radius enhance operational reliability by reducing cable fatigue and minimizing maintenance requirements. These features improve system durability and reduce unexpected downtime.

The system's robust design protects cables from impacts and vibrations, and its weather-resistant materials ensure reliable performance in extreme conditions. Its ability to reduce maintenance downtime and life cycle costs further supports sustainable practices by minimizing resource consumption and environmental impact.

The e-loop offers significant cost savings by reducing maintenance needs and extending service life. Its modular design allows for easy integration into existing systems, enabling seamless upgrades and minimizing installation time. These features contribute to overall cost efficiency, making the e-loop an attractive solution for industries operating in ocean and coastal environments.

Seadrill's West Polaris Drillship

In a recent offshore use case, Seadrill, a major offshore drilling company, was faced with the challenges of the traditional service loops installed on its top drive systems. These loops were prone to snagging and strain-related damage, leading to costly replacements of entire assemblies.

The e-loop technology successfully addressed these issues once installed on Seadrill's *West Polaris* drillship.



The e-loop combines multiple power, signal, and hydraulic loops into a single loop design that reduces the overall footprint and extends the system's durability.

From system design to on-site installation, igus provided Seadrill with support throughout the implementation process on the ship and delivered the e-loop as a ready-to-install solution.

Consisting of igus chainflex flexible cables, the system combined multiple power, signal and hydraulic loops into a single loop design that not only reduced the overall footprint, but also extended the system's durability. Compared to standard industrial cables used in traditional service loops, chainflex cables are designed for continuous flexing and harsh environments, offering resistance to abrasion, oil, chemicals, and temperature extremes.

With less cable failures and maintenance, Seadrill has seen substantial cost savings. The system proved so successful that Seadrill installed it on a second vessel, the *West Capella*.

Pertamina Drilling Services, Indonesia

The top drive system from the Indonesian company Pertamina Drilling Services, delivers critical clockwise torque to drill strings on oil rigs. This equipment is much larger than a typical hand drill and essential to operations—any downtime is unacceptable. Between 2022 and 2023, service loop failures prevented top drive operation, causing losses of several hundreds of millions of dollars.

In response, Pertamina modernized its cable management system by implementing the e-loop systems with chainflex cables. The results have been transformative: not only does the system operate with significantly greater reliability, technicians also report increased confidence in the solution. Installation and maintenance have become more efficient, with cable installation time reduced from 12 to just 6 hr.—cutting maintenance downtime by 50 percent.

Akita Drilling in Canada

Akita Drilling, a Canadian company operating about 20 drilling rigs, implemented the e-loop to solve its cable management challenges. Operating in Saskatchewan's harsh weather conditions, the company needed a robust solution to safely supply energy and signals to the top drive mechanism that moves drill pipes up and down.

The modular e-loop system replaced the previous service loop with a design featuring an internal tension cable that protects all power and signal cables from the forces encountered during operation. Its weather-resistant construction absorbs vibrations and



The e-loop provides a robust cable management solution for Akita's top drive mechanism, which operates in Saskatchewan's harsh weather conditions.

impacts—even successfully withstanding severe snow-storm testing without issues.

Other Applications

In addition to the offshore oil and gas sector, the e-loop system offers reliability, flexibility and versatility across multiple industries where robust cable management is essential.

In the wind energy sector, the e-loop addresses challenges such as cable fatigue due to undefined bend radii and vulnerability to extreme weather conditions. By providing a defined bend radius and weather-resistant materials, it improves system durability and reduces maintenance downtime, enhancing operational efficiency.

In shore power supply, to ensure reliable energy transmission in coastal areas, the e-loop's modular design supports individual component replacement without dismantling the entire system. This feature is particularly beneficial for coastal zone management efforts, where minimizing environmental impact and operational disruptions is crucial.

In coastal construction projects, the e-loop provides a reliable cable management solution for heavy machinery.

Its robust outer protection against impacts and vibrations ensures operational safety and reliability, even in harsh coastal environments. One use case involves the bucket wheel excavators used by Holcim for cement production. This implementation has enhanced the machines' reliability by safely guiding cables with large cross-sections and heavy weights, preventing tangling and reducing maintenance.

Conclusion

The igus e-loop technology represents an advancement in cable management systems, offering significant benefits for maritime operations. Its robust design, enhanced operational reliability and cost efficiency make it an ideal solution for industries operating in challenging environments where component failure is not an option.

You can learn more at: www.igus.com. **ST**

Tim Schneebeck is the industry manager for offshore oil and gas at igus.

Regenerative Aquaculture

Co-Locating Sugar Kelp and Blue Mussel Farms for Sustainable Growth

By Dr. Nora von Xylander

The cultivation of sugar kelp (*S. latissima*) and blue mussel (*M. edulis*) species is rapidly expanding worldwide, largely driven by alignment with several United Nations Sustainable Development Goals and the European Union's Water Framework Directive aiming for "good ecological status" in all coastal waters. This is a promising approach contributing to the U.K.'s sustainable marine ecosystem management. Unlike traditional agricultural practices, kelp and mussel ocean farming does not compete for arable land, requires no freshwater resources, and contributes to the active removal of excess nutrients from marine ecosystems. By integrating these two native species into regenerative aquaculture systems, Algalpelago's Blue Forest project in the U.K. aims to address key ecological challenges, including nutrient cycling, eutrophication mitigation, carbon extraction and marine habitat restoration.

Algalpelago's initiative will address the pressing need for sustainable, large-scale aquaculture systems that restore marine ecosystems by deploying an advanced modular cultivation system at Algalpelago's licensed site off the coast of North Devon this year. This 5 hectares (ha) pilot system, uniquely engineered by Arctic Seaweed for high energy conditions and offshore scalability, incorporates automated seeding and harvesting technologies, with the capacity to produce up to 40 tonnes of fresh sugar kelp annually. The licensed site offers the potential to scale up operations to 116 ha.

Beyond its ecological objectives, the Blue Forest project also evaluates the natural capital value of regenerative ocean farming, offering vital insights into its long-term potential for fostering resilient marine ecosystems and supporting a sustainable blue economy.

Nutrient and Carbon Extraction by Sugar Kelp

In Europe, sugar kelp is the most extensively cultivated kelp species, with numerous research and devel-

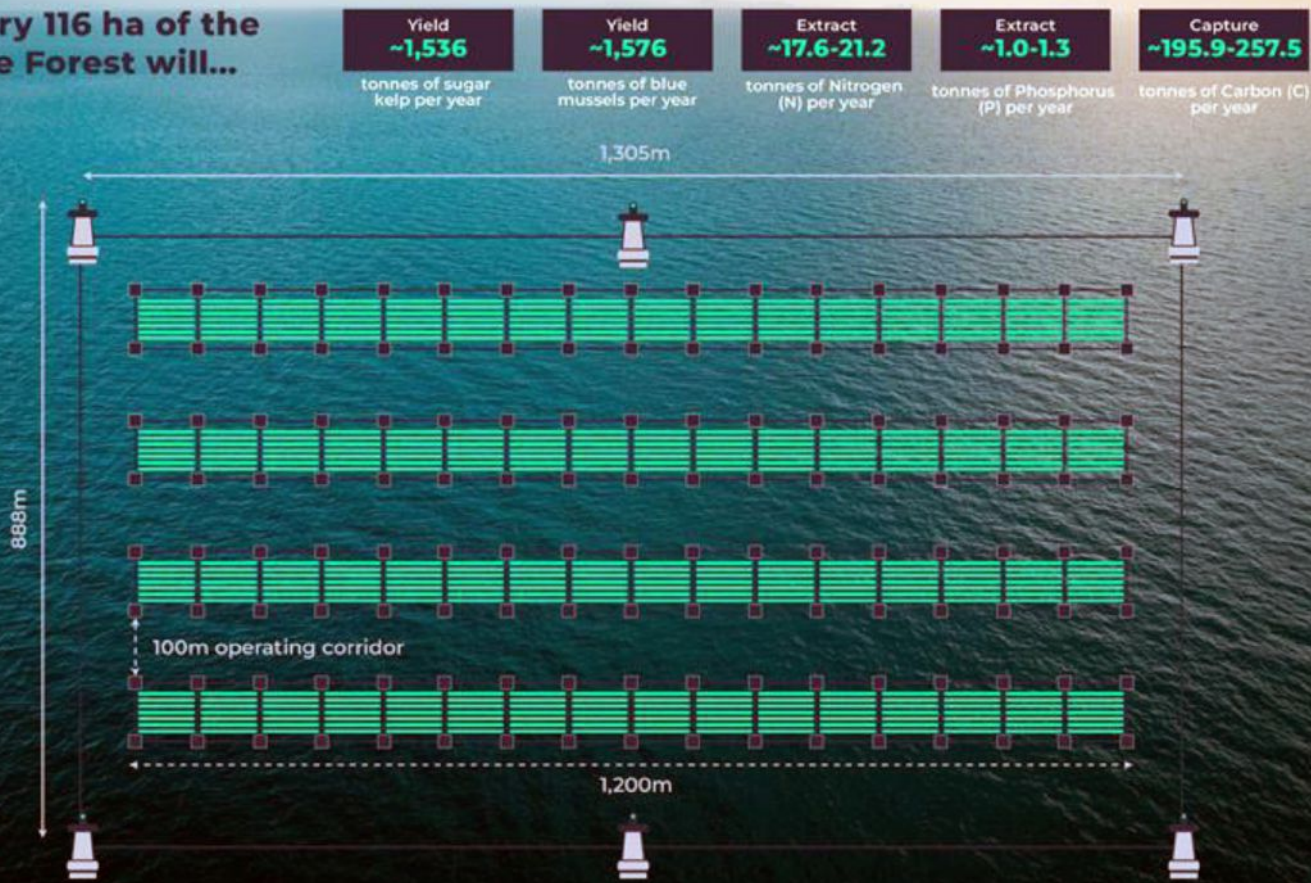
opment initiatives focused on scaling up its production. This species, having seasonal growth patterns, has shown remarkable potential for nutrient mitigation, effectively assimilating nitrogen (N), phosphorus (P) and carbon dioxide (CO₂) directly from seawater during its growth cycle. Elevated nutrient concentrations, particularly nitrate (N) and phosphate (P), are primary contributors to eutrophication in coastal waters, causing detrimental ecological, economical, and societal impacts.

By acting as a nutrient sink, *S. latissima* offers a natural solution to these challenges. Studies report nutrient extraction rates ranging from approximately 50 to 100 kg N and approximately 0.2 to 6 kg P per hectare (ha⁻¹) per year (yr⁻¹), respectively. For carbon extraction, *S. latissima* cultivation has demonstrated removal potentials of 2.4 t CO₂ ha⁻¹ yr⁻¹, with optimized cultivation methods yielding up to 5.0 t C ha⁻¹ yr⁻¹. Innovations in cultivation infrastructure, such as high-density line systems and multi-layered designs, have proven effective in increasing yields and nutrient extraction capacity. The optimization of net cultivation systems can achieve yields of 91.3 tonnes (t) fresh weight ha⁻¹ yr⁻¹, extracting 110 kg N ha⁻¹ and 13 kg P ha⁻¹ per year. The integration of sugar kelp farming in nutrient-rich environments, i.e., where there is increased dissolved inorganic nitrogen, has been previously shown to significantly enhance biomass production and nutrient bio-extraction. Large-scale cultivation in these conditions can yield between 220 to 340 t wet weight (WW) ha⁻¹ per growing season, corresponding to nitrogen removal rates of approximately 1.2 t N ha⁻¹ yr⁻¹.

Blue Mussels: Nutrient Cycling, Water Quality

The blue mussel, another integral species in the Blue Forest project, contributes to nutrient and carbon cycling through its filter-feeding and shell production capabilities. Mussels remove particulate organic matter, including phytoplankton and detritus, from the water column,

Every 116 ha of the Blue Forest will...



An overview of Algapelago's Blue Forest project.

thereby reducing nutrient levels and improving water clarity, promoting benthic primary production and overall ecosystem resilience. Studies have shown that mussel cultivation can significantly contribute to nutrient removal, with estimates indicating the extraction of approximately 700 kg N ha⁻¹ yr⁻¹ and 6,600 kg C ha⁻¹ yr⁻¹ under optimal conditions. Further research has demonstrated that mussel farming can achieve a high area-specific biomass of 60 t WW ha⁻¹ yr⁻¹, corresponding to nitrogen and phosphate removal of approximately 600 to 900 kg N ha⁻¹ and 30 to 40 kg P ha⁻¹ per full one-year production cycle. Additionally, long-line mussel farming has been proposed as a cost-effective mitigation tool, with nutrient removal costs lower than many land-based measures.

However, mussel farming can also negatively influence local nutrient cycling through the sedimentation of bio-deposits and the regeneration of nutrients back into the water column. Mussels produce feces and other waste, which, upon decomposition, release nutrients back into the local marine environment. Previous research found that within three weeks of deposition, up to 13.1 percent of available nitrogen in the form of dissolved inorganic nitrogen and up to 8.7 percent of available phosphate can be regenerated back into the water column.

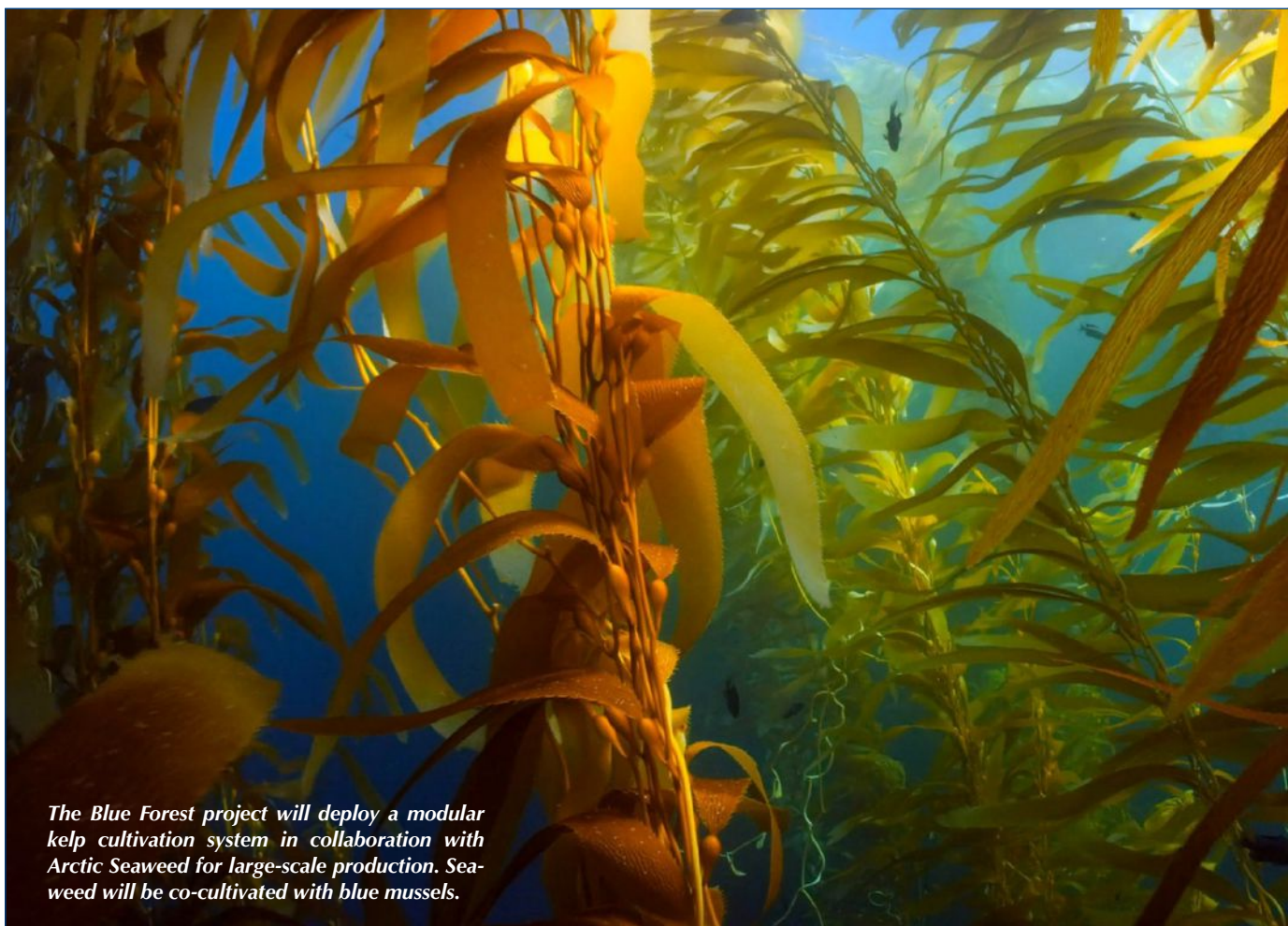
To maximize the nutrient removal benefits of mussel

farming while minimizing potential nutrient regeneration, studies suggest harvesting within the first year of the production cycle, before bio-deposit accumulation leads to hypoxic conditions and the initial net sink of nitrogen becomes a net source. Although mussel farming can help mitigate eutrophication and improve coastal water quality while generating food, more research is needed to assess the environmental impact of mussel farming, particularly looking at the prevention of nutrient regeneration and waste (i.e., empty shells and sludge) management.

Increasing awareness of the potential of synergistic cultivation approaches and conducting environmental life cycle assessments of regenerative aquaculture will provide valuable insights for the improvement of sustainable aquaculture practices.

Synergies

The co-cultivation of sugar kelp and blue mussels in integrated aquaculture systems presents a highly promising strategy for enhancing nutrient mitigation in marine ecosystems. As extractive species, mussels and kelp contribute to nutrient cycling in complementary ways. Mussels filter feed on suspended organic matter from the water column, while kelp absorbs dissolved inorganic nutrients, such as nitrogen and phosphate, directly from seawater. This coupled interaction helps mitigate the re-



The Blue Forest project will deploy a modular kelp cultivation system in collaboration with Arctic Seaweed for large-scale production. Seaweed will be co-cultivated with blue mussels.

generation of nutrients from mussel feces into the water column, thus maximizing nutrient uptake efficiency and overall productivity.

The integration of *M. edulis* with *S. latissima* in aquaculture systems offers multiple ecological benefits beyond nutrient removal. Mussel filtration enhances water clarity, reducing competition for dissolved nutrients and optimizing conditions for kelp growth by improving light penetration. Meanwhile, kelp canopies provide structural habitat, enhancing biodiversity and supporting the settlement of mussel larvae. Beyond nutrient mitigation and biodiversity enhancement, the co-cultivation of these two native species has potential applications for carbon sequestration and climate change mitigation. Both sugar kelp and blue mussel production present an opportunity to contribute to “blue carbon” sequestration by directly absorbing CO₂ from seawater for photosynthesis and shell formation, respectively.

Site selection plays a critical role in the success of integrated cultivation. Research suggests that mussels perform better in sheltered, nutrient-rich inner coastal areas, whereas kelp thrives in more exposed outer coastal waters with high dissolved nutrient concentrations, less resuspended particulate organic matter, and sufficient light penetration. Understanding these environmental requirements is essential for optimizing co-cultivation strategies and ensuring maximum nutrient mitigation

efficiency while maximizing ecological and economic benefits.

Full Site Deployment Potential

Bideford Bay, situated on the north coast of Devon, hosts a diverse array of marine life, including fish, invertebrates, migratory birds and salt marsh habitats. This location has been selected as Algalpelago’s farm site to deploy a modular integrated kelp and mussel cultivation system over a total area of 116 ha.

Nutrient sources for the bay enter primarily from the Taw and Torridge Rivers, which transport a mix of agricultural runoff and urban sewage. Algalpelago’s Blue Forest Project will assess the nutrient cycling, carbon extracting, and ecological and economic potential of co-cultivating *S. latissima* and *M. edulis* at large scale.

The current kelp cultivation system setup at Bideford Bay comprises 4-by-200-m long-lines at approximately 2-m cultivation depth, seeded using twine, with a total seed line length of 0.8 km. This setup yields approximately 6 tonnes of sugar kelp at a density of 8 kg/m.

To enhance scalability and efficiency, the Blue Forest project will deploy a modular kelp cultivation system in collaboration with Arctic Seaweed (AS), whose offshore-engineered cultivation system is designed for large-scale production. The AS system features automation for rapid seeding and harvesting, a high-density



seeding approach, and adjustable cultivation depths. It currently comprises 10 seeding modules, utilizing direct seeding, with a total seed line length of 4 km and an expected yield of 20 tonnes at 5 kg/m density. As the Blue Forest project evolves, the goal is to integrate mussel cultivation onto the AS rig. The mussel cultivation system will employ a dropper-based setup, comprising 2-by-100-m long-lines, with droppers spaced at 1-m intervals and extending 10 m in length. With a total seeded dropper length of 2 km, the system will rely on natural settlement and operate at 3- to 13-m depths, targeting a predicted yield of 20 tonnes at a density of 10 kg/m.

At full production potential, the integrated cultivation rig covering 116 ha will comprise 256 km of sugar kelp seed lines yielding 6 kg/m and a total of 197 km of mussel droppers yielding 8 kg/m. This large-scale production system is projected to yield 1,536 tonnes of sugar kelp and 1,576 tonnes of blue mussels per year.

Based on scientific literature values for optimized large-scale cultivation systems, 1 t of sugar

kelp is estimated to extract approximately 1.2 to 3.5 kg N, 0.14 kg P and 15.0 to 54.8 kg C per year. This results in a total nutrient and carbon extraction potential of approximately 1,851 to 5,421 kg N; 219 kg P; and 22,588 to 84,118 kg C per year for 1,536 t of sugar kelp.

Meanwhile, 1 t of blue mussels is expected to extract approximately 10 to 15 kg N, 0.5 to 0.7 kg P, and 110 kg C per year. This will yield a total nutrient and carbon extraction potential of approximately 15,760 to 23,640 kg N; 788 to 1,051 kg P; and 173,360 kg C per year for 1,576 t of blue mussel cultivation.

In total, Algalpelago's Blue Forest integrated cultivation system is estimated to produce 3,112 tonnes of sugar kelp and blue mussel biomass and extract approximately 17.6 to 21.2 t N, 1.0 to 1.3 t P, and 195.9 to 257.5 t C per year for the full farm layout.

Ecosystem Services

Valuation of ecosystem services is being increasingly used as a financial tool to support aquaculture practices and sustainable marine management. The Economics of Ecosystems and Biodiversity initiative has been instrumental in quantifying the economic benefits of ecosystem services, estimating the total value of coastal and marine ecosystem services at \$50 trillion per year.

A cost-benefit analysis of *S. latissima* cultivation also revealed promising potential for profitability, demon-

strating a positive net present value of approximately €446,000 per hectare over a 10-year period.

Proper accounting of ecosystem services provided by regenerative aquaculture, such as those delivered by the Blue Forest Project, incentivizes greater investment in regenerative aquaculture through blue financing, carbon credit schemes and marine biodiversity-linked funding mechanisms.

Conclusion

As Algalpelago prepares to deploy its modular cultivation system, it will test the scalability and ecological impacts of co-cultivating *S. latissima* and *M. edulis*. By demonstrating the nutrient mitigation potential and broader ecological benefits of this integrated approach, the project will position regenerative aquaculture as a cornerstone of sustainable marine resource management and a critical tool for combating climate change.

Overall, this integrated scalable and environmentally conscious approach will not only remove excess nutrients from coastal waters but also provide opportunities for food and biomass production while enhancing marine biodiversity and ecosystem resilience. The Blue Forest project also provides significant potential for natural capital value, enhancing ecosystem services that support biodiversity, water quality and climate regulation. By integrating economic viability with ecological benefits, this project exemplifies how regenerative aquaculture can serve as a scalable and sustainable solution to environmental challenges, providing both tangible financial returns and invaluable natural capital gains. By recognizing and quantifying these benefits, Algalpelago's Blue Forest project advances sustainable aquaculture practices while aligning with global conservation and climate goals.

Acknowledgments

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Q&A: Seaweed Farming for Minerals

Blue Evolution CEO Beau Perry on New Critical Mineral Extraction

Blue Evolution has launched Orca Minerals, the first U.S.-based platform to mine critical minerals using a method not based on traditional mining. Instead of blasting rock or disturbing the seabed, Orca uses cultivated seaweed and sunlight to harvest rare earth elements and critical minerals directly from seawater. This is photosynthetic mineral sourcing: a regenerative, decentralized alternative to typical extraction.

As the U.S. government scrambles to reduce its reliance on Chinese rare earth refining, Orca represents a new kind of industrial infrastructure: one that grows, regenerates and absorbs CO₂ rather than emitting it. The platform builds on a decade of seaweed cultivation and bioprocessing already in operation across Alaska and Mexico. It is backed by the U.S. Advanced Research Projects Agency–Energy (ARPA-E) and supported by Pacific Northwest National Laboratory (PNNL), UC Davis, and Virginia Tech.

Blue Evolution's CEO, Beau Perry, discussed the new platform with *Sea Technology*.

Why does the U.S. need photosynthetic alternatives to secure mineral independence?

Because our current approach to mineral supply is hitting structural limits—geologically, ecologically, economically and politically. Even with domestic permitting reform, traditional mining faces a time-to-production horizon of seven to 15 years, and often involves significant environmental and social opposition.

The seaweed-based approach can reach meaningful scale in three to five years. That timeline reflects the initial maturation of the Orca platform, including new supply chains and extraction technology—but it's a one-time startup horizon.

Beyond that, each new site scales much faster, with lower permitting friction and capital intensity. We're building a system where critical minerals can be pro-

duced alongside other high-value seaweed co-products—faster, cleaner and closer to home.

Consider that over 70 percent of global refining capacity for key minerals is concentrated in a handful of geopolitical jurisdictions—think of Chinese monopolis-



Credit: Blue Evolution



Credit: Blue Evolution



tic strategy. Photosynthetic mineral recovery, specifically through macroalgae, offers a decentralized, renewable and biologically governed alternative.

Seaweed grows exponentially, requires no freshwater, fertilizers, or arable land, and can be deployed within U.S. coastal jurisdictions with lower permitting friction than terrestrial extractive projects. The U.S. Exclusive Economic Zone spans more than 4.3 million square miles—and remains largely underutilized for strategic biomaterial production.

Orca's approach enables mineral production with no tailings, no blasting and no water contamination, aligning with national environmental goals while reducing reliance on politically constrained supply chains.

What scientific discovery triggered the launch of Orca?

First, lab and fieldwork with Pacific Northwest National Laboratory confirmed that select seaweed strains, based on samples taken from our network of farming partners in Alaska circa 2018 to 2020, can bioaccumulate specific critical minerals—lithium, cobalt, magnesium—from seawater at concentrations above background levels, particularly in high-nutrient coastal zones and upwelling regions. The uptake appeared both element-specific and environmentally 'tunable'—a key criterion for viable sourcing.

Second, process modeling and systems engineer-



Credit: Blue Evolution

ing work that have followed showed that this biological accumulation could be mapped to scalable, modular infrastructure—enabling tunable mineral recovery at the deployment level based on seawater chemistry and downstream market needs.

Combined, this made clear we were no longer in the realm of ecological curiosity or basic research. We had the basis for a new, infrastructure-light mineral supply model—one that uses biology to do the front-end separation traditionally done by mechanical or chemical processes.

This unlocks new economic pathways for distributed, lower-cost sourcing—especially in regulatory environments where industrial development faces increasing friction.



Credit: Blue Evolution

Your company emphasizes partnerships with indigenous communities and climate agencies. How did you build these into the business model?

They're codified through two mechanisms: place-based operating models and integrated MRV [measurement, reporting, verification] frameworks.

Our farming systems are co-developed with indigenous and coastal partners, not just for access or inclusion but because site governance and ecological alignment are central to regenerative operations, which are designed to last and be highly resilient in nature. We use a distributed infrastructure model—local deployment, local labor, local co-benefits—which avoids the centralized accumulation model of conventional extraction.

On the agency side, we've built our impact quantification in alignment with emerging MRV standards for blue carbon, nitrogen removal and biodiversity uplift. This allows us to plug into evolving carbon and ecosystem service markets, and positions Orca within regulatory frameworks, such as the Section 45Q federal tax credit for carbon removal, EPA nutrient trading programs, and NOAA coastal resilience initiatives.

By linking our performance to auditable environmental outcomes, we de-risk public and institutional partnerships and open up access to non-dilutive capital pools that will be critical for scaling.

What is your roadmap to economic viability?

It's built on multi-revenue product stacking, modu-

“Orca’s approach enables mineral production with no tailings, no blasting and no water contamination, aligning with national environmental goals while reducing reliance on politically constrained supply chains.”

lar deployment, and regulatory asymmetry. The primary element of Blue Evolution’s biorefinery revenue stack is extraction of high-value compounds for human and veterinary health, green industrial biochemicals, plant biostimulants, and critical mineral recovery.

Secondary is biomass for fertilizer, feed, biopolymers and bioenergy.

Tertiary is environmental performance monetized via carbon markets and nutrient credit systems, et cetera.

The cost advantages are: no land acquisition or deep extraction, minimal permitting delays, OPEX linked to biological cycles and regional climate—not industrial throughput, and CAPEX efficiency through modular infrastructure and existing marine assets, such as shared offshore platforms.

In terms of regulatory arbitrage, Orca sidesteps most of the high-cost, high-friction permitting pathways that terrestrial mining requires. Our operations fall under marine

aquaculture and coastal development frameworks, which are generally faster to permit, less contested, and increasingly supported by federal blue economy priorities.

In terms of MRV-enforced validation, because we measure carbon uptake, water quality impact, and ecosystem performance in real time, we can tokenize, credit, or directly contract those benefits to government buyers, insurers, or climate finance institutions. That’s economic resilience beyond commodity pricing.

We don’t rely on one mineral or one buyer. Our model is pro-resilience and built to adapt and scale with shifting policy, climate, and market conditions. **ST**

Learn more at: <https://blueevolution.com/blog/blue-evolution-launches-orca-minerals-first-u-s-platform-for-regenerative-biomining-of-critical-minerals>.

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Retrofit for Helsinki Ferry

The passenger ferry MS *Suomenlinna II* has become the first ship to be retrofitted with ABB's new-generation ACS880LC drive. This drive technology will significantly enhance vessel efficiency and help to secure smooth and reliable operations for many years to come.

Built in 2004, the 329-gross-ton vessel was equipped with an ACS600 drive system, which had become obsolete, but the existing cabinets, busbars and cables were suitable for repurposing. Instead of replacing the full system, ABB delivered a module-based retrofit, with minimal impact on the ferry's operating schedule.

An integral part of the Helsinki public transport system, the 395-passenger-capacity ferry makes multiple daily crossings between the city and the Suomenlinna sea fortress, a UNESCO World Heritage Site.

International Collaboration for Ports

The International Harbour Masters Association and UN Trade and Development (UNCTAD) TrainForTrade Programme have signed a memorandum of understanding to formalize their collaboration in advancing capacity building and knowledge sharing for port communities worldwide.

The partnership will: facilitate the exchange of expertise and best practices in port management and operations; support capacity building initiatives under the TrainForTrade Port Management Programme; promote joint activities including workshops, seminars, and digital training simulations; and collaborate on the development of training packages and content to address emerging challenges in the maritime and port sectors.

Report Finds Older Ships More Prone to Incidents

According to DNV's latest report, "Maritime Safety Trends 2014-2024 - Preparing for future risks," the number of maritime casualty incidents has increased by 42 percent between 2018 and 2024, during which the global fleet grew by just 10 percent. The findings highlight the risks connected with operating older ships, often more prone to faults, groundings and fire-related incidents.

The data set, provided by Lloyd's List Intelligence, had more than 2,200 recorded casualty incidents per year since 2021. Machinery damage/failure was responsible for the highest number of casualty incidents in all years, climbing to 60 percent of all cases in 2024, up from 38 percent a decade ago. The data show a clear correlation between vessel age and operational reliability, with incidents involving vessels more than 25 years old accounting for 41 percent of all reported cases, up from 32 percent in 2014. Across all age groups machinery damage/failure incidents grew by 20 percent in 2024.

The Role of Indirect Decarbonization Efforts

The Zero Emission Maritime Buyers Alliance (ZEMBA) and Katalist have convened a group of 13 first-mover

organizations across the maritime sector, including A.P. Møller – Mærsk A/S, Liquid Wind, NORDEN, Patagonia, Swire Shipping Pte. Ltd., Swire Bulk Pte. Ltd., Tchibo, and Unifeeder A/S, for the first time to share joint perspectives on the Science Based Targets initiative's (SBTi) Corporate Net Zero Standard 2.0.

Currently undergoing major revision, SBTi's globally recognized Standard aims to provide companies with requirements, guidance, and best practices toward setting and achieving emissions reductions and net-zero targets.

The maritime transport sector—considered one of the world's hardest-to-abate industries—is at the forefront of heavy industry decarbonization. Through participation in SBTi's public consultation process and an open letter that has been published, these organizations' comments highlighted the importance of indirect mitigation efforts for the maritime sector's clean energy transition.

Particularly in the early years of the sectors' clean energy transition, direct emission mitigation efforts face challenges of transparency and assurability. Often indirect mitigation efforts, such as book-and-claim solutions, can unlock increased demand and channel investment toward creating the markets for the most advanced, scalable fuels and technologies within the sector, as companies are not constrained by only investing in the offerings of their carriers.

Maritime Risk Management Hub

The maritime risk specialist Ambrey has launched the Global Operations Centre (GOC) in the U.K., a state-of-the-art facility set to redefine the future of maritime risk operations on a global scale.

The GOC brings together cutting-edge analytics, digital innovation, and the expertise of seasoned master mariners to deliver a comprehensive suite of services to prepare, support, and respond to crews and vessels navigating the world's most complex maritime environments.

Carbon Insetting Matchmaker

Carboninsets, a new independent matchmaker service for verified Environmental Attribute Certificates (EACs), has launched to support companies in reducing their Scope 3 emissions throughout their supply chains. Carboninsets unites cargo owners and freight forwarders with stakeholders from across all transportation modalities, regions, and technologies, following globally accepted standards.

With supply chain emissions accounting for more than 80 percent of most companies' carbon footprints and traditional carbon offsets recognized as an increasingly inefficient means of reducing supply chain emissions, Carboninsets arrives at a critical juncture in the pursuit of net-zero global emissions. It offers freight forwarders and cargo owners access to a large inventory of existing EACs and the ability to invest in tailored low-carbon transport projects, at any volume.

Ocean Workers on the Frontline of Climate

Lloyd's Register Foundation, a global safety charity, has called for ocean workers to be recognized as a

frontline group when it comes to the impacts of climate change. According to the foundation's latest World Risk Poll Focus On report, "Risk perceptions and experiences of ocean workers," powered by Gallup, which surveyed 147,000 people across 142 countries: 80 percent of ocean workers say they are worried about being seriously harmed by severe weather; 33 percent of ocean workers reported having personally experienced serious harm from severe weather in the last two years; 25 percent of ocean workers reported experiencing harm from their work in the past two years; and 68 percent of ocean workers said they have never received occupational safety and health training.

OceanQuest Joins Seabed 2030

The Nippon Foundation-GEBCO Seabed 2030 Project and OceanQuest have signed a memorandum of understanding at the 2025 UN Ocean Conference in Nice, France.

This follows OceanQuest's recent Around Africa Expedition, delivered in collaboration with OceanX. In just four months, the mission mapped 120,036 km² of seafloor, gathering vital data on deep-sea ecosystems and contributing to Seabed 2030's mission to map the global seafloor.

ROVs for Ukraine

Sixteen Deep Trekker REVOLUTION ROVs (*Sea Technology*, March 2025) have been delivered to the State Emergency Service of Ukraine (SESU) under a United Nations Development Programme (UNDP) initiative, funded by South Korea, France and New Zealand. The systems will be used by trained SESU teams for operations in water bodies contaminated with explosive remnants of war across Ukraine to support critical underwater explosive ordnance disposal operations.

The ROV deployment is part of a larger UNDP-led mine action program in Ukraine. Roughly 13,500 km² of inland water must be assessed for explosive hazards.

Marine Electronics Venture

Great Circle Group has launched as a new venture uniting Electronics Unlimited and Navtronics with the technology entrepreneurs Damon Tassone and Michael Wexler to establish a marine technology national sales and service brand.

The formation of Great Circle Group addresses growing demand for sophisticated, reliable marine technology services through three key differentiators: technology enablement across all business operations; a focus on creating the industry's most attractive environment for technical talent; and the scale to provide consistent, high-quality service across multiple regions.

Hydrospace Acquisition

Hydrospace Group Inc. has acquired CalAquaria, which will become a division of Hydrospace. Hydrospace Group offers pressure vessels for human occupancy and electric drive systems. CalAquaria's services translate from its expertise in acrylic aquariums. **ST**

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Route Planner



Axiom chartplotters now offer real-time route synchronization through integration with the Orca navigation app. When users identify their starting point and destination, Orca's advanced navigational algorithms will find the best route specifically for their vessel. To take advantage of this new feature, Axiom owners should update their units to the latest LightHouse 4 software download. Raymarine.

Emissions Management

The BV-confirmed Blue Visby Solution is a multilateral platform that aims to cut emissions from shipping by around 15 percent through coordinated, sector-wide behavioral change. Participating vessels receive optimized arrival times calculated by an algorithm. This approach offers systemic optimization of the ocean passage, contractual refinements and a methodology for sharing the financial consequences. Blue Visby Consortium.

AI Surveillance

Advanced AI and machine learning algorithms transform a CCTV video system into a proactive observation surveillance solution with real-time insights, intelligent video analytics, predictive environmental intelligence and dynamic perimeter awareness. SIDUS Solutions.

Ammonia-Fuel Engine

This four-stroke, engine-based solution for ammonia fuel now delivers higher than ever levels of efficiency and performance, based on the FuelEU Maritime reference and mea-

sured on both a well-to-wake and tank-to-wake basis. A 95% ammonia energy share now achieves up to a 90 percent reduction in greenhouse gas emissions compared to equivalent diesel engines. This represents a further 18 percent improvement on the solution's emissions performance. Wärtsilä Marine.

Firefighting Foam



Alcohol-resistant, fluorine-free firefighting foam concentrates offer a safe transition away from PFAS-based products. They are ready for operational deployment across a range of vessel types and are technically proven against even challenging fuels, such as methanol. Survitec Group Ltd.

Subsea Data Workflow

The Absolute Ocean platform has been integrated with NaviSuite software to automate the entire subsea-to-client data workflow, providing expert insight to non-expert users. This software integration enables collected subsea data to flow directly into Absolute Ocean after being automatically processed by NaviSuite. Clients can log in to view pre-processed data as data are collected, enabling decisions in minutes, instead of hours or days. Terradepth Inc. and EIVA a/s.

Cargo Hold Preparation

CharterReady analyzes inspection data to proactively identify potential issues. It streamlines operations, reduces risk of cargo hold rejection and enhances transparency. Designed specifically for bulk ship-

ping charterers, this product helps charterers ensure vessel readiness and eliminates the inefficiencies of manual reporting, simplifying cargo hold inspections and improving data quality with a centralized platform. Kaiko Systems GmbH.

Large Retractable Thruster

The R series for offshore vessels features a seal design that minimizes downtime by actively managing water ingress, with low maintenance requirements that can be performed from inside the vessel during normal operation. A floating housing moves with the stern tube to keep the seals in contact even at high speeds and sea states, and a simple scraping solution reduces marine growth on the stern tube. Steerprop Oy.

Shallow-Water Optical Sensor



Designed for inland water and shallow marine environments, the Hyperion32 is depth-rated to 50 m, offering a cost-effective alternative for users who don't require deep-sea capability. Its streamlined 32-mm-diameter housing offers a lighter, more compact form factor. This versatile sensor is ideal for environmental monitoring, academic research, agriculture, municipal water management, industrial compliance, conservation, aquaculture and civil engineering. Teledyne Valeport Water.

Shore Power System

Developed specifically for container terminals, this flexible, high-performance solution supports ports in reducing emissions and improving operational efficiency. Cavotec SA.

Piston Engine Oil

HDAX 9700 is a fuel-agnostic medium-speed trunk piston engine oil. Developed in response to stricter

emissions regulations and the rise of dual-fuel engine technology, HDAX 9700 is a premium SAE 40 oil formulated to protect four-stroke engines running on diesel, LNG, CNG, biofuels, methanol and ammonia. Its hybrid additive technology effectively controls ash accumulation, improves resistance to oxidation and nitration, and helps prevent corrosion, all with low oil consumption. Chevron Marine Products.

Portable Thermal Night Vision

Ocean Scout Pro enables confident navigation at night. Users will be able to identify navigation aids and find people in the water. Featuring a wide 32° field-of-view, Ocean Scout Pro allows for rapid area sweeps and detecting human heat signatures up to 500 m away. Teledyne FLIR.

Aquaculture Lighting

The Seacage 680W compact light was originally developed to support fish growth in aquaculture environ-

ments while reducing sea lice exposure by up to 50%. Featuring a proprietary fish light spectrum, the Seacage 680W delivers high output in a compact form. Philips.

Battery Power Station

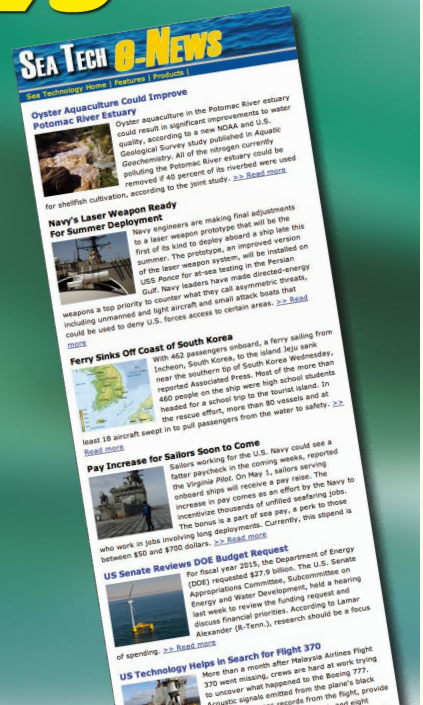
EcoVault is a clean, quiet and scalable LFP battery power station designed for marine applications. It offers a dependable, zero-emission alternative to diesel generators and supports efficient energy deployment on vessels, ports, and other marine environments. It is scalable up to 368 kWh to provide mobile power for offshore or dockside use. HyperPower.

Web-Based Marine Management

Valmet DNAe is a fully web-based marine control system that integrates seamlessly with all onboard equipment, providing shipowners with a unified platform that crew members can manage. This automation system has ISASecure SSA Level 1 certification for its built-in cybersecurity approach. Valmet. **ST**

SEA TECH e-NEWS

Featuring the government and industry news you need to know, *Sea Tech e-News* delivers timely information straight to your inbox, with details on recent product releases, updates on new hires and promotion, and workshops. We send out the newsletter every other week, so you'll get a steady stream of news edited down to what matters most.



Micropile Anchoring

Subsea Micropiles has reached a major technical milestone with the installation of a commercial drilled and grouted micropile anchor solution for Orkney Harbour Authority (OHA) in Scotland. The technical solution developed by Subsea Micropiles could become critical infrastructure for floating offshore wind in the country, as well as a mooring point for OHA's tug fleet.

Micropiling technology for the offshore sector uses smaller vessels and remote seabed drilling systems, which enables large construction jobs to be more reliably completed with lower cost, minimal environmental impact and high local content. Subsea Micropiles' approach provides a scalable industrial solution for large projects in offshore wind involving both fixed and floating structures. Foundation designs can be adapted for high-load

regimes across a wide range of soil conditions.

Wave Energy Collaboration

As part of a long-term technical partnership for the commercialization of Carnegie Clean Energy Ltd.'s CETO wave energy technology, SKF and Carnegie are collaborating on the design and delivery of a power take-off (PTO) system.

CETO is a fully submerged, point absorber technology comprising a buoy that sits a few meters below the surface of the ocean and moves with the ocean's waves. This motion drives a PTO system that converts wave motion into electricity.

SKF provided early PTO bearing and shaft design activities under a development agreement. Following completion of those design activities, SKF has subsequently been awarded the contract to manufacture three PTO units for the CETO

deployment at the Biscay Marine Energy Platform.

Geotechnical Site Investigation For German Offshore Wind

Geoquip Marine has completed a preliminary geotechnical site investigation for two 4-GW offshore wind projects.

The investigation will support the developer in advancing the next phase of design for both project sites, located in the German sector of the North Sea.

Geoquip drilled 28 boreholes across the project sites to analyze the subsea terrain for turbine foundations and conducted thorough soil sampling and seismic site monitoring to inform the engineering parameters for both projects in depths of 40 m. By deploying the *Dina Polaris* vessel, equipped with state-of-the-art geotechnical drilling, sampling and testing equipment along with an offshore laboratory, Geoquip provided accurate, real-time seabed data, identifying challenging site conditions.

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Germany has set ambitious offshore wind capacity targets of at least 30 GW to be installed by 2030, and these projects will be vital in supporting the country toward its goal. The potential renewable power from both projects could integrate low-carbon, hydrogen and biofuel production, supporting wider industry decarbonization in Germany.

Scotland Offshore Wind Data

BlueFloat Energy and Nadara have concluded comprehensive two-year wind and metocean monitoring campaigns at the Broadshore Hub and Bellrock floating offshore wind farm sites, marking a milestone in the development of Scotland's next generation of renewable energy infrastructure.

The campaigns involved the deployment of EOLOS' FLS200 floating lidar buoys at the Broadshore Hub site, located 50 km north of Fraserburgh, and the Bellrock site, situated 120 km east of Aberdeen.

These buoys collected high-quality wind, wave, current and atmospheric data that will inform the engineering design of the wind farm projects and reduce the uncertainty of the energy yield estimates to maximize project value.

The metocean data will be integrated with findings from recent geophysical and geotechnical seabed surveys conducted by Acteon, further enhancing the understanding of site conditions and supporting the refinement of project designs.

The Broadshore (900 MW) and Bellrock (1,800 MW) projects are part of the BlueFloat Energy and Nadara partnership's 4.4-GW portfolio of Scottish floating offshore wind developments. These include the 1,500-MW Stromar project in collaboration with Ørsted. The partnership is also developing two 100-MW innovation projects, Sinclair and Scaraben, adjacent to Broadshore to form the Broadshore Hub.

These projects will trial innovative technologies and develop a pilot community ownership model to shape the future of community benefit from floating offshore wind projects throughout Scotland.

Tidal Array in Wales

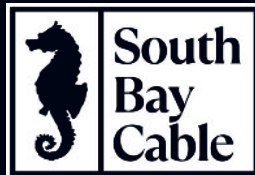
Hutchinson Engineering will build Inyanga Marine Energy Group's 20-MW HydroWing tidal energy array to be deployed at Morlais off Anglesey in Wales, one of the largest consented tidal energy projects in Europe.

The contract with Hutchinson Engineering covers the fabrication of the foundation frame and the rear nacelle, including welding, painting and coating, to a specification capa-

ble of withstanding the harsh underwater environment.

The foundation frame will weigh 120 tons, with an energy yield of 1.2 MW from a single unit. The nacelle is 19 m high. The foundation frame of structural steel will have a life span of 25 years and will be manufactured with full consideration of sustainability, including decommissioning. The tidal energy prototype will deploy in the first quarter of 2026. **ST**

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AI-Assisted Ship Design

Lomar's corporate venture lab, lomarlabs, is collaborating with BlueNose, a maritime technology company, to optimize ship aerodynamics through AI-assisted design and the use of advanced materials. By integrating fluid dynamics with cutting-edge shape generation, BlueNose is set to enhance fuel efficiency in commercial vessels, reducing fuel consumption by up to 5 percent.

BlueNose's algorithmically guided optimized structures are strategically placed at the front of ships to minimize air resistance, leading to substantial fuel savings, lower emissions and reduced operational costs.

Developed through close collaboration with leading academic researchers and industry experts at the forefront of climate technology and innovation, this modular system, now gearing up for at-sea deployment following extensive testing in simulated environments, is designed for use across a wide range of commercial vessels.

Open-Source AI for Extreme Weather Events

Universities Space Research Association's (USRA) Research Institute for Advanced Computer Science and the Boston Consulting Group's BCG X AI Science Institute have announced the open-source release of the GAIA (Geospatial Artificial Intelligence for Atmospheres) Foundation model, built in collaboration with NASA.

This novel GenAI model aims to address one of the most urgent challenges of our time: predicting and understanding extreme weather events.

The model was trained and tested on 25 years of data from the Geostationary Operational Environmental Satellites (GOES) and data from the European Meteosat (EUMETSAT) and Japanese Himawari weather satellites for global coverage. The initial release includes downstream applications for filling gaps in sat-

ellite data coverage and for precipitation. It is poised to support tracking and forecasting of tropical cyclones, atmospheric rivers, and other extreme weather phenomena in support of disaster preparedness, response, and recovery, as well as other use cases.

Over the past two decades, the cost of natural disasters has surged more than 100-fold, now totaling tens of billions of dollars annually. To confront this escalating crisis, the research team has moved beyond traditional task-specific machine learning models, which require separate models for each weather event, to a single, global foundation model that supports multiple extreme weather phenomena within a unified framework.

This marks a first milestone of the partnership formed in April 2024 to pioneer geospatial AI for science and engineering as part of USRA's new Generative Artificial Intelligence Lab for Science & Engineering, managed within USRA's Research Institute for Advanced Computer Science. This partnership combines USRA's AI and Earth science expertise with BCG X AI Science Institute's advanced engineering and data science expertise and NASA's comprehensive data. It leverages USRA's partnership with the National Research Platform, a National Science Foundation-funded network of high-performance computing resources at universities across the U.S.

New BC Ferries Ready to Run On Electricity

Under its contract with BC Ferries, Damen Shipyards Group has selected Corvus Energy to supply energy storage systems (ESS) for four new, fully electric-capable passenger car ferries currently under construction. The vessels will join BC Ferries' fleet of hybrid electric *Island*-class vessels.

Delivery is scheduled by 2027. This will expand BC Ferries' existing fleet of six hybrid diesel-electric *Island*-class ferries.

The new ferries can operate on fully electric power, utilizing renewable shore power for battery charging. When the vessel is operating on electric power alone, it will not consume fuel, and there will be zero shipboard emissions, benefiting the environment, passengers, and local communities. Each vessel will carry up to 390 passengers and 47 vehicles.

Each vessel will be equipped with a 2,034-kWh Corvus Orca ESS.

Port of Toulon Shore Power

The commissioning of France's largest-ever shore power solution for ships at the Port of Toulon has been completed. The solution uses a single conversion station with a digitalized smart grid network architecture.

The installation is currently in its final acceptance period. The consortium that delivered the installation was led by ABB and included the company Eiffage Construction and the electrical installation company Fauché.

The facility now offers connections at 11- and 6.6-kV and frequencies of 50 or 60 Hz, supporting cruise and ferry formats. This enables supporting port calls by three ferries simultaneously, or one cruise ship. In addition, the port is equipped with the necessary technology to connect a 1-MW hydrogen fuel cell system.

Funding for Echandia

Echandia, a Swedish maritime battery system supplier, has secured new long-term financing from S2G Investments, a multi-stage firm with a dedicated oceans strategy. S2G is Echandia's first U.S.-based investor.

The investment is part of Echandia's most recent funding round and brings the total funding round to \$34 million.

Echandia's advanced lithium titanate oxide battery systems are designed for maritime operations, where conventional lithium-ion or diesel systems often fall short. Applications include powering ferries, tugboats, RoRo/RoPax ships, and offshore workboats, enabling fully electric and hybrid propulsion. **ST**

Deep-Tow Survey Systems Donated to CSIRO

Fugro has donated two Edge-Tech deep-tow survey systems to the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's national science agency.

This donation is part of Fugro's ongoing support of global ocean science initiatives and aligns with its active roles in support of the United Nations Decade of Ocean Science for Sustainable Development.

The survey systems can operate at depths up to 6,000 m. They were used by Fugro in the deep waters of the Southern Indian Ocean during the search for MH370, the Malaysia Airlines international passenger flight that disappeared from radar March 2014.

The systems will now be used on board CSIRO's RV *Investigator*, enabling environmental research such as high-resolution deep-sea mapping and the study of biodiversity in deepwater benthic habitats.

SoCal Giant Sea Bass Show Evidence of Recovery

A team led by researchers at UC Santa Barbara has conducted the first direct population estimate of giant sea bass, a critically endangered species, in Southern California (SoCal). Using photos sourced from divers, they found slightly more than 1,200 adult giant sea bass in SoCal waters from 2015 to 2022.

The results, published in the *Marine Ecology Progress Series*, represent an upward trend, suggesting that conservation efforts are helping the species recover from decades of overfishing. Yet, recovery will take a while for this slow-growing species.

Fish Evolution in Arctic

During the Late Cretaceous period, northern Alaska was located far above the Arctic Circle. It endured months of winter darkness and freezing temperatures, even as much of the planet remained warm. An international team of scientists has discovered that the world's

oldest known relatives of salmon and carp lived in this extreme environment. Using the latest in 3D imaging technology, they analyzed fossilized fish bones found in the rocks of the Prince Creek Formation in Alaska to reveal a previously undiscovered polar ecosystem. The findings were published in *Papers in Paleontology*.

The research suggests this remote region may have been an evolutionary launchpad for fish that now dominate northern rivers and lakes worldwide.

This study supports the idea of a distinct Arctic ecosystem, known as the Paanaqtat Province, where unique animals, including dinosaurs, mammals and fish, evolved in isolation.

Natural Hazards Cause Subsea Cable Damage

A study led by the U.K.'s National Oceanography Centre, published in *Earth-Science Reviews*, has found that natural hazards account for around a quarter of all recorded instances of subsea cable damage between 1965 and 2019, posing a threat to the growing infrastructure underpinning global connectivity.

While human activities such as fishing and anchoring remain the primary causes of damage, the study warns that climate change is intensifying many natural hazards, increasing risks to these vital networks.

The threats from natural hazards range from earthquakes and submarine landslides to powerful underwater currents triggered by river floods. These events can damage cables, bury them under sediment, or render them inoperable.

With climate change driving more extreme weather, rising sea levels, and sediment-laden river discharges, the frequency and severity of these hazards are expected to grow, amplifying the challenges of maintaining resilient subsea infrastructure. The vulnerabilities were starkly illustrated by the 2022 Hunga Volcano eruption in Tonga. Underwater density currents generated

by the eruption destroyed Tonga's sole international cable, isolating the nation for weeks and hindering emergency response efforts. Similarly, powerful turbidity currents in the Congo Canyon, driven by record-breaking floods, have repeatedly damaged cables, disrupting internet services across West Africa.

To mitigate these risks, the researchers advocate for improved cable routing, enhanced repair readiness and investment in complementary technologies such as satellite backups. Initiatives such as Seabed 2030, which aims to map the entire ocean floor by 2030, are also critical for identifying potential hazards and guiding safer infrastructure development.

Catch-and-Release Device to Sample Deep-Sea Organisms

Building upon previous research, University of Rhode Island (URI) Professor of Ocean Engineering and Oceanography Brennan Phillips and a multidisciplinary team of scientists will use cutting-edge technology to research fragile deep-sea organisms and possibly discover new species. The team will receive \$2.2 million over three years from the Ocean Shot Research Grant Program, an initiative of the Sasakawa Peace Foundation's Ocean Policy Research Institute, supported by The Nippon Foundation.

Phillips will collaborate with Robert Wood's Microrobotics Laboratory at Harvard to develop a biopsy/preservation device. The lab came up with the rotary actuated dodecahedron design for their last project, and the URI team worked with the lab to turn that design into a large-scale oceanographic instrument for the deep sea.

It is an origami-inspired robotic encapsulation device with a biopsy tool, modeled on the biology of the mantis shrimp, to nondestructively sample gelatinous organisms floating in the water.

The device will enable "catch and release sampling," enclosing an animal in an underwater chamber to collect tissue samples for genetic analysis before releasing the animal unharmed. **ST**

LNG STS Transfer

Baseblue has completed its first LNG ship-to-ship (STS) bunkering operation in Portland, Jamaica; a milestone in the company's ongoing efforts to expand the availability of LNG as a marine fuel.

The operation involved the seamless transfer of approximately 8,800 MMBtu of LNG. This bunkering event also included a cooldown of the receiving vessel, a key technical step to enable LNG bunkering, requiring rigorous safety procedures and pre-operation compatibility planning.

The execution highlights Baseblue's growing global LNG supply chain capabilities and reflects its push into new geographies. Historically active in LNG bunkering operations across Asia and Europe, this marks the company's first such supply in the Caribbean, broadening its footprint in the Americas.

Florida Seagrass Found Healthy

A new study published in *Marine Ecology Progress Series* shows that seagrass ecosystems along the northern half of Florida's Gulf Coast have remained relatively healthy and undisturbed for the last several thousand years.

This is not the case for most other seagrass ecosystems the world over, nearly 30 percent of which have disappeared since 1879.

An estimated 7 percent of seagrass beds were lost each year between 1990 and 2009. Those that remain are generally not faring well, and the discovery of a healthy refugium is rare.

The fossils of mollusks and other marine organisms with tough exteriors are so dependent on their environments that they can be used as a surrogate for species that don't normally get preserved, according to the researchers. Thus, if mollusks are healthy, that indicates their environment is healthy.

The study authors sampled from 21 locations in six estuaries, using a long hose made from PVC pipe to suction up sections of the seafloor.

After counting and identifying the specimens, their results showed that mollusk diversity, and the health of seagrass meadows by extension, hasn't changed much over the last several millennia, including the most recent one in which humans have left their mark.

This system is still in very good condition, which makes it even more important to protect it, the researchers said.

Ammonia Vessel Guidelines

ClassNK has released the "Guidelines for Safety Operation for Ammonia-Fueled Vessels" at: www.classnk.or.jp/account/ja/Rules_Guidance/ssl/guidelines.aspx.

The guidelines summarize specific precautions and management methods for the transportation, storage, and operation of ammonia fuel.

With the aim of decarbonizing the shipping industry, alternative-fueled vessels are approaching 40 percent of the total on an order basis and will continue to grow.

The guidelines will be updated according to future industry discussions, research and the latest knowledge. They are part of the ClassNK Transition Support Services for customers to achieve zero emissions.

Circular Economy for Tuna Fishing Satellite Buoys

Marine Instruments has launched the Blue Recovery Programme to promote a circular economy in tuna fishing. This international initiative is supported by regional entities, NGOs, and companies in the tuna sector. The program aims to establish an efficient logistics network to enable the collection, sorting and potential reassignment of unused satellite buoys.

Potential uses for this satellite technology include marine debris tagging and tracking, coastal fishery resource studies, fishery improvement projects, whale and turtle monitoring, and ocean current assessment, among others. This approach benefits fishing fleets, local communities, environmental orga-

nizations and research centers. They will receive repurposed devices to help advance their initiatives.

Protection Pledge for French Polynesia Waters

French Polynesia will establish one of the world's largest networks of marine protected areas (MPAs) in a region of the South Pacific Ocean that hosts a vast array of life.

The pledge, announced at the United Nations Ocean Conference, is to protect nearly 23 percent of French Polynesia's waters. This includes two MPAs that collectively span 900,000 km².

In addition, the government will create an artisanal fishing zone—collectively covering 186,000 km²—that extends 15 nautical mi. (nm) from the Austral, Marquesas, and Gambier islands and 30 nm around the Society Islands. Fishing there will be limited to traditional single pole-and-line catch from boats less than 12 m long.

A commitment was also made to bolster conservation measures in the remainder of French Polynesia's waters by including public participation in management, strengthening fisheries management plans, and banning deep-sea mining and drifting fish aggregating devices (free-floating objects that commercial fishers commonly place in the open ocean to attract fish).

Seabed 2030 Progress

The Nippon Foundation-GEBCO Seabed 2030 Project has announced that 27.3 percent of the world's ocean floor has now been mapped to modern standards. The goal is to map the entire seafloor around the world.

This increase in data represents more than 4 million km² of newly mapped seafloor.

Seafloor data can improve tsunami early-warning systems, guide the installation of undersea cables and identify biodiversity hotspots, among other applications.

Seabed 2030 currently has 185 partner organizations contributing seafloor mapping data.

The data from the project are free via the GEBCO global grid. **ST**

people

The U.S. Department of Transportation has announced **Sang H. Yi** as acting maritime administrator (MARAD). Yi will lead MARAD's efforts to maintain and modernize the vital infrastructure that supports both commercial shipping and military sealift operations. He will also guide the department's initiatives to strengthen the maritime workforce, foster innovation, and expand cross-industry collaboration to build a more robust and prepared maritime transportation system.



Castrol has appointed **Shalini Kashyap** as CEO of its global marine and energy business. Kashyap is also the VP of Castrol's Global Account Management (GAM) team. She has held several senior leadership positions across the organization since joining in 2016. Before taking on the GAM role, she was the global CFO of bp pulse, the company's electrification business. Kashyap played a pivotal role in expanding bp pulse's operations across more than 10 countries.

Hans-Christian Mordhorst has joined XMAR, a maritime technology company, as CEO. Mordhorst brings more than 25 years of experience in the maritime industry, including a decade of leadership in maritime technology ventures, blending traditional shipping expertise and tech-driven roles.

Scott Hansen has joined Phoenix International Holdings Inc. as project manager for the AUV division. He brings 20 years of experience in marine engineering and ROVs, working in the research, scientific, biological, and oceanographic industries around the world.

Anemoui Marine Technologies has appointed **Tejal Davda** as finance director. She brings a wealth of experience in maritime finance and leadership. Davda has a degree in economics and business finance and is a chartered accountant.

The American Geophysical Union's (AGU) new executive director and CEO is **Janice R. Lachance**, J.D., a fellow of the American Society of Association Executives and the National Academy of Public Administration. She joined AGU eight years ago.

Columbia Group has made senior leadership appointments to support its transformation into an integrated global maritime services platform. **Demetris Chrysostomou** is now the CEO for the Asia Region, **Norman Schmiedl** is the CEO of Columbia Blue, and **Simona Toma** is the chief of maritime HR.

Steerprop has appointed **Juhani Hupli** as director of service to lead the development and delivery of the company's life cycle solutions for its thrusters. Hupli brings more than 25 years of experience in the maritime industry, having held senior management roles at Wärtsilä.

American Waterways Operators, a U.S. tugboat, towboat and barge industry association, has elected new leaders. **Patrick Sutton**, senior VP of business development and planning at American Commercial Barge Line, was elected chairman of the board of directors. **Matt Woodruff**, VP of public and government affairs at Kirby Corp., was elected vice chairman. **Brian Hughes**, VP of operations and sales at Hughes Bros. Inc., was re-elected treasurer.

The Woods Hole Oceanographic Institution has presented **Prince Albert II of Monaco** with its inaugural series Centennial Medal in recognition of his work to raise awareness, inspire action, and advance ocean science and technology.

ATPI has updated its leadership team as it expands its role in the oil and gas and renewable sectors. **Zara Higgins** is the new head of energy for key international markets. **Judy Peplinski** has been promoted from U.S. managing director to the head of global strategy for the energy division. **Ettienne de Swardt** is the new U.S. managing director. **ST**

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contracts

BMT, Teddington, U.K., has been selected to deliver a state-of-the-art Integrated Marine Monitoring System for the Woodfibre LNG facility in Squamish, British Columbia, Canada. Woodfibre LNG is poised to become the world's first net-zero LNG export facility. McDermott International.

Sonardyne, Yateley, U.K., will deliver baseline environmental monitoring services for the U.K.'s first offshore carbon capture and storage site. Sonardyne has been contracted by the developer of the onshore and offshore infrastructure needed to transport carbon dioxide from carbon capture projects across Teesside and the Humber, collectively known as the East Coast Cluster, to secure storage under the North Sea. Northern Endurance Partnership.

Saab UK, Fareham, U.K., has sold and delivered a new Seaeye Panther XTP ROV that will be used for offshore inspection and construction around the world. CCC (Underwater Engineering) S.A.L.

Megamas Resources, Petaling Jaya, Malaysia, has made a ship design contract to start the engineering phase on a fiber-optic cable-laying vessel planned to be built at the Lloyd Werft Bremerhaven GmbH dockyard. Ulstein Design & Solutions AS.

MacGregor, Helsinki, Finland, has secured a contract to supply an advanced anchor handling towing winch package for a series of SPA90 anchor handling tug supply vessels for operation offshore. SINOPACIFIC Engineering & Contracting Co. Ltd.

MIND Technology Inc.'s, The Woodlands, Texas, Seamap unit has received an order for a GunLink source controller and associated equipment. Sanco Holdings A/S.

Cavotec, Lugano, Switzerland, has signed a shore power order for the

Port of Antwerp-Bruges in Belgium. The system will enable cruise vessels calling at the terminal to connect to shore-side electricity, allowing them to shut down their onboard generators and reduce emissions while berthed. Equans. **\$T**

meetings

SEPTEMBER

September 10-11—Digitalisation in Shipping: Europe Summit, Rotterdam, Netherlands. www.wplgroup.com/aci/event/digitalisation-in-shipping-europe.

September 10-11—International Antifouling Conference, Gothenburg, Sweden. <https://international-antifouling-conference.confetti.events>.

September 10-12—INMEX SMM India, Mumbai, India. www.inmex-smm-india.com.

September 15-19—London International Shipping Week, London, U.K. www.LISW.com.

September 24-25—European Carbon Dioxide Utilisation Summit, Antwerp, Belgium. www.wplgroup.com/aci/event/co2.

September 25—The Maritime Standard Transportation and Climate Change Conference, Abu Dhabi, United Arab Emirates. <https://tmstaccc.com>.

September 29-October 2—OCEANS 2025 Great Lakes, Chicago, Illinois. <https://greatlakes25.oceansconference.org>.

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>.

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

For more industry meetings, visit sea-technology.com/meetings. **\$T**

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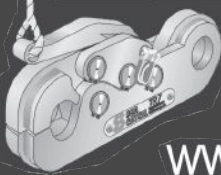
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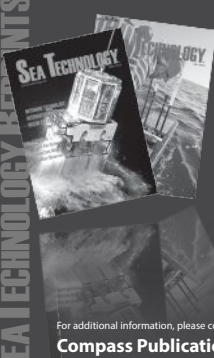


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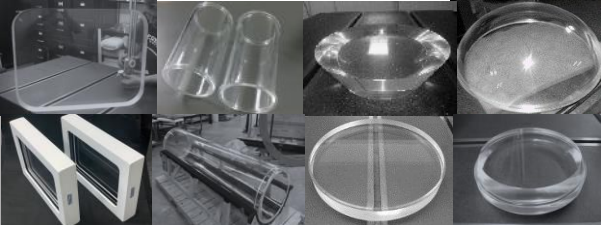
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We Need to Examine the Full Cost of ‘Prestige Reclamations’ —Dr. Dhritiraj Sengupta

Dr. Dhritiraj Sengupta is a physical geographer and Earth observation scientist at Plymouth Marine Laboratory in the U.K. and a visiting scientist at the University of Southampton. He is the lead author of “Pride and prejudice of the Anthropocene coasts,” published in *Ocean & Coastal Management*, 2025. This study originated from a conversation when Sengupta was researching seaports and geography.



Scientists call attention to the new generation of land reclamation, “prestige reclamation,” and how research is urgently needed to understand the ecological consequences, water quality changes and social implications of these mega-engineering projects in light of rising sea levels, the biodiversity crisis, and economic challenges.

With more than 1 billion of the world’s population living within 10 km of the coast, shorelines are some of the most highly populated and sought-after areas in the world. They contribute vast amounts of wealth to the global economy, supporting both light and heavy industries, including agriculture, fishing, raw material extraction, tourism, and recreation.

Coastal reclamation often occurs in economically productive regions where the demand for low-lying coastal land exceeds what is available. The process of coastal land reclamation involves filling-in or enclosing and draining areas of shallow sea or intertidal zone.

This is not a new practice. Industrial and agricultural examples in the Netherlands, U.K. and India date back to the ninth century. However, prestige reclamations differ drastically from the developments of the past, and these coastal engineering initiatives are rising.

A prestige coastal development is defined as high-end real estate

constructed on reclaimed land that maximizes coastal length and often includes a culturally significant symbol or social statement visible in the overall design when viewed from above. Examples include the Pearl in Doha, Qatar; the World Islands in Dubai, United Arab Emirates; Durrat al Bahrain in Bahrain; and Ocean Flower, Ying Yang Island, Grape Island, Conch Island and Pisces Island in China.

While prestige reclamations address the issue of coastal congestion, they are astronomically expensive to construct and maintain. Costs can easily mount to billions, such as the Dubai Palm Jumeirah reclamation that cost more than \$12 billion to complete.

Prestige reclamations are also expensive in terms of resource extraction and environmental impact. Pressing concerns include the permanent destruction of important marine habitats within the footprint of the developments and disruption of coastal ecosystems.

Consideration should also be given to the source of construction materials as this may represent hidden or indirect environmental impacts. The Palm Jumeirah used approximately 7 million tons of rock mined from the nearby Hajar Mountains and more than 100 million cubic meters of sand extracted from the seabed.

In cases where illegal sand mining activities have been identified, such as along the Mekong River that runs through East and Southeast Asia, the result has been erosion and the collapse of riverbanks, which leads to heightened flood risk in the wider area.

While land reclamation can offer a solution to urban expansion and has been shown to attract significant wealth to regions, the full collective impact of these developments is still not fully understood with respect to the environment, the wider economy (taking into ac-

count, for example, the fishing industry), carbon sequestration, the natural transport of sediments along the coast, changes in water quality, and climate resilience.

Coral reefs, the “rainforests of the sea,” are particularly vulnerable. In some cases of land reclamation, these vibrant ecosystems that are home to a myriad of marine life have been buried under tons of sand and concrete, disrupting the natural balance and leading to the decline of numerous species. In addition, new stressors will be introduced to these marine habitats, such as light and noise pollution, and pollutants from surface runoff.

We stand at a critical point in time to study these prestige reclamations. As sea levels are rising, we must ask: Is it climate-smart to invest in low-lying artificial land?

Furthermore, the global biodiversity crisis is one of the most pressing issues faced by our generation. We need to make the right decisions for our planet, informed by science.

Investigating the full cost of prestige reclamations demands further attention and global collaboration to study the impacts of and provide alternative solutions to the growing demand for coastal land.

Questions to explore with further research include: What are the ecological impacts of prestige reclamations? How do these developments differ from existing industrial and agricultural reclamations? How do the complex designs affect the water quality within and around the reclamations? How do the developments affect people living on or near these engineered coasts?

We are in an era when natural coastlines are being transformed into vast urban metropolises engineered to project out into the sea. This is an extreme example of “manmade” carried out at an extensive landscape scale. We should examine the heavy costs beyond the developers’ books. **ST**

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