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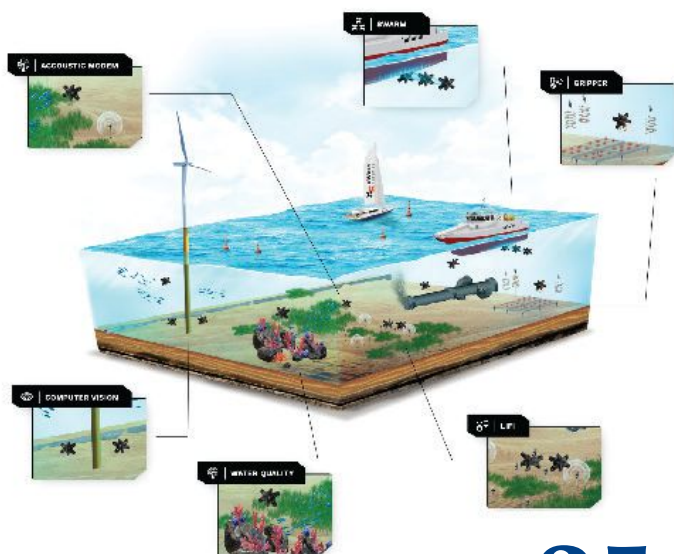
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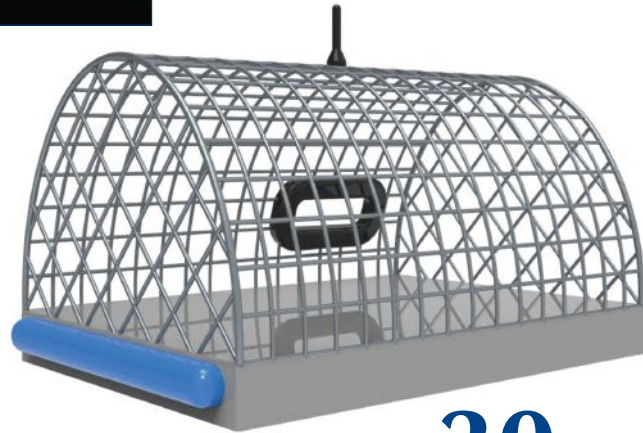
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)) Financing for Pioneer Energy Link Between Germany and UK. The European Investment Bank (EIB), as part of a consortium of more than 20 international banks, has agreed on the financing structure of the first ever energy link connecting Germany and the U.K. The investment to build this interconnector will amount to €2.8 billion, with the EIB set to contribute up to €400 million for the financing of the European part. The investor consortium is led by French investor Meridiam, Allianz Capital Partners and Japanese company Kansai Electric Power. Alongside the EIB, other promotional banks include the UK Infrastructure Bank and the Japan Bank for International Cooperation. The project will be the first interconnector between Germany and the U.K., facilitating electricity trade between the European Union and the U.K. and contributing to the integration of high shares of intermittent renewables across the North Sea. The expected start date of commercial operations is in 2028. The project comprises a high-voltage, direct-current link interconnecting England and Germany through German, Dutch and British waters. The project will have a rated capacity of 1,400 MW and DC voltage of 525 kV. The predominantly subsea cable will have a route length of 725 km and will connect a converter station and German grid interface to Tennet's electricity network near Fedderwarden and a converter station and grid interface on the Isle of Grain in the U.K. to the National Grid ESO network. Siemens has been appointed as the contractor for the converter stations, and Prysmian will manufacture and install the cable. The interconnector will help to ensure better utilization of offshore wind capacities on the coasts according to the respective local wind strength, thereby supporting EU and German renewable energy policies. The project will make it possible to reduce CO₂ emissions and will contribute to meeting the European greenhouse gas emission reduction target of at least 55 percent by 2030. Environmental impact studies have been carried out, and appropriate measures will be taken to avoid, mitigate and compensate the impacts.

)) Results of 10th European International Submarine Races. Organized by IMarEST and hosted by QinetiQ, the European International Submarine Races (eISR) took place for the 10th year in Europe's largest freshwater tank, QinetiQ's Ocean Basin, at Haslar Marine Technology Park in Gosport, U.K. The "human-powered submarine" race, which runs every other year, saw teams of students from the universities of Southampton and Warwick in the U.K. and universities from the U.S., Canada, Germany and Taiwan competing against each other. This year's overall winner was Rhein-Waal University of Applied Sciences, Germany, and the runner-up was the University of Michigan. The École de Technologie Supérieure from Montreal, Canada, won the BMT Award for Innovation, and Rhein-Waal also took home the UKNEST Agility Award. Over two weeks, the teams design, build and race their underwater vehicles using pedal power to propel them as they navigate the challenging underwater slalom course. To win the competition, teams must demonstrate creativity and comprehensively document their work with the aim of achieving sporting prowess. Points are awarded for speed, maneuverability, reliability, endurance and perseverance. Especially important in the scoring is the team's ability to rise to the unexpected challenges of the underwater environment.

)) Balloons to Detect Seismic Activity on Venus. A new study in AGU's *Geophysical Research Letters* reports on the first detection of a large, distant earthquake in a network of balloon-bound pressure sensors in the stratosphere. The technique could one day be applied on Venus, whose hot, dense and corrosive atmosphere limits our ability to sense Venus-quakes from the planet's surface. The balloons could also be used on Earth in hard-to-reach places. Monitoring seismic activity on other planets is critical for learning about their interior structures, but unlike on Earth, planetary scientists can't rely on a global network of ground-based sensors. Instead, they turn to the atmosphere. When an earthquake hits, the vibrating ground sends infrasound high into the atmosphere, where the balloons and their instruments are waiting. The balloons float through the stratosphere for several months after launch, passively following high-altitude atmospheric patterns. At about 11 m in diameter and 30 kg (66 lb.), the balloons can support up to four instruments. Seismology is relatively new in the stratosphere; the balloons are mostly used for atmospheric science. Previous research has confirmed that these balloon-based sensors can pick up small, local quakes, but until now, a multi-balloon network had not yet detected large earthquakes at a great distance. On December 14, 2021, a magnitude 7.3 earthquake hit Indonesia's Flores Sea. Within 10 min., four of ISAE's StratoLe-2 balloons within a 3,000-km radius detected the resulting infrasound, at altitudes as high as 20 km. From those sensor data, the research team was able to accurately back-calculate the earthquake's magnitude and other key parameters about the quake and planetary structure. They were even able to track the dispersion of the seismic wave across the surface with their network. The study is an important proof-of-concept for applying this seismic monitoring technique on Venus.

)) First Black Person Reaches Deepest Part of Ocean. On July 12, 2022, Dr. Dawn Wright became the first black person to visit the Challenger Deep at 11,000 m in the Mariana Trench, the deepest known place in the ocean (it is also nominated as a U.S. national marine sanctuary). Since 1960, only 23 people have taken this plunge because the area is so difficult to get to. Wright, a marine geologist and chief scientist at Esri, was part of a two-person dive aboard a submarine piloted by explorer Victor Vescovo. With only around 20 percent of the ocean floor accurately mapped with modern techniques, this dive aimed to map more of the mysterious ocean trench. **ST**

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Together, We Can Tackle Ocean Plastic Pollution

Much work has been underway to address the ocean plastic crisis: dedicated beach cleanups around the world, new laws and regulations to ban single-use plastics, new recycling and river intervention technologies, a possible international treaty, and more. All of this work is important and will ultimately lead to a different kind of plastic culture in the future.

However, even with these efforts, the ocean plastic crisis is accelerating and has already reached epic proportions. According to The Pew Charitable Trusts, 11 million metric tons of plastic reached the ocean in 2020, and that number is expected to nearly triple to 29 million tons by 2040. Reducing global consumer demand and trying to stop the global industrial production of plastic is not enough. It's time to go big.

One percent of plastic pollution (110,000 tons annually) that ends up in the ocean is directly from the U.S. coast, but the global impact of the U.S. is far greater because of plastic waste shipped to other countries and plastic waste generated by U.S. consumer products manufactured overseas that end up polluting the ocean. The goal is to stop at least 11 million metric tons of plastic from reaching the ocean every year. How will we do that?

First, we have to understand how plastic reaches the ocean. Most comes from land, and as much as 80 percent of this reaches the ocean via rivers.

The next question to answer is: what land and what rivers? One study estimates 84 percent of ocean plastic originates from nine countries in Asia and Brazil. Another estimates 70 percent comes from seven countries in Asia, Brazil, Turkey and Nigeria.

Industries use the term "point of contamination" to determine how to keep their processes free from contaminants. Because plastic debris reaches the ocean primarily through rivers, rivers have been identified as the primary point of ocean contamination. Emerging technologies for river intervention in the countries where the vast majority of plastic pollution reaches the ocean could be implemented now, while long-term solutions are also implemented in the ocean plastic pollution supply chain upstream.

Undoubtedly, technology will play a big role. Solutions to skim or filter plastic from rivers are already being used and/or tested. Investment will also have to be made in the basic elements of plastic trash management. We must recycle what we can, which means we need new recycling plants. We also need a disposal strategy for what can't be recycled to protect both human health and the environment.

Current efforts to address the ocean plastic crisis are to be applauded, but they are not enough. Significant investment and a unified global response by governments, multinational corporations, philanthropies and others, with a focus on the highest polluting countries, can begin to mitigate the problem.

To help accomplish this, OpenOceans Global is documenting coastlines pervasively fouled by plastic on its ocean plastic trash map: www.openoceans.org/trash-map. If people around the world can visualize where plastic ends up, they can then find the source and the solutions. OpenOceans Global has also developed an online app, www.openoceans.org/trash-survey, to enable citizen scientists to place plastic-fouled coastlines on the map, including a photograph and information about the source of plastic and what is being done to address it. *Sea Technology* readers are invited to use the app to document plastic-fouled beaches so we can visualize and address the problem.

Each of us can make simple changes, such as eliminating the use of plastic straws, but we all need to get together to go big on ocean plastic prevention before it's too late. **ST**

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JANUARY

Annual Review & Forecast

**OCEANS 2022 Chennai, February 21-24, Chennai, India

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

**Oceanology International, March 15-17, London, Excel, U.K.

MARCH

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

**AUVSI XPONENTIAL 2022, April 25-28, Orlando, FL

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

**Offshore Technology Conference, May 2-5, Houston, TX

MAY

Communications, Telemetry, Data Processing

**Undersea Defence Technology (UDT), June 7-9, Rotterdam, The Netherlands

**EUROMARITIME, June 28-30, Marseille, France

JUNE

Seafloor Mapping/Sonar Systems/Vessels

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22 Editorial Calendar

UE DATE

JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

****CLEAN PACIFIC 2022**, August 23-24, Renton, Washington

AUGUST

Geophysical Exploration/Seafloor Engineering

****IMAGE '22**, August 28-September 2, Houston, TX

SEPTEMBER

Ocean Resources Development & Coastal Zone Management

****OCEANS 2022 Hampton Roads**, October 17-21, Virginia Beach, VA

****EURONAVAL**, October 18-22, Paris, France

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

****Offshore Energy 2022**, November 29-30, Amsterdam, The Netherlands

NOVEMBER

Undersea Defense/Antisubmarine Warfare

****CLEAN GULF 2022**, November 8-10, New Orleans, Louisiana

DECEMBER

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The Hydrogen Future Is Now

Methanol-to-Hydrogen Tech Enables Energy Transition

By Robert Schluter

Hydrogen is the ideal future fuel for decarbonizing the maritime industry if we can solve the significant challenges related to its transportation, storage and cost. These challenges can be resolved by changing our mindset and considering methanol as a “hydrogen carrier” and using methanol-reforming technology to unlock the hydrogen within methanol.

For the marine operator, methanol and methanol-to-hydrogen generation provides a safe, reliable and cost-efficient solution.

As we have moved from rowing to sails to steam and to diesel, previous maritime energy revolutions have taken centuries and decades to take effect. We do not have that luxury for the next revolution—decarbonization—but, thankfully, we already have a path forward.

Hydrogen Production

Conventional thinking promotes water electrolysis as the preferred method for producing carbon-neutral hydrogen. However, producing hydrogen by passing an electric current through water is energy intensive, consuming 50 to 55 kWh for each kilogram of hydrogen produced and resulting in a high carbon intensity of more than 21 kgCO₂e/kg hydrogen.

To achieve the production goals of green hydrogen, the grid would need to be 100 percent renewable. Even so, green hydrogen produced at a dedicated renewable grid would still need to be transported to the point of use. This transportation process is energy intensive, has a substantial carbon footprint and is very costly.

Hydrogen Storage

Another technical barrier to realizing a maritime hydrogen economy is the low volumetric efficiency of hydrogen storage. Hydrogen is the lightest element on the periodic table and is hard to store. For example, 1 kg of hydrogen gas at standard temperature and pressure conditions occupies over 11 cubic meters (388.5 ft³).

Gaseous hydrogen is typically produced at relatively low pressures (10 to 40 bar), so it must be compressed before transportation for efficient, economical storage.

The main options for storing hydrogen for maritime applications are to store it as a compressed gas or liquid or to employ a carrier such as ammonia or methanol, which could then be reformed to produce clean hydrogen at the point of use. When comparing these options for storage efficiency, it is sensible to consider gravimetric capacity or the amount of hydrogen adsorbed per unit mass. This is expressed as kilograms of hydrogen stored in a kilogram of carrier and typically expressed as a percentage. Volumetric capacity determines the volume of storage tanks required for a particular application.

Methanol and ammonia offer the highest hydrogen density per unit of storage, but one additional, interesting fact pushes methanol ahead. When methanol is reformed to generate hydrogen, water is added to enable the steam reforming process. This water increases hydrogen yield by a third. So, when methanol and water are used to produce hydrogen, the hydrogen density is almost twice that of liquid hydrogen per unit storage. A further benefit is that only a limited amount of water needs to be bunkered on the vessel. Although water is used in the methanol-reforming process, the fuel cell power system produces water in similar quantities, creating a closed cycle.

Additionally, methanol production requires less energy input than ammonia, which contributes to its lower carbon footprint. In fact, some facilities report that they can produce methanol with around 0.40 tons of CO₂ per ton of methanol produced, according to 2022 data from the Methanol Institute in the Netherlands.

Renewable Methanol

Methanol offers the greatest potential for real decarbonization of the maritime industry because it is readily available globally and little modification is needed to the existing bunker infrastructure. When combined with on-



Methanol offers the greatest potential for decarbonization of the maritime industry because it is readily available globally and little modification is needed to the existing bunker infrastructure. When combined with onboard reforming, it offers hydrogen production on board, allowing low-carbon-footprint-based hydrogen to be used at the point of power production.

board reforming, it offers hydrogen production on board, allowing low-carbon-footprint-based hydrogen to be used at the point of power production.

But we need to look further toward decarbonization of the methanol itself. To fully decarbonize the maritime sector, we need a pathway for producing methanol that is not reliant on large amounts of electric energy, is scalable to support transportation, is cost-competitive with diesel fuel, and offers the near-term potential of being carbon neutral.

That pathway is gray methanol produced from natural gas, with a near-future alternative of using renewable methanol, which is made from sustainable feedstocks including municipal solid waste, biomass, biogas from digesters, CO₂ captured from industrial streams and CO₂ captured directly from the air.

Worldwide, about eight renewable plants are currently in operation and at least 20 more are coming online in the next five to 10 years. Production capacity is expected to reach 385 million metric tons annually by 2050, ac-

cording to the International Renewable Energy Agency and the Methanol Institute.

e1 Marine Solution

e1 Marine has developed a low-carbon footprint technology that uses methanol to produce green, carbon-neutral hydrogen affordably. It is suitable for shipping and port-side applications.

Using an e1 Marine methanol-to-hydrogen generator operating at 80 percent to 8 percent low heat value (LHV) energy efficiency, hydrogen can be made at the cost of \$3/kg (at \$500/metric ton methanol). Although the costs increase two to three times when using renewable methanol at current prices, the costs of using methanol-hydrogen reformation are still competitive compared to using compressed or liquefied hydrogen.

In the future, the CO₂ separated from hydrogen during the reforming process may also be captured and then recycled to allow further renewable methanol to be formed. This technology, which is currently under development by Element 1, one of the parents of e1 Marine, would facilitate a carbon-negative solution for the industry.

World's First Methanol-Fueled Towboat

The potential of our technology is being recognized, with the world's first methanol-fueled towboat set to become available for charter in 2023. The vessel, MV *Hydrogen One*, is being developed by Maritime Partners in cooperation with Elliott Bay Design Group, ABB, Power

The e1 Marine solution consumes 35 percent less energy than diesel generators and is, thus, cost-effective operationally even before considering any new regulations or carbon tax.

Cell and RIX Industries (*Sea Technology*, March 2022). It will be powered by fuel cells and batteries using an e1 Marine methanol-to-hydrogen generator to supply fuel for the fuel cells. The vessel will be IMO 2030 compliant, meet the U.S. Coast Guard's Subchapter M requirements, and have an operational range of 550 mi. before refueling.

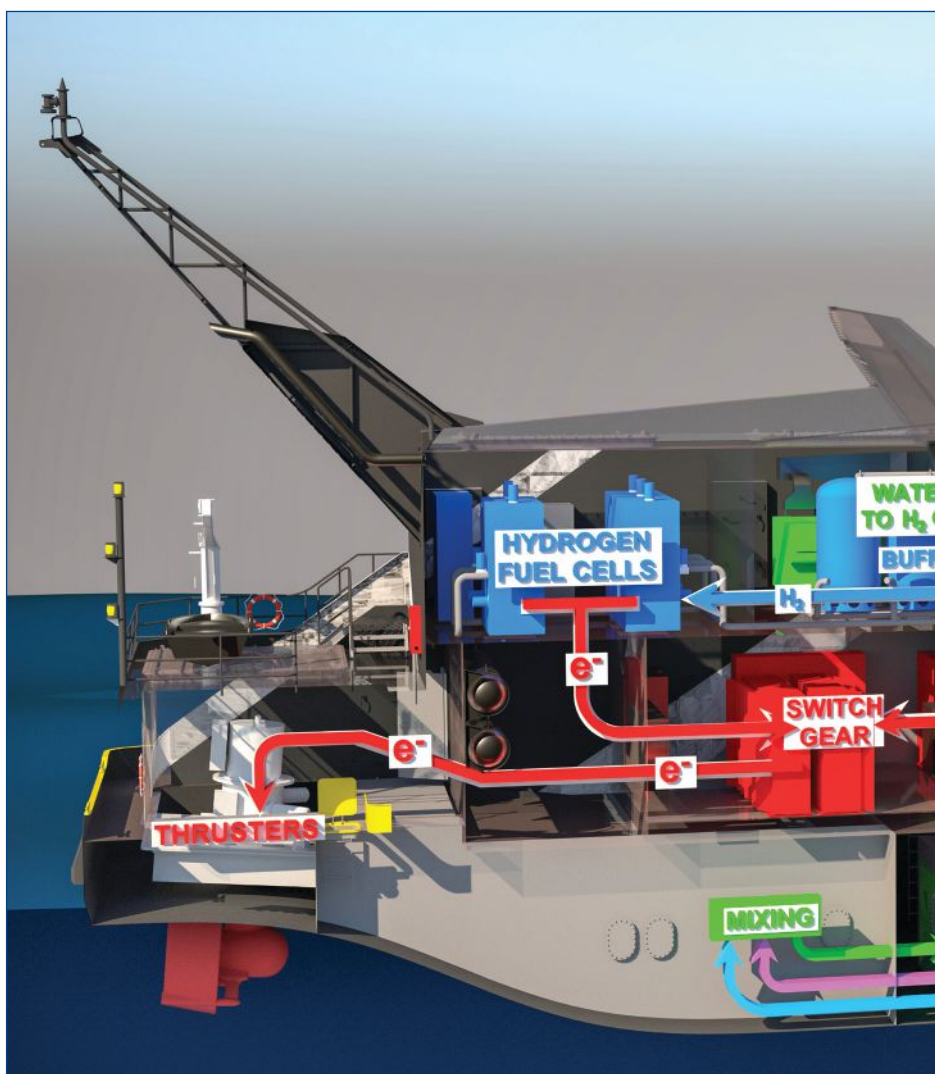
Fuel cells have many advantages over diesel engines, including superior fuel efficiency and low maintenance and repair costs. Power output from marine fuel cell systems can support loads from 50 kW to 4 MW, with larger power loads also possible.

Reforming methanol with water yields a syngas of carbon oxides in addition to hydrogen, necessitating purification before the hydrogen may be used by a fuel cell. Compact and affordable hydrogen purification processes are commercially available from Element 1 to separate hydrogen from syngas and deliver high-purity hydrogen, meeting ISO 14687 (2019) purity standards for fuel cell applications.

MV *Hydrogen One* is a particularly important development because decarbonizing the towboat sector poses substantial challenges due to towboats' inherent size, space and weight limitations. Batteries are only suitable for boats that operate on fixed routes, can recharge daily and have grid power capacity available at the port to recharge. A towboat's limited storage capacity restricts the use of pressurized or cryogenically stored gases as fuels. There are also very few dockside facilities to load such marine fuels, severely constraining a vessel's range and functionality.

Methanol is a common towboat cargo, and it is available in 88 of the world's top 100 ports. This availability enables a vessel to refuel safely almost anywhere without requiring costly diversions.

We see the *Hydrogen One* as a key demonstration of the potential of our technology that will act as a springboard for applications ranging from towboats to offshore



and deep-sea vessels and for shoreside applications in ports.

Shoreside Power

Concurrently with shipping's mandate to decarbonize, there is pressure on ports to use energy sources that are more sustainable and improve the air quality issues caused by port equipment and visiting ships.

In 2016, the U.S. Environmental Protection Agency (EPA) estimated that 39 million people in the U.S. live near ports. Fueled by population growth, economy and trade, the International Transport Forum at the Organization for Economic Co-operation and Development estimates that shipping emissions in ports will grow fourfold up to 2050, and there is growing political pressure in North America and at many of the biggest ports in Southeast Asia to better regulate shipping emissions.

The EU is also taking action. The European Commission plans to regulate the most polluting ships' access to EU ports and oblige docked ships to use shore-side electricity within its Green Deal. All EU ports will be required to have shoreside power available by the end of 2025 (Directive 2014/94/EU).

Vessel operators and owners need ports to help them



cally attainable path to significant emissions reductions in ports while improving power reliability and independence. e1 Marine has developed a modularized containerized methanol/fuel cell power solution that can provide zero-emission, megawatt-scale power in a flexible mobile container suitable for providing shoreside power at the pier, on a barge or lifted onto the vessel itself. The technology can also provide electricity for other port operations, including powering electric vehicles, drayage trucks and other port equipment.

Powering the Future

The maritime industry faces a once-in-a-generation challenge in managing how it utilizes energy as part of the global energy transition to net-zero carbon. e1 Marine's technology, with methanol providing a safe and effective carrying medium for hydrogen, enables the adoption of clean, zero-emission fuel cell power solutions.

e1 Marine's M-series methanol-to-hydrogen generator has received approval in principle (AiP) for marine applications from Lloyd's Register, and the company also anticipated a similar AiP from ABS this summer. The AiP represents an important landmark for demonstrating the compliance of e1 Marine's technology with all applicable regulations, codes and standards. Lloyd's Register has also confirmed that final approval for the

technology is possible, including for inland waterways, and is supporting efforts to secure U.S. Coast Guard approval in 2022.

The e1 Marine solution consumes 35 percent less energy than diesel generators and is, thus, cost-effective operationally even before considering any new regulations or carbon tax. It can operate on renewable methanol as it becomes available, and when combined with carbon capture, it will be a carbon-negative solution. It is a once-in-a-generation solution.

With regulation looming in the form of the Carbon Intensity Indicator from 2023, shipping being added to the EU Emissions Trading System, and regulations only set to get stricter, fuels that offer reduced emissions today and from an established feedstock with existing infrastructure are already making a difference. The industry doesn't need to wait: The hydrogen future is now. **ST**

Robert Schluter is the managing director of e1 Marine. He has more than 20 years of business operations and business development experience involving advanced technology. His previous experience includes: co-founder and chief business development officer of Element 1 Corp., founder and CEO of Pangaea Technology Resources, U.S. naval engineering officer on board the USS Mahan (DDG-42) and admiral's aide at Charleston Naval Base. Schluter holds a bachelor of science degree in business management from Ithaca College, New York.

decarbonize their supply chains because most ships will be oil-powered in the short to medium term. Unless or until these ships are retrofitted with alternatives, they will have no other source of power while in port. Approximately one-third to one-half of harmful in-port emissions come from the vessel's auxiliary diesel engines, running while the vessel is at berth, providing electrical power for lighting, hotel services and loading/discharging equipment.

Challenges for Ports

There's no shortage of ports publicly stating their aim to become net zero. However, in many ports, electricity connections and availability aren't capable of handling the extra capacity needed. Many ports, for example, are located near major cities with their own enormous, competing electricity demands.

Added to this, climate change is creating a higher frequency of adverse weather conditions impacting ports. Hurricanes on the Gulf Coast, for example, have become frequent causes of blackouts. Solving this challenge requires power sources that are flexible and reliable.

Hydrogen matched to fuel cells to produce on-site, on-demand electricity can provide a clear and realisti-

Scaling Up Seaweed

New Zealand Resource Benefits Industry, Environment and Health

By Alison Smith • Clare Bradley • Dr. Pablo Gregorini

As the world begins to grasp the benefits of seaweed, Aotearoa New Zealand is innovating high value uses of its precious underwater forests while simultaneously focusing on undoing the pollution of the last couple of centuries.

New Zealand is the world's sixth largest island, populated by just over 5 million people. It was the last large and livable place in the world to be discovered by humans. Ancestors of the Maori arrived from Polynesia be-

tween 1200 and 1300 A.D. to a land with flora and fauna that had evolved for millions of years without human influence. Colonization followed Captain Cook's Voyage of Discovery in 1769, with destruction of the native forests for timber among the first impacts, delivering sediment to the streams and waterways that lead to the coasts.

Since then, the pressures of land use change and intensification, increasing sedimentation entering the ocean from waterways, pollution, invasive species, and

AgriSea creates products for various industries by harvesting and processing New Zealand's native seaweed.





AgResearch senior scientist Dr. Linda Samuelsson is developing a high-protein food prototype based on seaweed.

climate change have continued their toll on the health of land and sea, according to the New Zealand Ministry for the Environment.

Deforestation on the country's steep slopes is a main cause of increased sediment that harms native sea life and the ecosystems dependent on it. A keystone species in New Zealand is seaweed, such as kelp. Sediment in the water affects the amount of light kelp can get to photosynthesize. Through imbalances in practices such as overfishing of certain species, native sea urchins (kina) may strip a reef of kelp, creating an open area known as a barren that prevents the growth of large seaweeds such as kelp for years.

Adding to the environmental challenge, some management practices of the dairy industry, which has long played a significant role in the New Zealand economy, have contributed to increased nutrients such as nitrogen and phosphorus in waterways that potentially harm ecosystems. New Zealand produces 20 times more dairy products than the domestic market can consume. In helping to feed the world, a problem has evolved for the land and waters of New Zealand.

The government's latest State of the Environment Report (2022) shows that between 1977 and 2013, human influence led to an estimated 74 percent increase in total nitrogen loads into the ocean; a 159 percent increase in nitrate-nitrogen loads; a 48 percent increase in total phosphorus; and an 18 percent increase in dissolved reactive phosphorus (Snelder et al, 2018).

The country's 2018 Land, Air and Water Report showed 192 million tonnes of soil were being eroded in

New Zealand every year, 44 percent of which came from agricultural pastures.

At the interface between land and sea, and woven alongside a goal for economic growth in a new industry for New Zealand, is a native species. A small number of manufacturing companies, along with scientists and government economic development agencies, have determined that products resulting from the country's seaweed resources have maximum impact from a health and environmental perspective. The goal is to scale up while avoiding the exploitation of undersea native forests.

Typically, New Zealand's native seaweed is gathered from the shore after storms by companies, rather than taken from the water, to avoid overharvesting.

Now, there is a move toward ocean farming, with New Zealand seaweed being grown in a nursery for out-planting on aquaculture farms as part of a trial run by Envirostrat.

Seaweed for Industry

Kelp is a key species within the reef ecosystem and beyond. Kelp forests provide important ecosystem services both within the reef zones and further out to sea, including: serving as a nursery for fish species; providing food for fish and shellfish; fixing carbon (kelp photosynthesizes sunlight and convert carbon dioxide and water into food); buffering the intertidal habitats from wave disturbance, thus making the environment more hospitable for a wide variety of marine organisms; and increasing dissolved oxygen, which can be used by marine flora and fauna.



A leader in New Zealand's seaweed industry is the family owned AgriSea New Zealand Ltd. The company processes raw product in a factory and sells it in granulated and liquid form for application by the dairy, dry stock, horticulture, apiculture and equine industries, as well as by lifestyle block owners (those who own small farms) and home gardeners.

As just one example of an AgriSea product, AgriSea Bee Nutrition is produced via a natural brewing process that excludes the use of any chemical, freezing or dehydration techniques that may denature the seaweeds nutrient balance, maximizing the extraction of available ingredients.

AgriSea is focused on increasing the value of seaweed to New Zealand's economy while broadening the scientific knowledge of the significant role that seaweed can play ecologically.

Health Benefits for Agriculture

Marine seaweeds are getting attention for their methane mitigation potential in animal production systems. A series of experiments focusing on a commercial brown seaweed (*Ascophyllum nodosum*) extract (Tasco by Acadian Seaplants Ltd. of Nova Scotia, Canada) found benefits to the antioxidant status of sheep challenged with heat stress and cattle-grazing, endophyte-infected, tall-fescue grass.

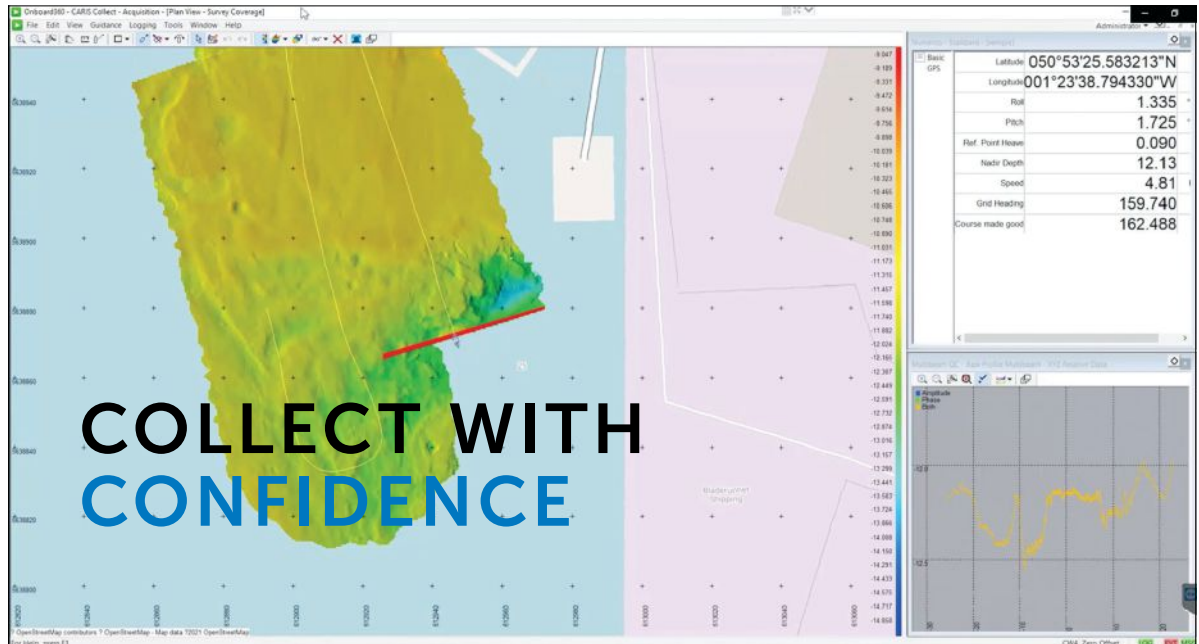
AgriSea has developed a new animal nutrition supplement now scientifically proven to reduce oxidative stress for healthier cows and calves. The Fortress+ Dairy animal supplement has been proven to reduce nitrogen

excretions by up to 18 percent. A Lincoln University study measured nine indicators of dairy cow health for dairy herds under three different nutrition treatments. Of the three, fermented seaweed extract with terrestrial plant bioactives showed the biggest improvements in animal health, before and after calving. The study found an 18 percent reduction just in the nitrogen level of the excretions, which equates to a 25 percent reduction in nitrogen entering waterways.

A published experiment by Matt R. Beck, Pablo Gregorini, Clare Bradley and Ashleigh Browne of the Lincoln University Faculty of Agriculture and Life Sciences, titled "Effect of a Native New Zealand Seaweed-Based Product on Ruminant Health and Environmental Impact," detailed the positive results of testing AgriSea's liquid seaweed "Animal Nutrition" product, which is based on the extraction of the New Zealand keystone species *Ecklonia radiata*. As part of the research, AgriSea's Animal Nutrition was given to late-gestating dairy cows with the hypothesis that it would improve animal production, well-being and health while reducing environmental effect. The objective was to measure animal health indicators either directly or through markers to determine benefits of the seaweed-based extract.

Cows supplemented with AgriSea Animal Nutrition and an added terrestrial plant extract displayed improved antioxidant status and reduced oxidative stress. Researchers believe this may be due to improved energy status by the improved fermentation, or from the extraction of phenolic compounds in the marine seaweed and/or terrestrial plants. Cows supplemented with AgriSea Animal

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AgriSea CEO Clare Bradley (right) and Chief Innovation Officer Tane Bradley (left).

Alternative Proteins

Another focus for production of high-value products from native seaweed is nutrition for humans. Seaweed has been consumed for thousands of years, but researchers believe many of the important nutrients are locked inside the seaweed and aren't readily absorbed by our bodies when we eat it.

Scientists from New Zealand's Crown Research Institute AgResearch are aiming to unlock the health potential of seaweed as a food ingredient, joining counterparts in Singapore in a project funded by the New Zealand government and the government of Singapore. New Zealand has invested \$3.3 million with parallel funding from the government of Singapore's Future Foods research program and partners the University of Otago, University of Auckland, A*STAR, AgriSea, Ideas 2 plate and AMiLi to develop foods using seaweed. The focus is on the species *Undaria pinnatifida*, which is abundant in waters around New Zealand and Singapore and listed among the 100 most invasive species worldwide. Since past eradication programs in New Zealand have failed, encouraging wild harvest of the seaweed from infested coastlines would allow for re-establishment of native seaweed species.

"What we are aiming to do with

this research is develop ways to cook or process the seaweed so that we have flavors and textures that appeal to people, but we also want to look at the health aspect," says AgResearch senior scientist Dr. Linda Samuelsson.

"Seaweed proteins are typically less digestible than animal proteins, so we will be looking at in what form the seaweed can better deliver the nutrients to the person eating it. We'll also be looking at how the seaweed proteins interact with peoples' gut microbiome, the collection of micro-organisms that live in the digestive tract."

In the experimental lab is development chef Dale Bowie, whose career has included working at Heston Blumenthal's Michelin three-star restaurant in the United Kingdom. In the second year of the three-year project, scientists expect to develop a flavorful and nutritious seaweed food prototype.

Water Cleanup

AgriSea is also experimenting with the use of seaweed for a purely environmental purpose: to clean up waterways in New Zealand.

Because of New Zealand's pasture-based farming system, with cows continuously outside, as opposed to

Nutrition plus terrestrial plant extract (Fortress+ Dairy) had greater volatile fatty acid production than the control cows, with added energy likely the reason for the greater body condition score seen in seaweed-treated cows.

Anecdotal evidence from AgriSea's customers also suggests there is a nutritional and health benefit when orally applied to livestock (at 5 ml per head per day). Additional preliminary data collected from in-vitro fermentations indicate the product may alter ammonia release when applied at a similar recommended dosage.

In nature, ruminants use dietary diversity to their benefit. Fortress+ Dairy increases feed diversity by providing a premium multifunctional package of phytochemicals, vitamins, amino acids, minerals and trace elements, which improve animal well-being by preventing cellular damage from oxidative stress.

Brown seaweeds and terrestrial plant extracts are a rich source of highly functional bioactive molecules that have antioxidant and anti-inflammatory properties. The combination of these extracts in Fortress+ Dairy has been scientifically shown to reduce oxidative stress and enhance ruminal fermentation, leading to improvements in animal health, welfare and production.

“The goal is to scale up while avoiding the exploitation of undersea native forests.”

feed-lot farming in which the effluent is collected, there are high levels of nutrient loading on the soils. Many New Zealanders observed the impacts on stream and harbor water quality from an expansion of dairy farming in recent decades, and the government is backing initiatives such as the one by AgriSea.

Seaweed doesn't have root systems, so it grows by pulling nutrients from the water around it. In a trial using locally sourced *Ulva* seaweed, growing conditions mimicking the waters of a New Zealand estuary with high levels of excess minerals such as nitrogen, phosphorous and other heavy metals will be used to test how effective seaweed is in soaking up the nutrients that freshwater plants are currently unable to absorb.

The seaweed is being grown in tanks and will act as a sponge to filter feed on excess minerals—in short, cleaning up the water, which can then be returned to the sea, filtered and clean. The two-year project is a collective effort, with University of Waikato environmental research fellow Marie Magnusson leading the research team.

These examples show how seaweed can benefit the environment, industry, and animal and human health. **ST**

Alison Smith is an award-winning New Zealand-based freelance writer and solutions journalist and author of a work on Captain Cook's first interactions with Maori in the Hauraki-Coromandel region of New Zealand. She has a particular interest in the environmental and marine space and is currently writing about the potential of seaweed.

Clare Bradley is the CEO of AgriSea and supreme award winner of the NZI Rural Women New Zealand Business Awards 2019. She is the newly appointed chair of Aotearoa New Zealand Seaweed Association, working toward a better world through a blue economy and regenerative food production with seaweed.

Dr. Pablo Gregorini is the head of New Zealand's Lincoln University Centre of Excellence for Designing Future Productive Landscapes. He chairs the International Scientific Committee for the Nutrition of Herbivores and serves on the International Scientific Committee for Farm Systems Design and International Scientific Board of ALEPH (interdisciplinary consortium of scientists working on the role of animal foods in healthy, sustainable and ethical diets).

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Optimizing Remote Surveys

Software Advances Vehicle-Based Remote Inspection

By Sarafina McPherson Kimø • Ole Kristensen



A USV survey operated from a remote control room. The remote operator sees several different views, including a map, processed data overview, automated workflow overview, camera view, quality control (QC) visualizations and real-time data being acquired.

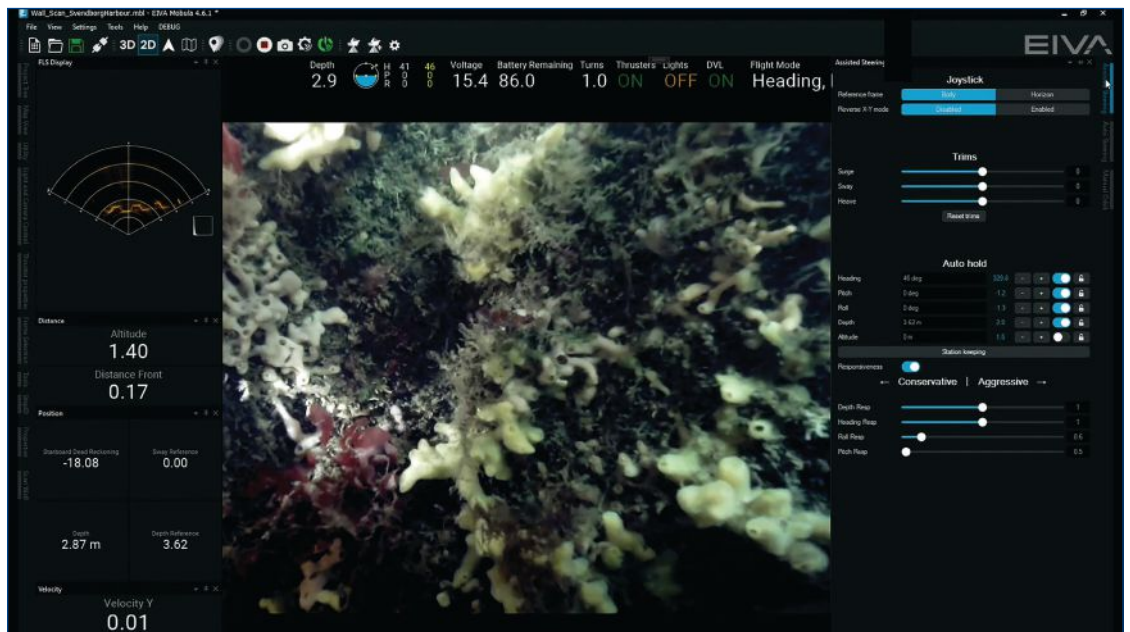
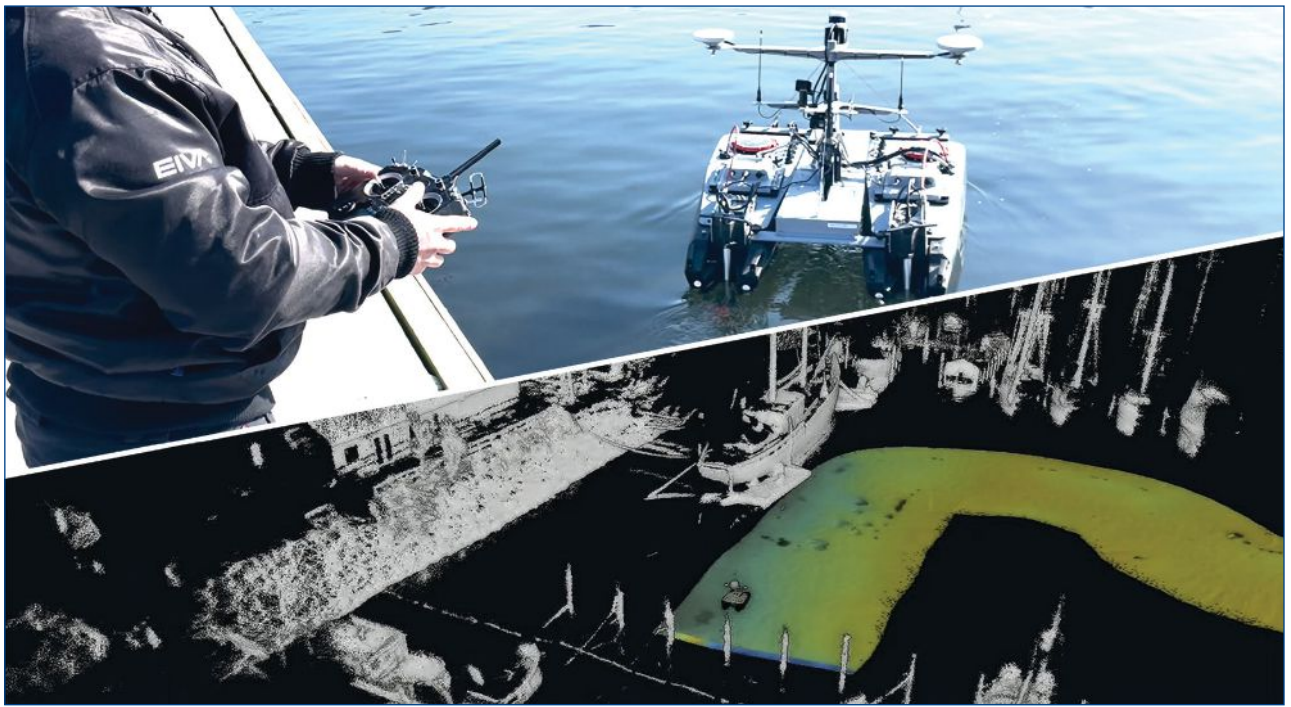
Remote surveys are surging in many maritime industries—likely due to the many benefits they provide. Whether on unmanned or manned vessels, remote surveys help address the low availability of trained surveyors by allowing surveyors to work all over the world from wherever they are. In addition, operations with unmanned vehicles are low-cost, low-fuel and can reach more places—in part, thanks to the fact that they can be lighter and smaller than traditional ones. This enables industry to contribute to understanding our oceans more fully for sustainable development of ocean resources and management of coastal zones—while at the same time

lowering the carbon footprint of these surveys.

In this article, we will dive into the software capabilities that survey solutions must provide for efficient and safe remote operations and show tools you can use for a variety of survey types. The article is written based on the experiences of EIVA, a maritime software and hardware engineering company with over 40 years in the industry. EIVA has worked these past years to develop remote and automated survey solutions.

Essential Capabilities of Remote Survey Software

First, for remote surveys to be viable, operators need

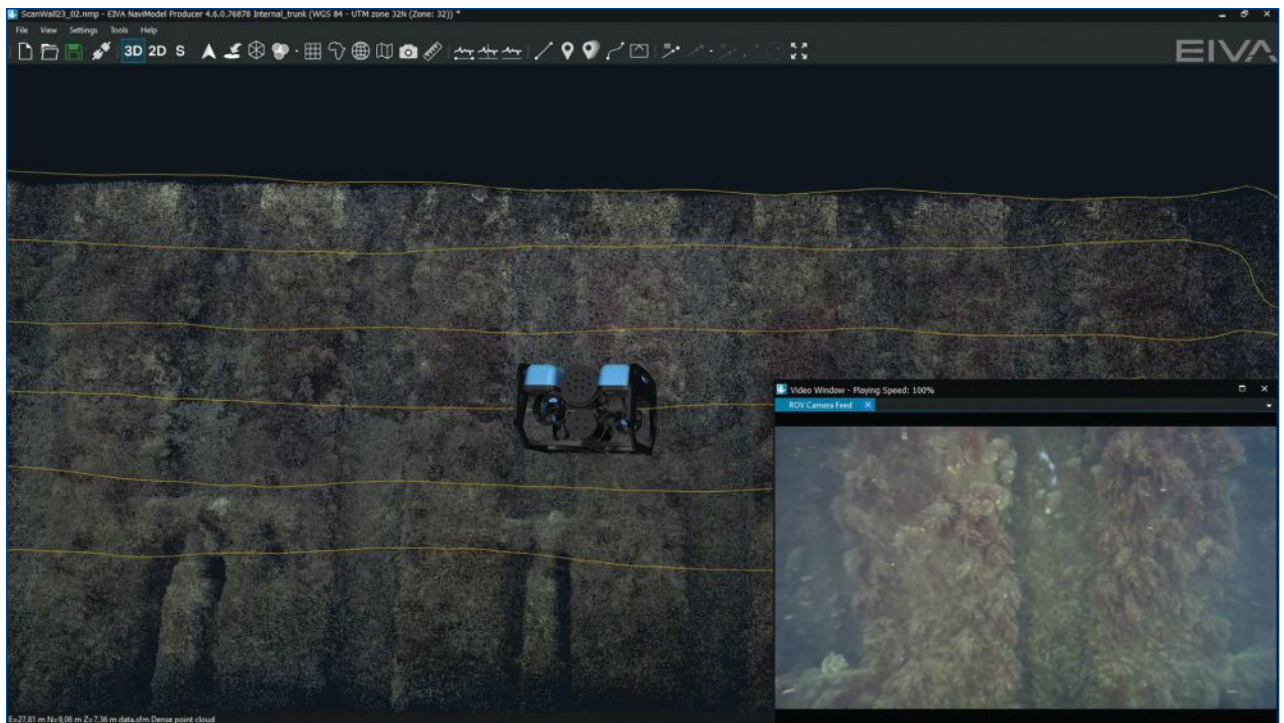


(Top) Data fusion display of LiDAR and multibeam echosounder data (bottom) from a recent sea trial in Denmark with EIVA's USV-16 (top). Remote sea trials have also recently been conducted in Brazil with the Tupan USV from TideWise. (Bottom) NaviSuite Mobula ROV control and inspection software during a harbor wall inspection with a custom user display showing the camera feed, forward-looking sonar and positioning (left), as well as the automated and assisted steering options (right).

reliable remote monitoring of survey operations and safe vehicle control. To provide these, the EIVA team has worked closely with customers and partners, developing and testing integrated solutions with key capabilities.

Real-time data are displayed in a customizable user interface, so operators can react quickly to any inputs from the vehicle. Data fusion functionality acquires and displays different types of data simultaneously, so operators only need to survey once. The software must also support many different types of sensors collecting various data, such as multibeam, LiDAR, subsea lasers, camera, side scan sonar, profiling sonars and more, which is why EIVA's software solutions are sensor agnostic, with the possibility to integrate virtually any sensor.

There are a variety of quality control visualization options, such as displaying density of multibeam data collected in order to immediately spot if there are any holes, so the operator can adjust the route accordingly. Streamed data are compressed for viewing in the remote display with custom settings, so the relevant data are dis-



played in real time even on low-bandwidth connections. Workflows and data processing are automated to create immediately deliverable data, for example, through real-time automated data cleaning with EIVA's data-cleaning tool, EC-3D, as well as NaviSuite Workflow Manager, EIVA's configurable workflow automation tool. These automation tools advance remote surveying by enabling autonomous surveys.

Surveyors can switch between automated and manual survey control modes to take control of tasks requiring their attention, while the software takes care of the rest. Precise vehicle control is possible, for example, by steering and holding position.

Tools Enabling Remote Surveys Of Different Types

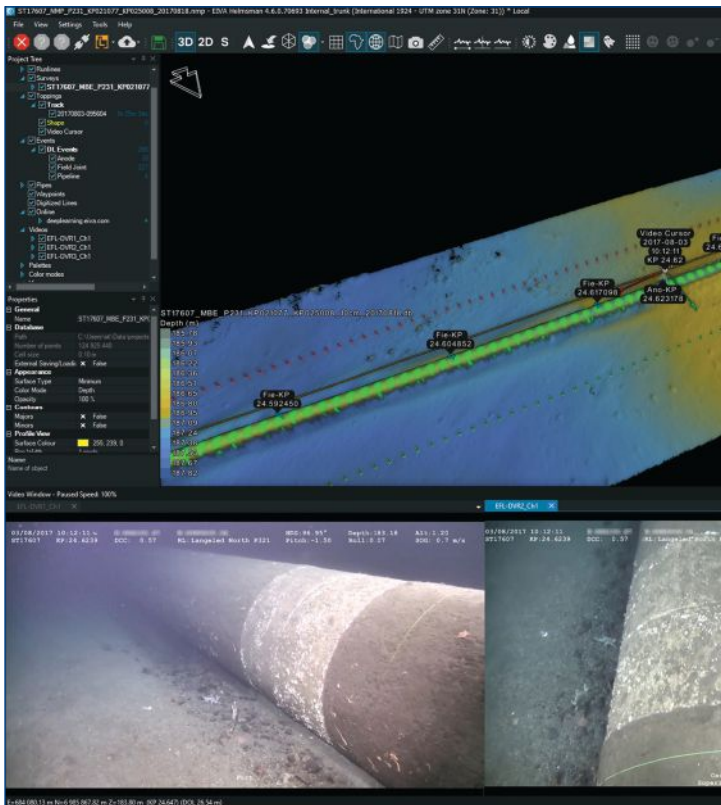
EIVA incorporates these remote survey capabilities into solutions for three main types of survey setups: USVs, ROVs and AUVs.

These setups complement each other by being designed for surveys of different challenging environments/structures.

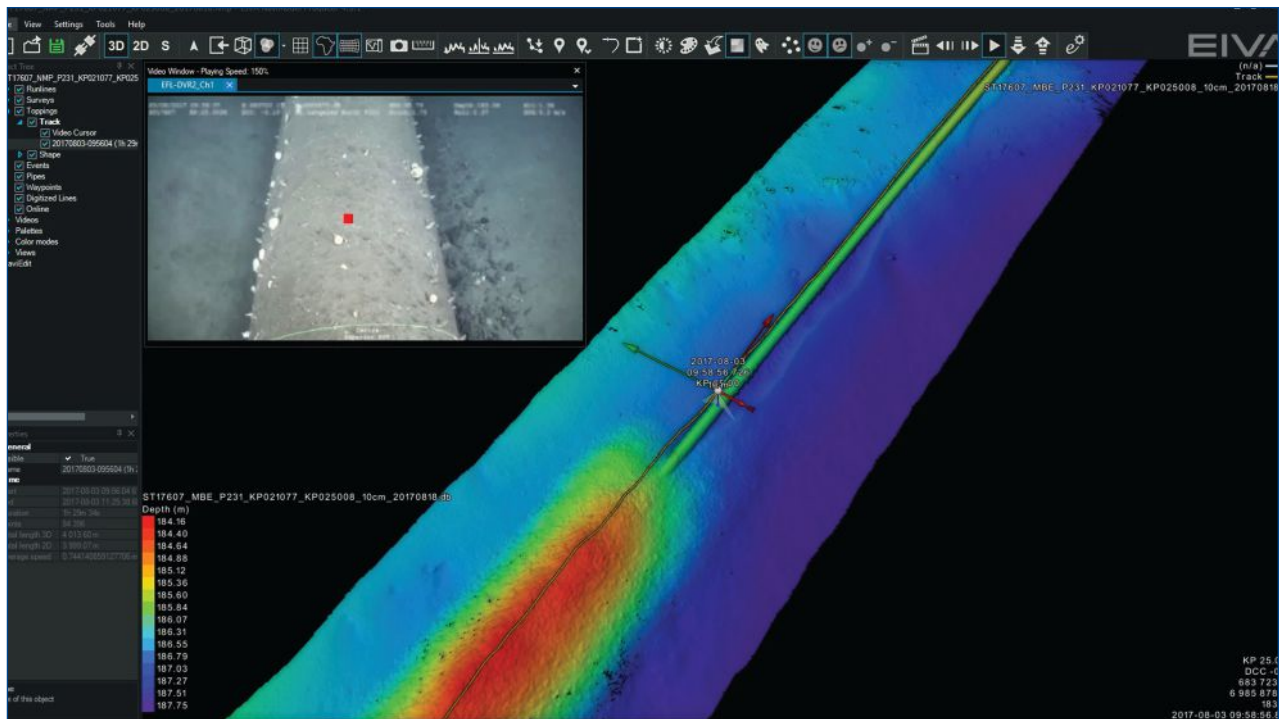
For example, ROV and AUV inspections allow for sur-

veys of subsea structures, tunnels and other areas that cannot be seen from the water's surface.

USVs are ideal for shallow or narrow areas, as Flemming Christensen, the owner of SensorSurvey, a hydrographic survey company, described: "When we encountered areas where we couldn't sail, such as narrow cable trenches or shallow water, we were able to use the small USV we rented from EIVA to continue our survey even in those areas."



(Top left) A harbor wall was inspected with a Blue Robotics BlueROV2 equipped with a camera and using NaviSuite Mobula software. VSLAM was then used to create a point cloud 3D model, which is shown here along with the camera view and a 3D model of the ROV. (Bottom) Automated eventing of NaviSuite Deep Learning displayed with synchronized camera views and 3D model, as well as a log of events (right). (Top right) Pipeline navigation aiding in NaviSuite Nardoa 3D pipeline inspection software.



Surface Vessels Scanning Offshore to Inland

For remote surveying below and above the water's surface with vessels such as USVs, there is EIVA's hydrographic survey software bundle NaviSuite Kuda. In addition to remote surveys, over-the-horizon surveys with a two-man crew have been performed with NaviSuite Kuda—during which the survey operator was in another city (or country, even) than where the USV was deployed. NaviSuite Kuda, in addition to the above listed capa-

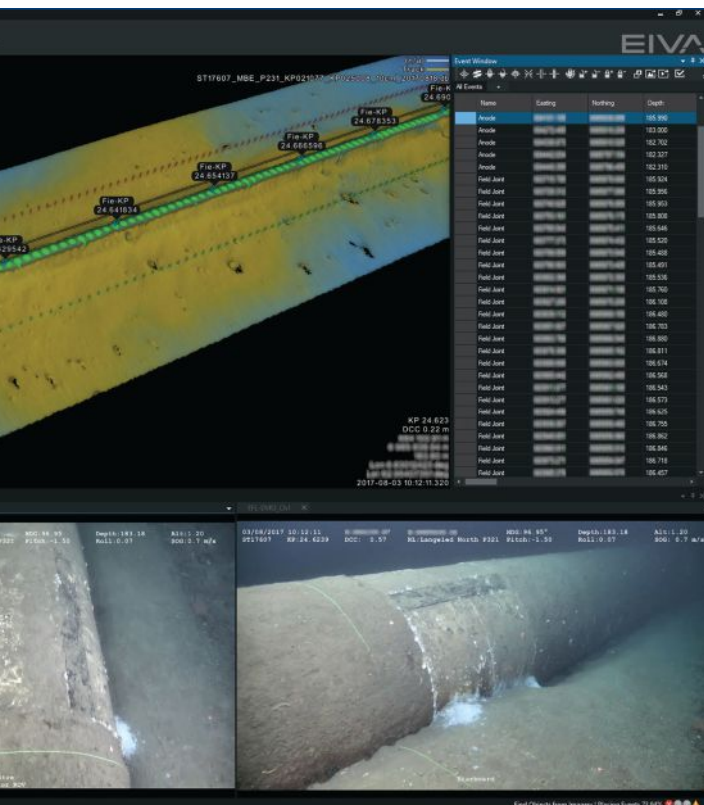
bilities, serves surveyors through automation of runline planning. Increasingly, surveyors must map large open areas, for example, during construction pre-surveys for offshore wind farm sites—which used to mean long hours of monitoring repetitive runlines. To help change this, when survey company Clinton requested a solution for automating this process, EIVA developed the Coverage Assist tool. This tool creates runlines based on previous surveyed lines, ensuring optimal coverage.

"The NaviSuite Coverage Assist tool is ideal for optimally surveying large areas," said Anders Wikmar, survey and technical manager at Clinton. "Through real-time calculations, it can smoothly take into consideration changes in wind, currents and water depth."

In some areas, e.g., harbors or offshore wind farms, obstructions need to be avoided, in which case, users can still use the Coverage Assist tool by defining exclusion zones to avoid or, as a new feature, using real-time LiDAR and sonar data to dynamically avoid obstacles.

With NaviSuite Kuda software it is possible to input runlines to any vessels with an NMEA autopilot. In addition, EIVA's recently launched NaviSuite Kuda – Autopilot ensures safer over-the-horizon surveys by providing the hardware and software setup needed for +/-15 cm precision line-keeping and other useful capabilities, which were not supported by the standardized NMEA APB format, such as battery/thruster monitoring and a hold-position capability.

These tools for safe automation of hydrographic surveys complement the intuitive interface of NaviSuite Kuda, which has recently been tailored to provide a more streamlined overview. Freelance surveyor Rich Lear said about the new interface of NaviSuite Kuda Core: "I think many surveyors will appreciate its simplified setup, since it means you have easy access to the information you need without any other data distracting you."



***“EIVA often needs help beta testing our solutions,
so feel free to reach out if you are interested in getting involved.”***

ROVs Diving Down to Inspect at Any Angle

For ROV inspections of harbor walls, subsea structures, tunnels and more, there is EIVA's ROV control and inspection software, NaviSuite Mobula. In addition to an extensive configurable remote user interface, this software provides precise ROV control with manual joystick steering in 6° of freedom, along with assisted steering modes, such as hold heading or position, and automated inspection modes, such as scan wall or orbit object.

NaviSuite Mobula is available in several variants tailored to different setups, ranging from advanced steering software to a total solution comprising inspection planning to data processing and delivery in the form of video recordings, 3D models and more.

To further automate inspections and improve pilot situational awareness, EIVA is soon releasing VSLAM, a computer vision algorithm that, in real time, creates point clouds from as little as a single camera feed. This makes it possible to use an inexpensive setup to create 3D models during ROV dives in real time, providing pilots with an even better understanding of the ROV's surroundings and, after inspections, serving as data deliv-

erables akin to those created using sonar or underwater laser technology.

AUVs Intelligently Following Subsea Structures

The high level of automation found in these software solutions reflects EIVA's goal to provide the building blocks for autonomous, remote surveys. NaviSuite Deep Learning is a tool for automated eventing based on image recognition with machine learning. The tool has currently been trained to recognize over 20 types of events along a pipeline when used as an extension of EIVA's software bundle for 3D pipeline and cable route inspections, NaviSuite Nardoa. It is also available as a complete image recognition toolbox for any application; for example, it is currently being trained to recognize observations in coral habitats and mussel farms.

The automatically evented observations can be used both as deliverables and as input for navigation-aiding methods. Following the registered anodes along a pipeline is one of several navigation-aiding methods EIVA has developed. Another navigation-aiding method developed uses machine learning to follow the center of a pipe. With a single NaviSuite Deep Learning – Onboard computer, it's possible to integrate these capabilities into AUVs, and with a NaviSuite Workflow Manager – Onboard computer, you can completely automate data processing workflows.

Get Involved in the Future of Remote Surveys

Solutions for remote, automated surveys and inspections make it possible to safely achieve low-carbon operations and take advantage of the skilled surveyors around the world. The above-mentioned solutions have been developed by working closely with survey companies and hardware providers, so real-life needs and the latest technologies serve as EIVA's compass for development. To achieve this, EIVA often needs help beta testing our solutions, so feel free to reach out if you are interested in getting involved. You can, for example, provide survey data, which can be used to train NaviSuite Deep Learning for a variety of applications, from pipelines to corals—or maybe you have a whole new application in mind?

You can reach out at: eiva.com/contact. **ST**

Sarafina McPherson Kimø is content editor at EIVA. She shares news of how EIVA's software and hardware solutions can help solve the challenges industry professionals encounter. You can find her customer case studies, news articles and videos showing solutions in action on EIVA's social media channels or eiva.com.

Ole Kristensen is the vice president of software development at EIVA and one of the team's most long-standing members, having joined in 1993. The totality of EIVA's current line of software products has been conceived of, built, developed and refined under his expertise and sage guidance.

The advertisement is a vertical banner with a blue and red color scheme. At the top, a red banner contains the text "Ocean Engineering" in white. Below this, the main section is titled "Underway Monitoring" in large white letters. Underneath the title, there are four circular images: "OceanPack™ Underway" (a rack of electronic equipment), "MicroPlastic" (a small device), "SOCAT ready" (a circular device with a red stamp), and "pCO₂ GHG Analyzer" (a device with a digital display). Below these images, the text "Modular, easy to use and reliable Auto-calibration monitoring systems" is written. The bottom section is titled "Li-Ion Batteries" in large white letters. Below this title, there are three circular images: "Li-Ion Batteries" (a row of cylindrical batteries), "Vehicle" (a small vehicle), and "Energy Storage" (a yellow battery pack with a red stamp "API17F certified"). Below these images, the text "Highly reliable, efficient and safe underwater power solutions AC+DC" is written. At the bottom of the banner, the SubCtech logo is displayed, along with contact information: "SubCtech GmbH", "www.subcotech.com", and "info@subcotech.com". There are also two certification logos: "UN 38.3" and "ISO 9001".

AUVs as Sustainability Tool

Drones Facilitate Monitoring, Assessment for Blue Economy

By Rob Smets

A sustainable planet, if we are to aspire to one, will need sustainable, far-reaching solutions. The blue economy should be a significant opportunity to help achieve this (<https://oceanfdn.org/blue-economy>).

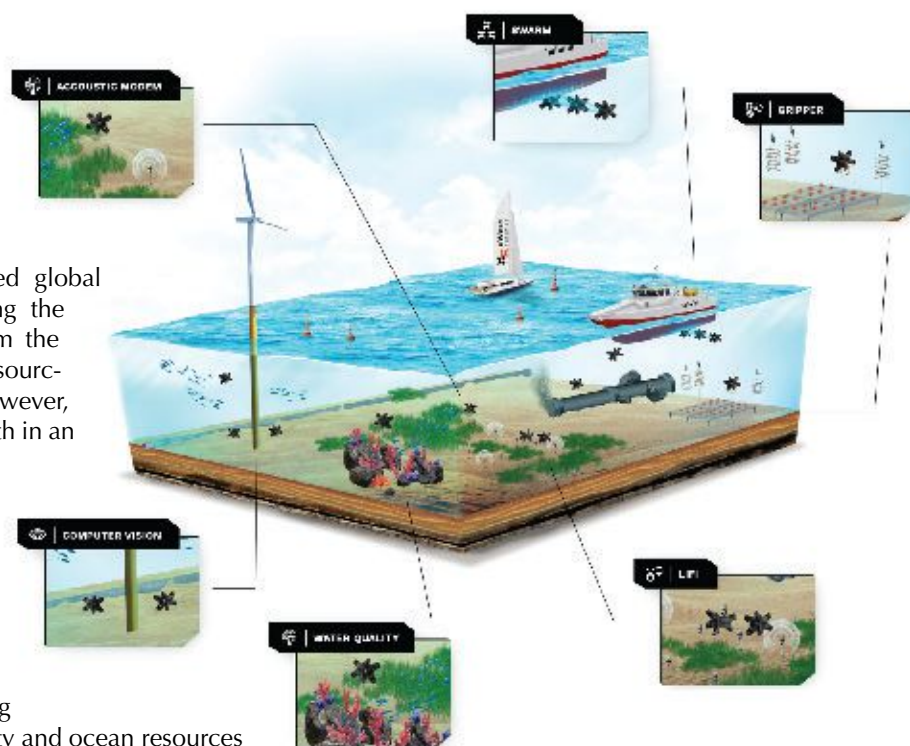
There are currently vast incentives to grow a marine-based global economy, whether for harnessing the phenomenal energy sources from the oceans or maximizing marine resources for fishing and aquaculture. However, the blue economy demands growth in an ecologically sustainable manner.

uWare Robotics is aware that there are potentially conflicting trends regarding ocean resources and coastal management. On the one hand, there is the push to further develop industries based on ocean resources. On the other, there is a growing need to protect marine biodiversity and ocean resources by 2030, as aligned with the United Nations Sustainable Development Goals (SDGs), specifically SDG 14, which aims to conserve the oceans, seas and marine resources and use them sustainably. The ecology-versus-economy dichotomy is an ever-present issue.

This article explores the future of ocean resource development and coastal zone management within the context of the current (and pressing) realities of ecological distress in the oceans and coastal regions. The focus will be on how technological solutions can help ensure the sustainable development of ocean resources.

The Need to Protect Marine Biodiversity and Resources

The oceans are home to 80 percent of the planet's bio-



uWare's vision of technological solutions for coastal management and intervention.

diversity. Major ocean resources include those used for food and nutrition, medicine, renewable energy sources and oxygen/carbon sequestration. The critical importance of the world's oceans for the provision of planetary-wide, regional and local natural systems cannot be underestimated. For example, the oceans produce over 50 percent of the oxygen needed to support life on Earth and have helped absorb between 20 and 30 percent of

(Top) uWare's AUV-based solutions could enable ecosystem monitoring of seagrass meadows. (Bottom) Applications for uWare's tech and software include ship hull monitoring.



In recent years, plastics have become the “canary in the coal mine” issue regarding ocean pollution. The infamous Great Pacific Garbage Patch, a collection of marine debris in the North Pacific Ocean that is twice the size of Texas, grabbed headlines in the 2010s and raised awareness about the extent of the crisis. *National Geographic* estimates that plastic waste into the oceans is set to triple to 29 million metric tons each year by 2040, by which time it is estimated that there will be 600 million metric tons of plastic waste in the oceans.

Why have the world's oceans been this ecologically abused to date? There are numerous reasons. The oceans are

the carbon dioxide generated by human activities in just the past 40 years.

No less than 3 billion people worldwide are dependent on the oceans for their livelihood and a primary source of protein. Coastal ecosystems, such as mangroves and barrier islands, are rich in biodiversity and are critical in moderating the impacts of storms. These coastal regions are also lucrative in terms of tourism and recreation. Take Kenya for example, the country has a 640 km coastline and a total ocean area of 245,000 km². It was estimated in 2017 that the blue economy could potentially add \$4.8 billion to the Kenyan economy by 2027.

Unfortunately, the oceans are under severe stress due to human activities and the creeping ravages of climate change. Oceanic oxygen levels have declined by as much as 40 percent in certain parts of the world over the past five decades, according to *Scientific American*. During the same period, the average amount of oxygen in the oceans has decreased by 2 percent. The impacts of pollution on oceans are devastating and continue to rise. Toxins from pesticides, fertilizers and other chemicals used in agriculture flow into oceans via river systems, while the flow of industrial, nuclear, sewage and other waste streams into oceans (which was legal until the early 1970s) continues with illegal dumping worldwide.

vast and “out there” in our collective conscience and, thus, considered almost limitless in their ability to absorb our waste and pollution. There is a lack of understanding of the complexity and fragility of marine ecosystems, including especially fragile and at-risk coastal ecosystems, such as mangroves and seagrass meadows. Overfishing has resulted from relentless commercial fishing that did not take sustainable fish numbers and marine ecosystems into due consideration. Coastal regions have become overdeveloped for urban habitation and tourism. Pollution has increased due to oil spills, offshore mining and other commercial activities, plus the huge growth in the cruise ship industry. There is also a lack of laws that adequately address and enforce ocean-bound dumping, pollution and other human activities detrimental to oceans.

Development of Industries Based on Ocean Resources

The use of ocean resources does not need to be detrimental to marine ecosystems and coastal regions. According to the World Resources Institute: “Integrated ocean management aims to support a sustainable ocean economy that uses ocean resources in ways that preserve the health and resilience of marine ecosystems and improve livelihoods and jobs, balancing protection and production to achieve prosperity.”

Integrated ocean management should promote sustainable economic development, while protecting coastal and marine habitats and biodiversity. It is imperative that there is an acknowledgment and respect of the fact that the ecosystem must be at the center of any ocean-reliant (including coastal) industry.

We must remember that the oceans add more than \$1.5 trillion to the global economy and are the transportation routes for 90 percent of the world's goods. We have a huge debt to the oceans for those two figures alone, not to mention what they contribute to the planet in terms of oxygen, carbon sequestration and biodiversity.

Sustainable Coastal Management and Development

Coastal management is an important aspect of integrated ocean management. It must, of course, take coastal development factors into consideration, such as the building of ports and other infrastructure, or areas for tourism. However, the monitoring of key biodiversity areas is essential.

The "bridge" between the ever-present dichotomy of development versus conservation can be attained by: harnessing science and knowledge regarding coastal areas and ecosystems; establishing partnerships between public and private sectors; strengthening stakeholder engagement, particularly in local coastal communities; improving capacity-building projects; implementing regulatory frameworks, including at the local and regional

levels; and developing adaptive management systems.

Local stakeholder inputs are essential for coastal management. There are already success stories at the regional level regarding ocean and coastal development initiatives in this regard. For example, the Coral Triangle region, which comprises Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste, has implemented cross-regional processes that ensure the inputs of local coastal communities regarding their social, cultural, economic and political realities. Food security, climate change and marine biodiversity have also been integral to these public processes.

Socioeconomic Challenges of the Blue Economy

The socioeconomic challenges of coastal management are immense when one considers this statement by the United Nations Environment Programme (UNEP): "Some 37 percent of the world's population lives within 100 km of the coast, at a population density twice the global average." It is estimated that 34 percent of the coastal areas worldwide are at high risk of degradation due to development, with Europe having the most high-risk coastal areas (86 percent), followed by Asia (with 69 percent).

Excessive and unsustainable human development results in natural habitat loss, erosion, sedimentation and other ecological detriments to coastal ecosystems. Populations in coastal zones, particularly in poor or develop-



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needed to use technology since any underwater activities are inherently hazardous, even those close to shore.

Underwater robots may sound ideal on paper but they too have their limitations. ROVs have to be tethered and controlled, which limits their range and mobility. Torpedo-shaped AUVs may provide greater autonomy when collecting data, but they too have limited mobility and can be unstable in smaller spaces or when having to make sharp turns.

Technological Solutions for The Blue Economy

A “blue robotics revolution” is in the making. There is a growing range of ocean robotics products and services engineered to support the blue economy with artificial intelligence (AI)-enhanced capabilities.

uWare is aware of the technological limitations highlighted above and so has been working tirelessly for years now to find coastal management, data-related, AUV-based solutions that are intelligent, practical and cost-effective. The company is currently moving its innovation from phase one (coastal ecosystems) to phase two (blue economy) applications. These applications include the mapping, monitoring and inspecting of coastal ecosystems and coastal infrastructure, such as energy-related infrastructure or aquaculture installations, as needed by clients.

So, for example, clients in the mariculture/aquaculture industries could eventually use uWare’s technology and software to track biomass, crop health and the integrity of infrastructure. The company’s products could also help with regular environmental impact assessments (EIAs) and infrastructure inspections at offshore renewable energy installations, including those for wind, wave, solar and macro-algal farms. Port authorities and other entities can make use of the technology for their coastal infrastructure, including ship hulls, port structures or telecommunications-related installations.

uWare Applications

uWare is committed to becoming the standard in autonomous monitoring and assessment for all sustainable blue economy activities by 2030. uWare aims to achieve that by developing disruptive swarm AUV technology that is both smart and cost-effective, as well as end-to-end data solutions.

Our product offerings commenced with the uOne, a highly mobile and cost-effective AUV. It was the first product we developed, of which we are very proud. Our underwater robot or drone has a modular design that al-



(Top) Two uOne AUVs can be combined for cooperation and swarm capabilities. (Bottom) uOne coastal launching setup with travel case, uGroundControl on laptop, laptop protective casing and the uOne ready for action.

ing countries, are particularly at risk. Those communities living in low-lying islands or continental coastal areas are also at additional risk due to rising sea levels as a consequence of global warming.

Technological Challenges of the Blue Economy

Technology cannot solve everything, particularly with something as complex as sustainable coastal management. Current bottlenecks regarding technology include: cost-effectiveness—much of the technology needed for monitoring of coastal ecosystems remains very expensive; reliable data—because of cost and reliance on human bias, gathering consistent habitat and biodiversity data of larger areas remains a very difficult endeavor; data processing—the hardware required to process marine data often has high upfront investment costs that require powerful computers and/or servers, as well as maintenance knowledge; data savvy—technology may require a mix of programs and skills that is not easily found in the marine biology field; autonomous operations—most technology remains dependent on specialist teams and infrastructure; environmental impacts—some technology can be ecologically invasive in its collection of data; and safety—risks prevail if diving personnel are

allows for easy interfacing of sensors, including those for depth analysis, temperature, conductivity, acidity, pH, redox, turbidity and so forth. A GPU-powered internal computing unit allows for real-time computer vision (CV) analysis. It also features acoustic communication that was designed in house for wireless interaction underwater up to a 500-m range at 1 kbps. The uOne features cutting-edge capabilities such as photogrammetry, simultaneous localization and mapping (SLAM) in terms of both positioning and movement, and our very own “uBrain,” which greatly enhances our AUV’s obstacle avoidance abilities.

Our mighty uOne also has eight vectored thrusters allowing 6° of freedom in movement with up to 3-kt. speeds and active hovering with up to 3 kg of payload. The uOne is also light, weighing just 15 kg for easy handling, making it easily deployed and retrieved to and from a boat or from the shore. Lastly, the uOne has up to 4 hr. of underwater autonomy and an easily replaceable battery module.

We have also developed software for data storage and processing with a data platform that uses AI and CV. This hardware and software combo allows for automated 2D and 3D map generation that facilitates environmental and biodiversity data analysis, as well as CV-aided visual inspection capabilities.

We did our first external proof of concept for Innoceana, an NGO based in California, Costa Rica and Spain, in October 2021. It is working on seagrass preservation in Tenerife, mainly showing the effects of pollution, tourism and anchoring to the public and local government. This was an open-water data-gathering exercise where we activated the drone underwater for it to execute grid-type seabed mapping. The drone was completely autonomous during this exercise. You can watch the video of the mission at: www.youtube.com/watch?v=OaUOYNJcpnM.

During the past six months, we have further improved the technology, creating easy interfaces for mission programming, mission monitoring and data visualization. The drone can now be launched from shore or boat

without divers in the water, execute a full open-water data-gathering mission, and come back to the chosen exit point by itself. Currently, we are rigorously testing this mission pipeline in house to benchmark all specs and possible behaviors.

During the next six months, we will focus on validating this technology with external parties. We have ongoing conversations with governments and NGOs for seagrass mapping and general MPA monitoring, as well as with ports for seabed mapping. During this period, we will also finalize the SLAM (simultaneous localization and mapping) capabilities to execute 3D mapping of infrastructure for which we have interest from ports and shipping companies, as well as companies working on wave generators, kelp farms and artificial coral reefs.

As of September, our technology will be available for mapping missions as a service. As such, we are open for early adopters. After this next year of rigorous testing and pilot cases, we will move to full commercialization so our drones can be purchased.

We believe emphatically that uWare’s solution is two-fold in what it can achieve: It democratizes access to underwater data in coastal ecosystems and catalyzes coastal development that is sustainable for ecosystems and communities alike. We believe this to be the proverbial “win-win” scenario within the blue economy that is technologically sound, equitable and, above all else, sustainable. **ST**

Rob Smets is the managing director of uWare Robotics, which pushes the boundaries of cost-effective, autonomous technology for underwater monitoring. He was the European youth delegate at OOC2022 in Palau on Technological Advancements for MPAs and the Belgian youth delegate at UNOC2022 in Lisbon for Ocean Data Mapping.



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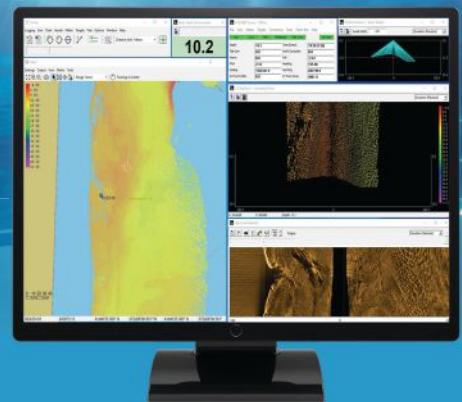
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Sustainable Fishing Gear

Ropeless, Tautline Buoy Systems Decrease Marine Life Entanglement

By Clayton Burke • Wayne MacDougall • Kyle Macleod

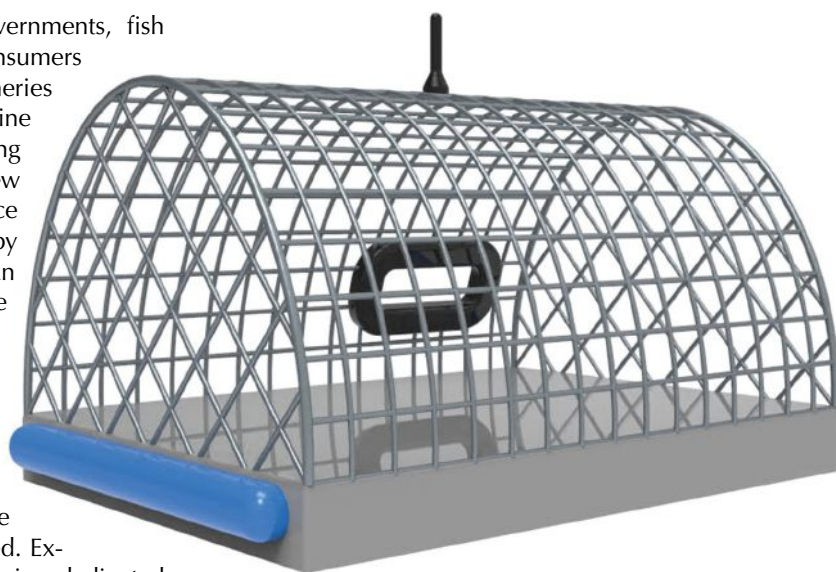
Open dialogue with fishermen, governments, fish markets and restaurants and consumers will allow for safe and sustainable fisheries that lower, if not remove, risk to all marine life. Collaborative efforts in developing ropeless gear, weak-link inserts and new tautline buoys have the potential to reduce entanglement risk to all marine life by more than 90 percent. Ropeless gear can also increase safety for fishing crew. The majority cause of fishing crew casualties, and nearly 20 percent of fatalities each year, is rope entanglement.

Ropeless gear can provide a platform to deploy sensors with fishing gear to monitor acoustics, temperature, currents, salinity, pollutants and much more in each fishing area per season as needed. Extensive data can be collected without using dedicated research vessels with associated costs. The data can be used to monitor the health of species for conservation and establishing future catch limits for a region. The data can also be used to monitor changes in migration patterns, marine noise and chemical pollutants in a rapidly evolving marine environment. A database can inform successful engineering of future fishing designs.

NOAA, the New England Aquarium and Woods Hole Oceanographic Institution have built a solid foundation of published marine research enabling outside agencies, companies and inventors to advance technology in sustainable fishing. SOS Foundation, a designer of ropeless fishing gear and tautline buoy systems, is contributing to this research.

Ghost Fishing and Marine Debris

While ghost fishing gear, marine debris and entanglements from floating nets and ropes are well documented and researched, an equal, if not greater, problem lies



Lobster trap with ropeless system that includes lift bag and antenna. (Credit: All In One Inventions)

unseen on the seafloor. Damaged traps that become disconnected and lost, e.g., during storms, can leave valuable catch to die and attract more sea life that then become entangled. This cycle can change feeding patterns, as ground fish then stay preoccupied with this ghost bait-food. They then do not need to search for active traps, thus reducing catch for the fishing industry.

New regulations in North America favor providing weakened line inserts that act as a fuse breaking the line in the event of entanglement, but this does not prevent or reduce the dangers to marine life. It does, however, assist large mammals by reducing the weight of entanglement from traps, so a mammal can drag away a smaller section of line. This leaves untraceable fishing traps, creating new generations of ghost fishing gear.

Trap bottom with air tank and lift bags at top and bottom. (Credit: All In One Inventions)

Weak-link inserts fitted with GPS tracking for disconnected lines combined with location technology for disconnected gear once breakage occurs is a needed technology improvement that requires more research, with a focus on ghost fishing and marine debris.

With well over 40,000 lost fishing apparatus from 1981 to 2018, according to a report from the Global Ghost Gear Initiative, adding new ghost gear must be prevented. One way of doing this is by taking responsibility for lost and damaged gear, which has been a difficult task.

A simple and effective solution to end new ghost gear is the use of marking with permanent asset management tags. By marking fishing equipment, buoys and lines will allow for a record to identify any recovered lost or damaged gear. Proper tracking will enable recovery costs and compliance issues to be traced back to their source. This is the first and simplest step in assigning accountability for ghost gear and marine debris.

SOS Ropeless System

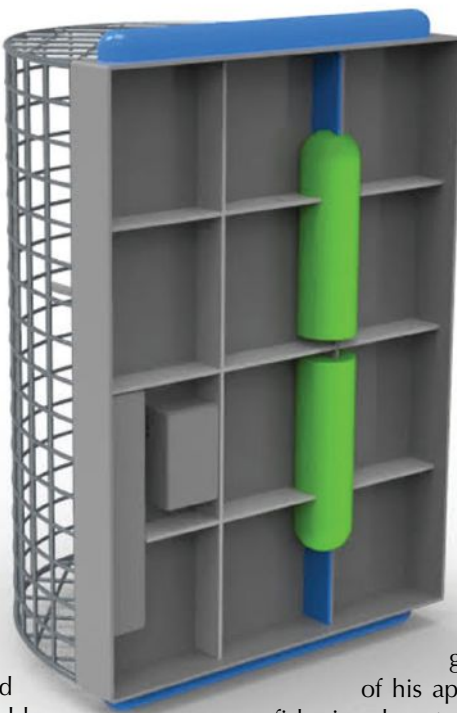
Symphony of Science (SOS Foundation) is a privately funded startup in Nova Scotia, Canada, seeking to find creative solutions for issues having the greatest impact on our ecosystems and lives. It aims to bring companies, inventors, researchers and governments together to coordinate projects for individuals, private organizations and researchers that will improve or create ideas, products and services using independent research and scientific development.

SOS has collaborated on two new commercial fishing systems designed to end marine entanglement issues and fisheries closures. Collaborators include X and LO Marine of New Waterford, Canada (a lobster trap manufacturer and a company of generational fishermen); All In One Inventions of Miami, Florida; and Patent 360 of the Washington D.C. region.

SOS has designed a system to adapt to existing fishing traps/pots and convert them for ropeless operation by using marine lift bags, a compressed tank of air, proven electronics and a rechargeable, replaceable battery. The system operates on radio frequency (RF) signals to control buoyancy of active fishing traps, enabling retrieval of catch, baiting and redeployment of gear.

The ropeless system uses an RF signal from a vessel to fill the bags that will raise the trap and catch to the surface, releasing a drag chute (anchor) attached to a short line. The trap then becomes a buoy, with current and waves keeping the chute and line taut at the surface, allowing for standard grappling and hauling methods.

The design is based on recommendations from com-



mercial fishermen and trap manufacturers and regulations from the Department of Fisheries and Oceans Canada and NOAA. This ropeless system reduces cost and complexity and allows for traditional gear, methods and fishing practices. This design does not use a stored or submerged coil of rope or require new high-cost traps/pots. It can be combined with GPS and/or AIS on a vessel to produce a digital map of fishing grounds with the location of all submerged active gear. This map can be a resource for all marine traffic, a U.S. requirement for the 2023 season and beyond. RF operation will give each vessel captain control

of his approved gear only. Government fisheries departments can then assign dedicated operation channels to each vessel license and retain operational control for monitoring and to check compliance issues.

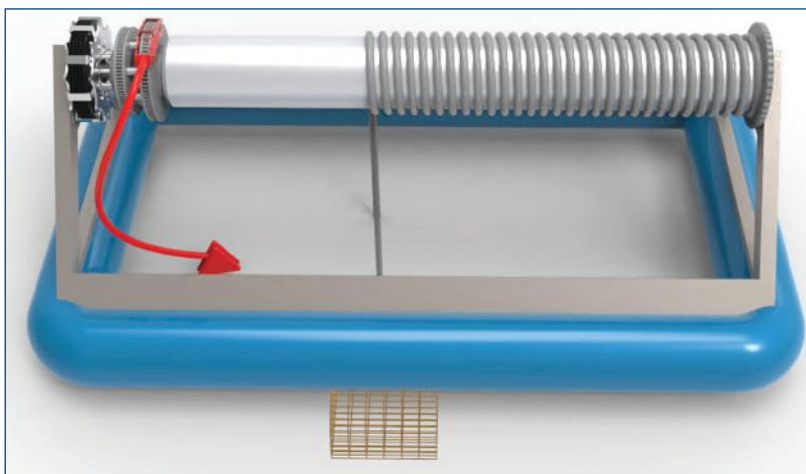
The system has four levels of control. The first level is a signal from an assigned captain/vessel or fisheries department officials allowing fishing operations and compliance and monitoring of the season, species and fishing grounds. The second level is a timed programmable release in the event of delays or equipment failure of an assigned vessel; the trap will rise and signal the fisheries department and other vessels for recovery. The third level is a shock sensor triggered by movement, contact or tampering (either coincidental or intentional); the release will be triggered and a signal will be sent to the captain and fisheries department for real-time monitoring of all traps. The fourth level of control is a battery monitor that notifies when the system voltage drops; an automatic surfacing will result in this case.

The system battery is independent of the GPS unit, and the battery enables signaling and tracking to continue operation in the event of component failure or damage.

Ropeless fishing combined with GPS and AIS will reduce time and exposure for fisherman on rough waters and during bad weather. It will also reduce fuel usage and overall carbon footprint for the commercial fishing industry.

Tautline Buoys

SOS tautline buoy systems are an industry-first design, based on the insight that marine entanglement is caused by slack rope in the water. This extra rope is used to offset the effects of tides, currents and waves. Designing a new buoy and drum assembly allows this reserve of line to become safely wound onto a drum held under medium tension, removing all slack from active fishing traps/pots and



Tautline buoy assembly with surface float attached. (Credit: All In One Inventions)

buoy lines. Tensioned line can be released and rewound to compensate for tide action, weather and waves.

Sea life encountering a tensioned vertical line could, in all but the rarest of cases, suffer abrasion injuries. Whales and other fish approaching with their mouths aligned with this vertical line could initiate entanglement. Without the slack rope to snag or wrap around fins and tails, most marine life could escape severe entanglement.

NOAA's best practice recommendations for commercial fishing state that adding a second buoy to vertical lines removes some slack and lowers risk to marine species. Keeping rope under tension in the buoy removes risk to all marine species large and small. Simply switching buoys to a tautline design will allow safe commercial fishing to continue until ropeless technology and associated tracking networks are perfected and gain acceptance by governments, researchers and fishermen.

Three tautline systems have been developed by the SOS Foundation. One is a passive tautline system for shallow coastal waters in the 100-ft., 30-m range with benefits to sharks, turtles, dolphins and seals, as well as larger mammals. Requiring a tension adjustment on deployment, this system can then be relocated during fishing to similar depths without need of readjustment. A second system is an active tautline fitted with an electric drive on a drum to allow faster action in open waters with stronger currents and provide greater flexibility in the depth placement. The third system is a submersible tautline system for offshore deepwater fishing; it is a hybrid ropeless design.

All three designs use the same framework dimensions and materials, as well as bearings, shafts, drums and covers. This allows for efficient production in a single facility. Shared components and sizing keeps inventory levels lower and makes for easier field service to end-users with basic tools and skill levels, providing a stable product for long-term use.

Consultations with hundreds of fisherman both commercial and indigenous, as well as trap manufacturers

and marine scientists, revealed that SOS tautline buoys are a less restrictive, reasonable solution to meet or exceed current regulations and protect livelihoods and marine life without the higher costs associated with training and the reliability challenges facing current ropeless designs.

SOS submersible buoys will share construction materials and component parts, along with different sensors and electronics similar to the SOS ropeless system. The buoys will be hollow with an internal bladder to control buoyancy. Upon deployment, the system will vent the bladder and coil fishing line onto the drum resting

on the seafloor with traps. An RF signal from the vessel will fill the bladder for controlled ascent to the surface for recovery.

These tautline buoys can also be used by divers, salvage operations, governments and researchers. Similarly, submersible tautlines will have applications for military/navy to deploy sensors and equipment, preventing tampering or detection while allowing for ease of recovery with precise location.

SOS tautline buoy and ropeless systems are pre-production ready, and units could be available by the end of this year. Target markets include commercial fishing, research, government and military. Applications include the safe recovery of valuable seafood products, research equipment and sensors. This technology could also provide data for governments and defense needs by functioning as platforms to monitor coastal regions and harbors for homeland security purposes.

Acknowledgments

SOS would like to recognize the dedication and passion of generations of marine scientists and fishermen and the cooperation of governments in the development of sustainable fishing technology. SOS would like to thank, including and not limited to: NOAA, Canadian and U.S. fisheries departments, the New England Aquarium and Woods Hole Oceanographic Institution.

References

For a list of references, contact Kyle Macleod at: contact@sosfoundation.com. **ST**

SOS Foundation is open to offers of investment, licensing or sale of its tautline buoy and ropeless systems (either separately or combined). SOS is also open to requests from those needing design or engineering assistance. Inquiries are welcome at: contact@sosfoundation.com, waynemacdougall@hotmail.com or claytonaburke@outlook.com.

Clayton Burke is co-CEO and co-founder of SOS Foundation.

Wayne Macdougall is co-CEO and co-founder of SOS Foundation.

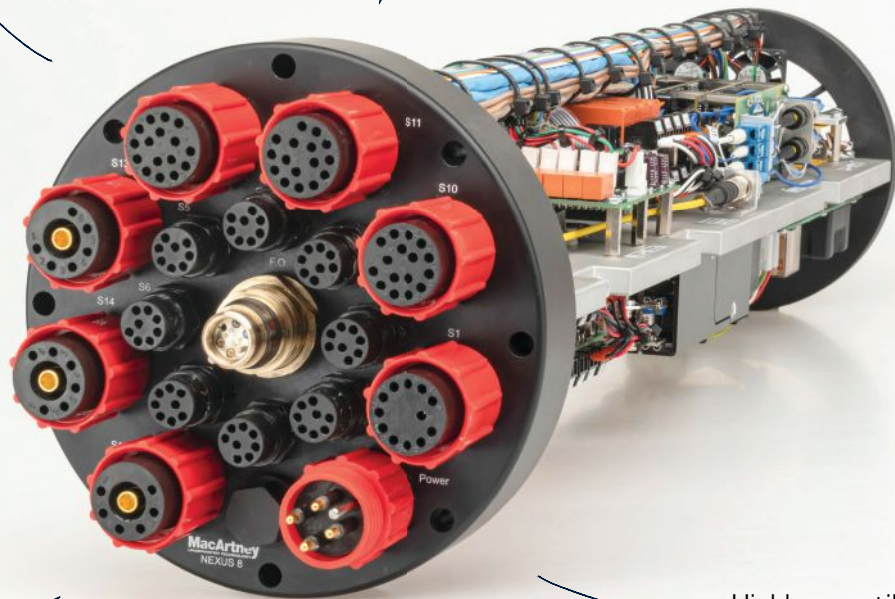
Kyle MacLeod is the chief information officer of SOS Foundation.

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AiP for Vessel to Collect, Process Plastic Waste

Bureau Veritas has awarded an approval in principle (AiP) to the MANTA, a pioneering vessel offering solutions for collecting and repurposing floating plastic waste in areas of high marine litter concentration, in the coastal waters of most affected countries and near the estuaries of major rivers.

A 56-m-long, 26-m-wide and 62-m-high sailing ship, the MANTA will be equipped with an onboard factory, including a waste-to-energy conversion unit. The vessel will be the first concentrated ecology and technology factory ship capable of collecting and processing floating ocean waste en masse before it gets fragmented, starts to drift and penetrates the marine ecosystem in the long term. The MANTA is due to set sail at the end of 2025. It will be powered by a combination of renewable energy technologies to minimize its carbon footprint and achieve 50 to 75 percent energy autonomy. It will also serve as a state-of-the-art scientific laboratory.

Opsealog Digitizes Fleet in France

Opsealog, a provider of digital performance management solutions for shipping, has partnered with French ferry operator La Mériidionale to digitize and optimize the operations of its fleet, which transports passengers and cargo between France, Corsica and Morocco. Opsealog's reporting software, Streamlog, has been deployed on all four of La Mériidionale's vessels from January 2022. This has enabled the ferry operator to digitize its environmental reporting, with automated reports generated to ensure compliance with the requirements of the EU's Monitoring, Reporting and Verification (MRV) regime and the International Maritime Organization's Data Collection System (DCS). Daily noon reports and performance dashboards and alerts are now available for managers through Opsealog's performance management application, Marinsights.

Funding for Hydrogen Ships in Norway

SeaShuttle, the ambitious project to build two hydrogen-powered, remotely controlled and autonomous-ready containerships for delivery by 2025, has secured 150 million NOK (€15 million) in funding from Norwegian state enterprise ENOVA. The bold scheme, led by multimodal transport and logistics group Samskip and marine robotics specialist Ocean Infinity, envisages two SeaShuttle ships operating emissions-free between Oslo Fjord and Rotterdam, each powered by a 3.2-MW hydrogen fuel cell.

Fugro Joins EMODnet

Fugro is now an associated partner of the European Marine Observation and Data Network (EMODnet), a long-term EU initiative to make diverse sources of marine data freely and uniformly available to all. Beneficiaries of this work include policy makers, scientists, private industry and the public. The Fugro-EMODnet partnership

will focus on expanding private sector collaboration and marine data sharing in support of a sustainable blue economy.

Planned partnership activities tightly align with Fugro's involvement in two global ocean science initiatives: The Nippon Foundation-GEBCO Seabed 2030 Project and the United Nations Decade of Ocean Science for Sustainable Development 2021 to 2030 (Ocean Decade). An early output of the partnership will be the direct delivery of crowdsourced bathymetry acquired by Fugro for Seabed 2030 into the EMODnet data services.

Rolls-Royce to Develop Hydrogen Electrolyzer

Rolls-Royce is entering the hydrogen production market and acquiring a 54 percent majority stake in electrolysis stack specialist Hoeller Electrolyzer, whose innovative technology will form the basis of a new range of mtu electrolyzer products from its Power Systems division. Hoeller Electrolyzer, based in Wismar, Germany, is an early-stage technology company that is developing highly efficient polymer electrolyte membrane (PEM) stacks, under the brand name Prometheus, for the cost-effective production of hydrogen.

Hydrogen is an increasingly attractive power source to fuel the green energy transition, and demand for "green" hydrogen, whose production creates no CO₂, is expected to rise significantly. It is needed for fuel cells and hydrogen engines, for the production of synthetic "drop-in" fuels and for industrial processes that currently use hydrogen not created in a carbon-neutral process. High-performance electrolyzers are a key component of any hydrogen system.

Dredger Customization for Mining Plant

Damen has delivered a customized cutter suction dredger, type CSD500, to a mining plant in Eastern Africa, just weeks after receiving the order. Customization included an increase in the dredging depth and addition of a spud carriage installation and customer-specific dredging instrumentation. Dredge pump revolutions and depth indications are made available as digital signals for the customer's operational software.

Van Ameyde Marine Expands in Singapore

Van Ameyde Marine, a Netherlands-headquartered marine surveying, consultancy and loss prevention group, is expanding its operations in Singapore to meet growing demand for a range of insurance-related services across the Asia-Pacific region. Van Ameyde Seaasia, now wholly owned by the group to provide claims management support to Singapore's marine insurance network, is ramping up its in-house capability to meet wider market demand.

The investment is partly due to the geographical importance of Singapore across the maritime, offshore and energy markets.

Data Visualization Portal for Seabed 2030

Terradepth and The Nippon Foundation-GEBCO Seabed 2030 project have announced a new partner-

ship that will utilize Terradept's geospatial data portal known as Absolute Ocean. Seabed 2030 will use Absolute Ocean as a data visualization and exploration tool as part of the international effort to map the entire ocean floor. Absolute Ocean will provide Seabed 2030 with a secure platform to allow data contributors to visualize their contributions in an interactive way and explore how they relate to other open-source data in the platform.

Ocean Pollution Data Collection

Kaiko Systems will join forces with Eyesea on marine pollution reporting. Eyesea is a nonprofit with a mission to map global pollution and maritime hazards. Its mobile application allows individuals to submit geotagged photographs, which the organization plans to use to identify what makes up maritime pollution, its density and where cleanup efforts can have the greatest impact.

ABB Divests Turbocharging Division

ABB will spin-off Accelleron (formerly ABB Turbocharging), its turbocharging division, by way of a dividend in kind of Accelleron Industries Ltd.'s shares to ABB's shareholders. Accelleron's listing on SIX Swiss Exchange in Zurich is planned for October 3, 2022 and is subject to, among others, approval by ABB's shareholders. ABB's shareholders will be able to realize the full value of Accelleron, while ABB continues to simplify its portfolio and focus on the megatrends of electrification and automation.

Iris Innovations Expands in Florida

Iris Innovations, specializing in rugged, affordable, onboard camera security and situational awareness systems, has opened a new U.S. office in Fort Lauderdale, Florida. The location allows Iris Innovations to enhance its presence in the U.S. and work more closely with customers in this key maritime market.

Seafarer Training Company Acquisition

FMTC Safety continues its global expansion by acquiring Houma-based On-Site Training & Instruction. With this acquisition, the Houma location now offers certified OPITO safety training for oil, gas and Occupational Safety and Health Administration (OSHA) workers. Later this year, the company will obtain the certified STCW accreditation and offer various STCW safety training courses for seafarers. FMTC has other locations in the Netherlands, France and Saudi Arabia.

Aquatec Moves into Canada

British through-water communications and subsea integrity specialist Aquatec has expanded its operations to Canada by establishing a presence at COVE, the Centre for Ocean Ventures & Entrepreneurship in Dartmouth, Nova Scotia. Now also trading from Nova Scotia under its new Canadian-registered denomination, Aquatec Subsea Inc., the company is investing in its North American expansion and taking strategic actions to consolidate its operations. Aquatec has also joined Canada's Ocean Supercluster. **ST**

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Sanction Data for Compliance



In addition to providing consolidated vetting data to enable faster and more efficient decision making, Mainstay Core provides a comprehensive snapshot view of sanction data to support compliance for ship charterers. It also minimizes the risks for ports and terminals at a time when the maritime industry is facing more than 2,000 sanctions due to the war in Ukraine. MIS Marine.

Electronic Protection

The electronic DC breaker (EDCB) and electronic bus link (EBL) guarantee selectivity and safety through ultrarapid fault detection and disconnection. This ensures complete redundancy in DC power distribution for fully electric and hybrid vessels. With microsecond range response, both devices provide maximum system protection and ride-through capability for DC hubs. Yaskawa Environmental Energy/The Switch.

Video, Communication System

CON-3700 console consolidates the Outland video and light system with the Amron communicator into a single, compact case for dive teams. Options include a smart camera controller with dive timer and tender headset. Outland Technology Inc. and Amron International Inc.

Hybrid Network, Terminals

KVH ONE hybrid network and TracNet terminals offer fast, reliable connectivity at sea and at the dock. The KVH ONE network includes

276 million sq. km of satellite coverage using KVH's global, layered HTS network, powered by Intelsat. The TracNet H30, H60 and H90 terminals feature satellite, cellular and Wi-Fi technology under one dome, with intelligent, automatic switching based on availability, cost and quality of data connection to continually deliver the best performance. KVH Industries Inc.

Explosion-Proof Motor



An ATEX/IECEx explosion-proof motor, the dKD280 is designed for the marine and offshore markets. Named after the 280 frame size, it meets Zone 0 classification, so it is suitable for use where an explosive gas atmosphere is present continuously or for long periods. It will commonly power combined anchor/mooring winches; hydraulic power units; axial and radial fans for ventilation and air conditioning; and pumps. BEN Buchele Elektromotorenwerke GmbH.

Ship Stability Management

DNV has awarded type approval to NAPA Stability, a new onboard stability solution that will replace NAPA Loading Computer, a stability management solution for passenger ships. As a cloud-based solution, it gives shore-side teams and crew a much clearer picture of their current loading condition in order to assess risks on an ongoing basis and allows faster collaboration and communication of vital information with third-party emergency response services when necessary. NAPA.

SEA TECH e-NEWS

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Oyster Aquaculture Could Improve

Potomac River Estuary

Oyster aquaculture in the Potomac River estuary

could result in significant improvements to water

quality, according to a new NOAA and U.S.

Geological Survey study published in Aquatic

Sciences. The study found that oyster aquaculture

could improve water quality in the Potomac River

estuary by up to 40 percent of the dissolved oxygen

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Remote IT Compliance



ITLink OS Updates enables remotely managed updates of IT operating systems (OS), thus enhancing cybersecurity. This tool allows for complete standardization of IT across a fleet. It provides first-line protection against cyber threats and improved performance of PCs and servers by ensuring operating systems have the latest updates and security patches. The tool also reports status to a shore-side dashboard. Marlink AS.

Explosive Ordnance Ops Logbook

Logbook 018, the Marine Explosive Ordnance (MEO) Operations Logbook, is designed to be used by MEO operatives to log, in detail, the exact work they carry out, such as survey, identification and disposal activities. There are separate sections for recording details of examinations and certifications held; training courses attended; and individual MEO field activities completed. International Marine Contractors Association.

Consumer Monitoring Solution

Radian leverages real-time asset and sensor data to enhance management solutions for industries engaged in a two-step distribution

model. Manufacturers, dealers, marina operators, boat clubs and financial institutions can all customize and prioritize their unique access to the aggregated data by selecting the most relevant data to their enterprise. By overlaying the time-stamped movement of each unit with hundreds of product-related attributes, Radian's platform delivers greater insight into what is selling, how quickly and why. Radian IoT Inc.

Oil Spill Response, Prevention

Known in its earliest conception as the "FUG Boom," the Sea Sentry oil containment boom has been reintroduced to the market. It is the preferred heavy-duty inflatable oil boom of the U.S. Navy. The boom is available on purpose-built pallets or on a hydraulically operated boom reel. QualiTech Environmental Inc.

Noise-Free Bearings

Vesconite bearing materials have unusually low co-efficients of friction, so there is little squeal in these bearings, thus reducing environmental impact. Running dry on stainless steel, Vesconite has a co-efficient of friction of 0.12 to 0.15; Vesconite Hilube has a co-efficient of friction of 0.08 to 0.12; and Vesconite Superlube has a co-efficient of friction of 0.05 to 0.08. Vesconite Bearings.

Hydrogen Generator

Si+ is a revolutionary porous silicon material that has the ability to generate ultrapure hydrogen from a

water source. It acts as a solid-state, hydrogen-generating material that is compact, robust and easily transportable. Its features solve many of the issues that have inhibited the growth of the hydrogen economy. Si+ is the first distributable, long-duration energy storage material of grid parity. EPRO Advance Technology Ltd.

Voyage Planning, Management

The latest release of My Fleet version 1.11 includes the new "Voyage Order" feature to improve collaborative voyage planning between stakeholders on shore and on board. Voyage Order is designed for the specific needs of the charterer, operations and marine management. The service provides a quick analysis of the time and distance required for a particular vessel, taking into account all critical navigational requirements, to load and bring its cargo to the desired destination, including advanced calculation of two-leg voyages. ChartWorld GmbH.

Lubricating Marine Grease

Clarity Synthetic EA Grease 0 is an anhydrous calcium-thickened lubricating grease based on biodegradable synthetic esters that meet the parameters specified in the 2013 Vessel General Permit (VGP) rules for environmentally acceptable lubricants issued by the U.S. Environmental Protection Agency. The grease is suitable for rudder carrier pumps, slides, hinges and propeller caps. Chevron Marine Products LLC. **ST**



Report Sees Future Training Involving More Digitalization

The Inmarsat report "A Fair Future for Seafarers" says that tomorrow's seafarers will train to become more agile in the workplace with less "singular specialization" and more emphasis on continuous professional development. The availability of ever-changing digital tools and technology in training is vitally important to a global workforce, which, undoubtedly, will need increasingly higher levels of technical training in the future.

OneLearn Global (OLG), headquartered in Cyprus, has welcomed these findings. OLG provides digital training solutions and offers a rapidly growing content library via a next-gen learning management system designed to deliver an enhanced, engaging, personalized, intuitive and enjoyable learning experience through digitalization.

Solar-Electric Ferry Supports Tourism in Germany

A solar-electric ferry is now running in the Baltic Sea: a 14.65-m-long, emission-free vessel operating between the village of Kamp on the mainland of Germany and the sunny island of Usedom, part of the popular 350-km Berlin – Usedom cycling route.

The solar ferry travels the same route as the previous, diesel-powered ferry, which lost its operating license a couple of years ago, creating a problem for the tourism industry in Kamp.

The *Antonia vom Kamp* operates at 8 km/h with a max speed of 15 km/h and is propelled by a single, 60-kW Deep Blue electric azimuth thruster (rudder propeller). The system is completed by two Deep Blue batteries with a total capacity of 80 kWh and a 4.3-kWp solar installation. The new solar-electric propul-

sion system will save an estimated 20 tonnes of CO₂ every year.

Initiative to Eliminate 'Sail Fast, Then Wait'

NAPA has become one of the founding and coordinating members of the Blue Visby Consortium, which aims to help the shipping industry eliminate the wasteful practice of "sail fast, then wait" (SFTW) through a collaborative platform.

Combining an innovative contractual framework and state-of-the-art digital technology, the Blue Visby solution optimizes arrivals, enabling vessels to reduce speed and emissions without impacting commercial performance.

By tackling SFTW, which sees ships sailing at speed across oceans only to wait at anchorage outside ports, the Blue Visby solution will help reduce emissions for maritime journeys by 15 percent on average. If applied globally, the solution has the potential to reduce the carbon footprint of the global shipping fleet



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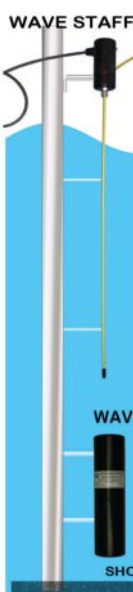
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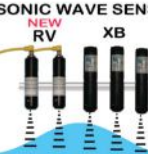


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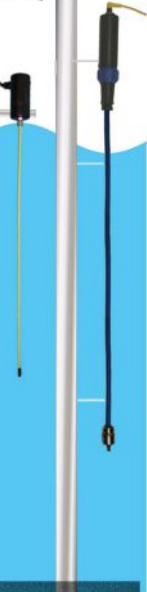
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by more than 60 million tonnes of CO₂ per year, which is larger than the total emissions of Norway.

NAPA joins the Blue Visby Consortium as a technology provider, contributing its digital and voyage expertise to help optimize and stagger arrival times for groups of vessels traveling to the same port. Taking into consideration parameters such as the performance and characteristics of each vessel, port congestion at destination and weather conditions, the Blue Visby algorithm provides an optimal target arrival time for each vessel, while keeping the order of arrival as if the vessels had sailed independently without the solution. This enables vessels to slow down, cutting their fuel consumption and emissions but still “keeping their place in the queue” so they can arrive one after the other, which reduces unnecessary waiting times outside ports.

The Blue Visby solution includes an innovative contractual framework to address the problem of so-called “split incentives.” It introduces a sharing mechanism that enables stakeholders on each voyage (shipowners, charterers and cargo interests) to share the costs and benefits of the implementation of the Blue Visby solution, including fuel savings, the costs of a lengthier journey and the financial value of emissions reductions where applicable. This contractual architecture is designed to be compatible with the standard terms of maritime contracts and does not require any new legislation or regulations.

Based on extensive analysis of 2019 shipping data from 150,000 voyages by 13,000 cargo ships in the 150 most visited ports, NAPA estimates that Blue Visby will enable vessels to reduce speed by about 1 kt. on average, well within the operational parameters of the existing commercial fleet. Speed could be reduced on 87 percent of the voyages, leading to shorter idle times and significant emissions savings.

AI Platform Lowers Fuel Consumption, Emissions

Every summer, ferries transport crowds of visitors between islands

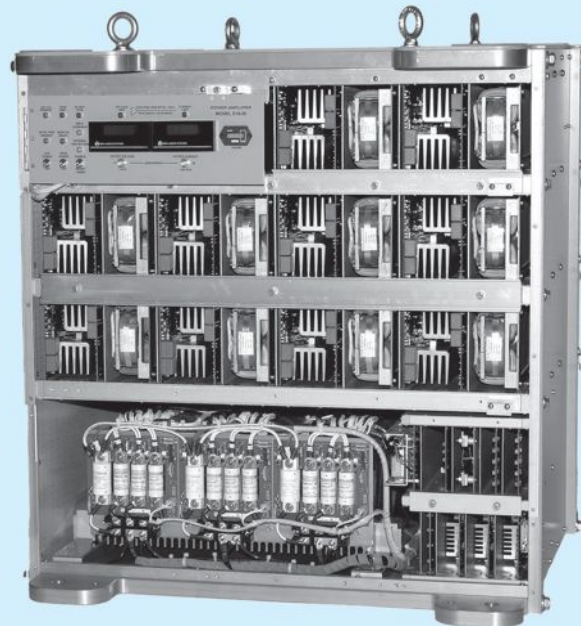
in the Swedish archipelago. With the help of a new AI platform, each ferry can now reduce its fuel consumption by 10 to 25 percent, which contributes to a significant reduction in CO₂ emissions, according to the results from long-term testing.

A ferry's fuel consumption can vary by as much as 60 percent on the same route. One factor is how the captain drives. Cetasol's new

digital platform, iHelm, developed with Semcon, uses AI to enable a captain to save a lot of fuel. iHelm processes large amounts of data from various sources, such as driving patterns from experienced captains, weather data, GPS positioning and ocean currents. Based on the data, it shows the captain how to drive as energy-efficiently as possible. The platform will apply to future electric or automated operations. **ST**

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environmental monitoring

Grant to Study Best Growing Conditions for Sea Veggies

Researchers from Florida Atlantic University's (FAU) Harbor Branch Oceanographic Institute recently received the first FAU Research Cores Internal Pilot (RCIP) Grant to support a water sample nutrient analysis project with FAU's Research Cores Water Analysis Lab (WAL) facility. The awarded funding will be used by researchers Megan Davis, Ph.D., research professor; Paul Wills, Ph.D., research professor and associate director for research; and Jordon Beckler, Ph.D., assistant research professor, to further investigate optimal growing conditions for various species of the halophyte "salt-loving" plant, also known as sea vegetables, for the purpose of applying the findings to commercial growth, harvest and sale of sea vegetables for human consumption.

Water sample nutrient analysis

researchers were awarded \$5,000 and will be using FAU's WAL facility to measure the water chemical compositions and nutrient concentrations in water samples taken from sea vegetable tanks in the Integrated Multitrophic Aquaculture system (IMTA) at Harbor Branch. Water samples will be collected and analyzed daily and before and after sea vegetable reservoir water changes, which are set to occur weekly. The concentrations observed will provide insight into the microbial processes and nutrient cycling yielding optimal growth of the plants.

The newly established RCIP grant program provides investigators access to FAU Research Core services for projects that have the potential to obtain external and competitive grant programs targeted to the subject matter. The pilot awards are offered to FAU researchers in sums of \$500 to \$5,000 for use at any of

the current FAU Research Core facilities.

Cayman Seabed Survey

The UK Hydrographic Office (UKHO) has completed a seabed mapping survey for the Cayman Islands, uncovering information about the depth and nature of the seabed and its ecosystems.

Geospatial data from the six-month study, launched in November 2021, were gathered over the land and in the sea around the islands to depths of around 40 m.

The data will support the islands' maritime trade and economic growth by shedding light on the seabed in the surrounding waters, enabling safe navigation and helping to drive the territory's sustainable blue economy.

Oil Pollution Sensors Installed Along Upper Great Lakes

Lake Superior State University's (LSSU) Center for Freshwater Research and Education (CFRE) has expanded its many conservation

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efforts through the strategic deployment of oil pollution sensors along Upper Great Lakes shorelines.

LSSU teamed with Ann Arbor-based LimnoTech on the sensors. LimnoTech fabricates and operates such sensors in the Great Lakes. Now, three have been placed along the St. Marys River and one is off the coast of Sugar Island.

Lake State and LimnoTech received \$10,000 in rapid-response funding from the Cooperative Institute for Great Lakes Research to underwrite the cost.

The sensors measure refined oil in the water and send the measurements via a cellular device to a cloud server for real-time data availability. The sensors form part of a pilot initiative to help establish a monitoring network to enable expeditious detection and amelioration of future oil spills in the Great Lakes.

Microplastics Found in Vital Marine Areas in Norway

A study on sediments and offshore fauna conducted by DNV, with support from the Norwegian Retailers' Environment Fund and in collaboration with the Norwegian Geotechnical Institute, has revealed that volumes of microplastics were detected in vital parts of Norway's marine systems.

Human activity globally generates nearly 370 million tons of plastic every year and is forecasted to keep rising, despite a marginal slowdown during the COVID-19 pandemic. In Norway, every citizen disposes on average more than 100 kg of plastic annually.

A significant part of microplastic pollution in aquatic environments originates from factories, discharged waste, and the weathering and loss of plastic equipment used in aquaculture, shipping and the oil and gas industry. In Norway, the major sources of plastic detected on beaches are packaging and consumer products, such as plastic bags and drinking bottles, and materials from the aquaculture industry, such as fishing nets and ropes.

Scrutiny has increased on microplastics, which are now found in all parts of the world's oceans,

including the seafloor, sea ice and biota. They may pose a threat to the sensitive benthic ecosystems, their effects have been documented through findings in dead marine mammals and birds. Microplastics may also affect human health via the food chain; they have been discovered in human blood and lung tissue for the first time this year, intensifying the urge to identify and minimize marine pollution sources.

Rail Bridge Monitoring

OceanWise Ltd has been selected to deliver a project with Network Rail in the U.K. that involves installing environmental monitoring equipment and delivering ongoing real-time tide and wave data to support operational decision making and improve safety at the historic Reedham Bridge site. This swing bridge crosses the river Ware near the Reedham railway station. **ST**



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Four New Marine Highway Projects

The U.S. Department of Transportation's Maritime Administration (MARAD) has designated four new marine highway projects as part of the America's Marine Highway Program (AMHP). Projects in North Carolina, Alaska and Puerto Rico will receive these designations. They can now apply for record levels of funding through the Bipartisan Infrastructure Law to help address supply chain challenges.

The four new marine highway projects are: Riverbush Steel Shuttle, North Carolina; Yakutat, Alaska's Freight Expansion Service, Alaska; Unalaska Express, Alaska; and Puerto Rico Maritime Transportation Services Project, Puerto Rico.

A marine highway project is a planned service, or expansion of an existing service, on a designated marine highway route. Since its inception in 2010, the AMHP has designated 58 marine highway projects.

In March, the department announced the availability of nearly \$25 million in grant funding through the Bipartisan Infrastructure Law for the AMHP. The Fiscal Year (FY) 2022 Appropriations Act made an additional \$14.8 million available for the AMHP. This is the most funding for marine highways in U.S. history.

\$25.2 Million for Emergency Coastal Resilience

The National Fish and Wildlife Foundation (NFWF), in partnership with NOAA, is offering \$25.2 million in grants to help coastal communities affected by hurricanes and wildfires in 2020 or 2021 increase their resilience to future natural disasters. The new grants will leverage \$4.9 million in additional funding to generate a total conservation impact of \$30.1 million.

Sixteen projects will help communities better withstand natural disasters and recover more quickly, all while improving habitat for fish and wildlife. Restoring and protecting natural systems will help protect coastal communities from the impacts of storms, floods, sea level rise inundation, erosion and wildfires.

Projects selected are employing a number of different nature-based activities that support wildlife, such as wetland habitat restoration, living shoreline construction, dam removal and wildfire fuels reduction. Communities across 10 states will benefit from this work, and, when fully implemented, these projects will benefit over 60,000 acres of habitat.

Grant projects will take place in Alabama, California, Connecticut, Florida, Louisiana, Maryland, Mississippi, North Carolina, New Jersey and New York.

US Shipbuilding Industry Award

The Shipbuilders Council of America (SCA) has presented U.S. Sen. Lisa Murkowski (R-Alaska) with the SCA Maritime Leadership Award. The annual award recognizes national leaders who demonstrate exemplary dedication and support for the nearly 400,000 people who serve in U.S. shipyards and the domestic industrial base.

Murkowski sits on the Senate Appropriations Committee, where she has advanced policies to strengthen investments in Navy force structure and Coast Guard shipbuilding programs, as well as building a new full fleet of Arctic security vessels, such as the polar icebreakers.

Combating IUU Fishing

NOAA has proposed new measures to strengthen its ability to combat illegal, unreported and unregulated (IUU) fishing activities and counter forced labor in the seafood supply chain. As a global leader in combating IUU fishing, NOAA employs a suite of tools to deter these activities where they may occur. The proposed changes are part of a rule-making process that is open for public comment.

NOAA's proposal broadens the scope of activities that can be considered under the High Seas Driftnet Fishing Moratorium Protection Act when identifying nations for IUU fishing, including pervasive and persistent fishing activities in waters under the jurisdiction of a nation, without authorization or in violation of that nation's laws. In addition, fishing activities in waters beyond any national jurisdiction that involve the use of forced labor may be considered by NOAA in identifying nations for IUU fishing under the act.

NOAA co-leads the U.S. Interagency Working Group on IUU Fishing under the Maritime SAFE Act, which supports a whole-of-government approach utilizing a range of regulatory and technological tools, to counter IUU fishing and related threats to maritime security.

Working with interagency partners, NOAA also seeks to expand the information foreign fishing vessels must submit when requesting entry into U.S. ports in order to fully implement the Port State Measures Agreement. The proposed rule enables a risk assessment of incoming vessels to determine if they have engaged in IUU fishing activities as defined under the agreement and to decide whether to deny a vessel entry to port.

New Head of Renewable Energy at BOEM

Karen J. Baker is the new chief for the Office of Renewable Energy Programs (OREP) at the U.S. Bureau of Ocean Energy Management (BOEM). Baker will oversee the responsible development of renewable energy resources on the Outer Continental Shelf through conscientious planning, stakeholder engagement, comprehensive environmental analysis and sound technical review.

With more than 25 years combined of private industry and Department of Defense civilian experience, Baker has served in a variety of leadership positions in strategic planning, energy and environmental policy, and public affairs. Baker comes to BOEM from the U.S. Army Corps of Engineers, where she served as the regional program's director for the North Atlantic Division. Baker helped develop the Army Strategy for the Environment, a foundational document in Army sustainability initiatives.

Baker holds a B.S. in marketing from the University of Maryland, an M.S. in environmental science and policy from John Hopkins University and an M.S. in National Security Strategy from the National War College. **ST**

London Tech Bridge Opens

The London Tech Bridge (LTB) has opened its innovation hub. It will leverage partnerships with the U.S. Office of Naval Research Global (ONR Global) and Royal Navy Office of the Chief Technology Officer to foster connectivity, agility and innovation. The location will sponsor dialogue, joint investment and cooperative development between the two navies.

The Tech Bridge network, powered by NavalX, spans 18 national and international locations. The network is designed to bridge the gap between the Navy and emerging entities such as startups, small businesses, academia, nonprofits and private capital that aren't traditionally part of the Navy's development and acquisition process.

The LTB uniquely builds upon the historic relationship between the U.S. and U.K., and seeks innovation and technology in artificial intelligence, autonomous systems, directed energy, green energy, advanced manufacturing and maintenance and sustainment.

While the Tech Bridge has defined these focus areas to guide its work, it remains open to innovative ideas and game-changing technologies; it remains agile and anticipates its focus areas evolving over time.

MacArtney Terminates Subsea EOM Cable

MacArtney Canada has terminated two 500-m, electro-optical-mechanical (EOM) cables for a towed subsea system for an unnamed defense organization. The double-armored EOM cables will facilitate power and telemetry to the payload while supporting its mechanical load.

GA-EMS Works on Submarine Propulsors

General Atomics Electromagnetic Systems (GA-EMS) has completed a task order from Naval Surface Warfare Center, Carderock Division (NSWCCD) to develop and demonstrate secure, cost-efficient procedures to render obsolete *Los Angeles*-class submarine propellers and related hardware for disposal and recovery of essential metal elements for reuse.

GA-EMS has also been awarded a task order by NSWCCD to demonstrate machining capability to produce prototype hardware for submarine propulsors.

Project to Reduce Maritime Traffic Noise

Noise generated by maritime traffic has increased over the last 50 years, due in particular to the increased number of ships and their tonnage. Noise pollution is mainly caused by propellers and the phenomenon of cavitation.

The members of the European project Life-PIAQUO, led by Naval Group, aim to reduce the impact of maritime traffic noise on marine ecosystems by developing concrete solutions for maritime transport. The project's members have partnered with Italian shipping company Grimaldi Euromed. Some of the solutions from the Life-PIAQUO project will be tested on a Grimaldi ship.

The partnership with Grimaldi has two objectives: to optimize propeller design to limit cavitation, which is

one of the main sources of radiated underwater noise, and to provide the ship's captain with a real-time self-estimation system of the emitted sound radiation and cavitation detection so the captain can adapt the speed of the vessel in vulnerable areas.

US Navy Exercises Option for L3Harris Submarine Imaging Masts

The U.S. Navy has exercised an option on a previously awarded L3Harris Technologies' contract to produce enhanced submarine imaging masts and spares. L3Harris will provide two configurations of its Type 20 low-profile mast to meet the Navy's operational requirements. Initial deliveries are scheduled to begin in 2024. The Type 20 mast is a modular non-hull-penetrating imaging sensor that uses a telescoping universal modular mast to deliver improved high-definition visual imaging capabilities. The mast will be used for *Virginia*- and *Columbia*-class submarines, enabling the users to see and control the submarine integrated imaging systems.

JFD Supports Submarine Rescue Ops

JFD, part of James Fisher and Sons plc, has supported three international submarine rescue operations in the first quarter of 2022. One exercise took place in Australia and two in the U.K. It is vital that regular submarine rescue system and submarine rescue vehicle exercises take place to prove equipment and train personnel for an efficient rescue should a real-life incident occur. **ST**

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EPCI for Subsea Tiebacks On Norwegian Shelf

TechnipFMC (NYSE: FTI) has been awarded an engineering, procurement, construction and installation (EPCI) contract by Equinor for subsea tiebacks for the Halten East development on the Norwegian Continental Shelf.

The contract covers the manufacture and installation of flowlines and the installation of umbilicals and subsea structures. The development of Halten East comprises the Gamma, Harepus, Flyndretind, Nona, Sigrid and Natalia discoveries. Halten East is a subsea development tied back to the existing infrastructure on the Åsgard field.

Falcon for Floating Turbine Work in Japan

Shibuya Diving Industry Ltd. (SDI) has chosen another Saab Seaeeye Falcon for its fleet to support Japan's growing offshore renewable sector. Supporting SDI in this acquisition was Saab Seaeeye's distributor in Japan, Marimex.

SDI mainly deploys the Falcon for floating turbine work as, in a crowded and mountainous country, the search for sites in Japan is going offshore, with floating turbines the favored option in the deep waters off the rugged coast.

The Falcon plays a vital safety role by undertaking missions too hazardous for divers, where the depth of water and strength of current are dangerous, such as surveying fishing grounds and fishing reefs prior to turbine installation and periodic inspection of mooring anchors and chains.

Collaboration on Hydrogen Production Platforms

Lhyfe and Chantiers de l'Atlantique have signed a memorandum of understanding for the development of offshore hydrogen production platforms.

This agreement comes as Lhyfe and Chantiers de l'Atlantique, already working together as part of the SEM-REV project on the

co-development of a pilot system for offshore hydrogen production, prepare to launch the world's first offshore renewable hydrogen production demonstrator in September 2022, off the coast of Saint-Nazaire, France.

On the strength of this first demonstrator, the two companies wanted to reinforce their partnership to deploy the system on a large scale. Lhyfe and Chantiers de l'Atlantique will collaborate on offshore renewable hydrogen production projects with on-grid or off-grid wind farms. Chantiers de l'Atlantique will design, build and install the platforms, while Lhyfe will be in charge of the design and operation of the renewable hydrogen production facilities.

This agreement aims to develop the renewable hydrogen fuel chain at sea and in ports. For offshore projects, the two partners plan to develop production solutions with a minimum capacity of 100 MW, which will be installed on existing fixed structures or mounted on seabed foundations or floating platforms.

North Sea Well Decom

Well-Safe Solutions has been contracted by Ithaca Energy to plug and abandon six wells on the Anglia platform in the southern North Sea, approximately 55 km from the U.K. mainland. The contract will see the Aberdeen-based well decommissioning specialists provide project management, well engineering and all managed delivery services for the project.

The Well-Safe Protector harsh environment jack-up rig was undertaking extensive technical preparations to mobilize to the field in late summer 2022.

Hybrid Heavy Transport Vessel For Offshore Wind Farms

Vallianz Holdings Ltd. and its subsidiaries have joined forces with Ulstein Design & Solutions B.V., Shift Clean Energy and Bureau Veritas to collaborate on the design and

construction of a heavy transport vessel (HTV) that will be the first of its kind in the global offshore wind industry.

Designed for worldwide operations, the HTV will be deployed for the transportation of structures such as monopiles, jackets, transition pieces and turbine blades to support offshore wind farm projects, as well as heavy structure modules for LNG, and carry out floatover operations of offshore structures.

Featuring zero-emission capability, the DP-2 vessel will be the first of its kind, as it will be driven by a hybrid power system consisting of alternative dual-fuel engines and a fully classed battery energy storage system. In addition, the HTV features the proven ULSTEIN X-BOW, which contributes to reduced energy consumption and provides more comfortable and safer operations when sailing through waves.

The design of the HTV is developed by Ulstein Group, headquartered in Norway. The HTV's electric battery system is to be provided by Canadian-based Shift. The vessel will be classed by Bureau Veritas.

Construction is expected to take up to 26 months, with planned completion by the end of 2024.

Buoyancy Solutions in GOM

CRP Subsea has been awarded a major deepwater contract to provide two of its buoyancy solutions in the Gulf of Mexico (GOM). CRP Subsea's rotating buoyancy modules will be used to mitigate flowline buckling in combination with its integral buoyancy modules, helping to generate a system riser configuration. Deployment is expected in mid-2023.

BWTS After-Sales Support

Joint venture Nakilat-Keppel Offshore & Marine (N-KOM) and Keppel Offshore & Marine Ltd. will provide after-sales technical support to vessels equipped with ERMA FIRST ballast water treatment systems (BWTS) calling at ports and repair yards in Qatar.

ERMA FIRST has installed over 2,500 systems on more than 2,000 vessels worldwide. **ST**

contracts

Fugro, Leidschendam, Netherlands, has signed a contract for the naval design of its Blue Prism USV. Specifically engineered for operations in both coastal and offshore environments, Blue Prism will combine an ultralow carbon footprint with high-quality data collection, weather resilience and endurance characteristics. Kooiman Engineering and Van Oossanen Naval Architects.

Damen, Gorinchem, Netherlands, has delivered the azimuth stern drive tug 2811 TSM *Odet* to the French Mediterranean coast. The vessel is equipped for both handling ships in harbors and sea towage. Thomas Services Maritimes.

Woods Hole Group Inc. (WHG), Bourne, Massachusetts, has purchased the entire fleet of Faria Watchdog vessel monitoring systems dedicated to fisheries products, technologies and services to expand WHG's sustainable fisheries business. Riverside Manufacturing LLC.

Korean Register (KR), Busan, South Korea, has signed a memorandum of understanding to jointly research and approve the application of autonomous navigation systems for mid- to large-size vessels. KLCSM and Samsung Heavy Industries.

DNV, Høvik, Norway, has been awarded four frame contracts for electricity and gas on the Danish transmission gas grid in relation to PtX (Power to X). Projects supporting PtX in Denmark follow the European Green Deal strategy for decarbonization. PtX will convert green power to hydrogen, ammonia and e-fuels, for example. Energinet TSO.

OTAQ, Lancaster, U.K., will supply integrated water quality measurement equipment to several aquaculture sites over a full farming cycle. OTAQ's new water quality monitoring product continually monitors a site's oxygen, temperature and salinity levels to provide aquaculture

farmers with immediate information about the quality of their water environment and assist with regulatory reporting. Salmones Antártica S.A.

Danfoss Power Solutions' Editron, Lappeenranta, Finland, will power a new hybrid-electric, buoy-laying vessel for the French government. The vessel will be used to maintain and replace navigational buoys around the island of Corsica. Arment des Phares et Balises. **ST**

meetings

Note: The coronavirus (COVID-19) pandemic could affect event dates. Check event websites for the latest updates.

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October 3-7—National Marine Electronics Association (NMEA) Conference, Anaheim, California. 410-975-9425 or www.nmea.org.

October 4-5—World Ocean Tech and Innovation Summit, Halifax, Canada. <https://events.economist.com/world-ocean-tech>.

October 5-7—NOIA Fall Meeting, Colorado Springs, Colorado. www.noia.org/noia-2022-fall-meeting.

October 9-12—Maritime Cyprus, Limassol, Cyprus. <https://maritimecyprus.dms.gov.cy>.

October 16-19—AAPA Annual Convention & Expo, Orlando, Florida. <https://my.aapa-ports.org/AC2022/Home/AC2022/Home.aspx>.

October 17—Offshore Wind Summit, Providence, Rhode Island. aparkins@noia.org or www.noia.org.

October 17-18—Sustainable Ocean Summit, Barcelona, Spain. summit@oceanCouncil.org or www.sustainableoceansummit.org.

October 17-21—OCEANS 2022 Hampton Roads, Hampton Roads,

Virginia. hamptonroads22.oceansconference.org.

October 18-20—International Ocean Conference on Ocean Energy and Ocean Energy Europe, Donostia/San Sebastián, Spain. <https://icoeoe2022donostia.org>.

October 18-21—EURONAVAL, Paris-Le Bourget, France. euronaval.fr.

October 19—Global Blue Finance Summit, Barcelona, Spain. <https://tinyurl.com/mu5karx8>.

October 27-28—National Association of Marine Surveyors New England Fall Conference, Newport, Rhode Island. www.namsglobal.org/calendar/2022/4/3-5-59th-annual-national-conference-

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November 2-4—MAST Med 2022, Athens, Greece. <https://mastconfex.com>.

November 8-9—Institute of Fisheries Management Annual Conference, Guildford, U.K. info@ifm.org.uk or <https://ifm.org.uk/events/ifm-53rd-annual-conference>.

November 8-10—CLEAN GULF, New Orleans, Louisiana. www.cleangulf.org.

November 14-18—BlueTech Week, San Diego, California. <https://tmabluetech.org/bluetech-week>.

November 17—Deepwater Executive Summit, Houston, Texas. <https://deepwaterexecsummit.com>.

November 17-19—Pacific Marine Expo, Seattle, Washington. www.PacificMarineExpo.com.

November 22-24—Marine Renewables Canada Conference, Halifax, Canada. <https://marinerenewables.ca/event/marine-renewables-canada-2022-annual-conference>.

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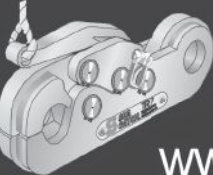
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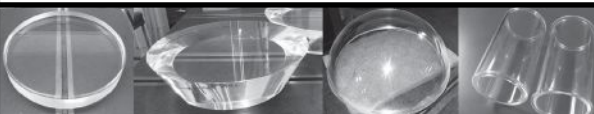
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IMO Energy Efficiency Measures: Opportunities for Improvement—Maria Polakis

Maria Polakis serves as regulatory compliance manager at bp trading & shipping. A naval architect and marine engineer by degree, she led the chartering, finance and commercial workstream for the Blue Sky Maritime Coalition in the run up to the white paper discussed in this editorial. Previously, Polakis was a principal engineer with the ABS Global Sustainability team and an IACS Environmental Panel member.



The shipping industry has undoubtedly embarked on a decarbonization journey with great enthusiasm. From regulations by the International Maritime Organization (IMO) and regional frameworks to efforts by vessel owners and fleet operators, stakeholders are engaged in advanced research, pilot projects, novel ship design and operating practices to meet the goals of climate change initiatives.

The latest developments by the IMO Marine Environment Protection Committee (MEPC), starting with the adoption of the GHG (greenhouse gas) Strategy in 2018, highlight the industry's commitment toward a low-carbon future.

Following the IMO MEPC 78th session in June 2022, an important milestone of the GHG Strategy for short-term measures was met. Requirements to regulate the carbon intensity of the global fleet starting January 1, 2023 have now been adopted in their entirety by the committee with the introduction of the G5 Guidelines in their interim form. This long awaited final building block of the Carbon Intensity Indicator (CII) regulation has been widely debated.

Considered instrumental in normalizing the CII calculation and benchmarking approach, correction factors and voyage adjustments continue to be thoroughly examined. From developmental work by

the IMO to industry studies backed by validated data sets from operating ships, agreement has yet to be reached on the factors that would enable a balance between realistic representation of a vessel's carbon intensity and maintaining alignment with the GHG Strategy's goals.

The Blue Sky Maritime Coalition (BSMC), a U.S.-based nonprofit focused on decarbonizing maritime activities in North America with net-zero emissions by 2050, has been closely observing the development of the CII regulatory framework, sharing anticipation with industry on the final outcomes. In the white paper "A Perspective on IMO Efficiency Measures: Opportunities for Improvement," BSMC uses verified ship operational data to evaluate the current form of the CII calculation methodology and rating system. This report is an example of industry collaborating to find opportunities for improvement and spurring further discussion among key stakeholders. Viewed through the lens of real-life vessel operations, the data arguably point toward the need for a paradigm shift in the way commercial contracts between owners and charterers are executed because of the CII regime.

The study uses operational data from 16 medium-range (MR) tankers. Results indicate that CII ratings vary across the gamut of these tankers, even among sister ships, clearly due to the trading profile and requirements of their individual commercial contracts. Average voyage lengths, including waiting times at ports and terminals, can overshadow the design superiority and technical characteristics of a newly delivered vessel compared to much older hulls that are operated under more favorable chartering terms.

Speed reduction alone does not improve CII rating with the current IMO formula. Unless the annual number of days when the vessel is transiting is high and waiting times

at port or anchor are minimized, the CII will likely be affected negatively.

In principle, the CII metric compares a vessel's absolute annual emissions to transport work, so climate impact is measured against societal benefit. Large numbers of transit days would raise the absolute level of CO₂ emissions, but these ships would be rewarded for contribution to the global transport of goods with an improved CII rating.

Given that the IMO GHG Strategy's targets include a reduction of absolute emissions by 2050 and reduction of the carbon intensity of the global fleet, the current CII formulation should be re-examined. The impact of commercial operations other than the "underway, making way" needs to be addressed in the IMO's CII formulation in a careful and fair manner. Otherwise, a vessel's inherent design characteristics, e.g., investments in energy-saving technologies and fuel-efficient shipboard operations, may be overshadowed by an inferior score relative to a ship's total amount of transit time.

Similar to the MR tanker comparison, a comparison of two Supramax bulk carriers in the report reinforces the message that a ship's trading profile defined in a charter contract can greatly affect compliance with MARPOL's pollution prevention regulations and bestow a commercial advantage or disadvantage though the assigned CII rating.

As the BSMC report concludes: "An improved mutual assumption of responsibility and obligation by both the charterer and vessel owner must find accommodation to incentivize the common goal of emission reduction more fairly. To accomplish this effort, both parties must have transparent negotiations under a new era of chartering contracts where environmental key performance indicators are shared amongst both parties."

The report is available at: <https://tinyurl.com/4am8zmjx>. **ST**

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