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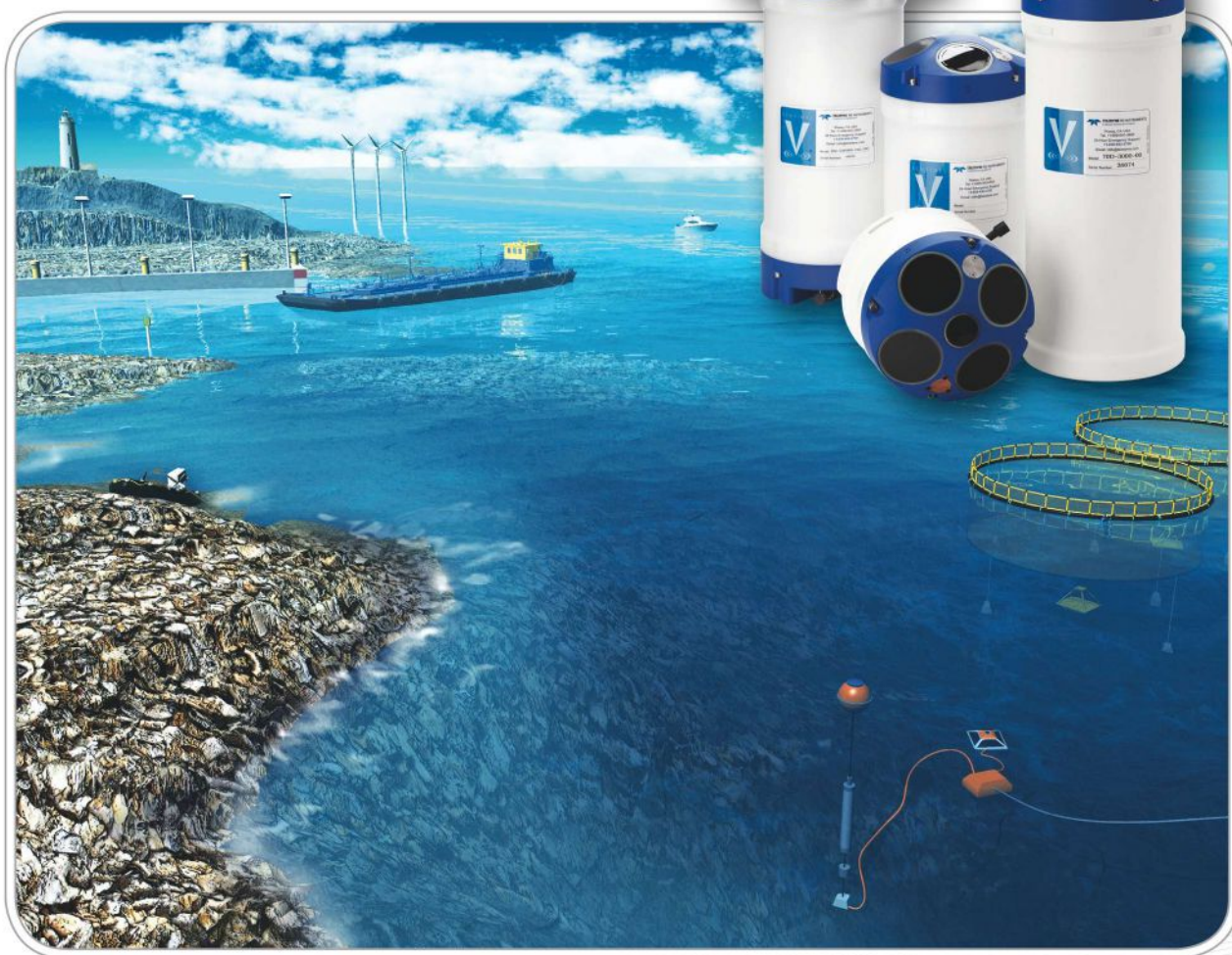
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NEXT MONTH

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Innovation Prizes to Jump-Start Reef Restoration

Scientists were wrong: The coral crisis happened much earlier than expected. It is happening now. We are losing about 100 by 150 m of coral reef a minute, and we have lost half of all coral reefs already. By 2050, 90 percent or more could be gone. About half the Great Barrier Reef's coral died in 2016 and 2017 because of record extreme heat, as the excellent documentary "Chasing Coral" depicts (<https://bit.ly/2KRdzC3>).

It's important to have hope for coral reefs and create your own vision of the future for either your local reefs or coral reefs globally that is positive, replicable and scalable; a vision that you can sell to the world. Think of this as a business plan, which begs the question: Why aren't there dozens of private companies involved with coral restoration since it's so important for marine biodiversity and the 500 million people depending on coral reefs for fisheries, tourism, culture, coastal protection and livelihoods?

Comparatively, forest restoration is big business potentially worth \$84 billion annually. Shouldn't corals be part of this restoration economy?

With new major funding announcements such as the Australian government committing half a billion Australian dollars to save the Great Barrier Reef, a collaboration with insurance companies in Mexico funding coral restoration after storms, and a debt swap agreement in the Seychelles to fund marine protected areas, as well as new philanthropies entering the field, it's clear we can't just throw money at innovative ideas—we will need to highlight and grow innovations that produce results and advance business models that can sustain themselves.

Recent innovations are popping up to help corals. Some are still in the lab phase or need help scaling, but exciting progress abounds. These include a floating biodegradable film to protect corals from bleaching, electrifying corals to improve growth rate, improving the reproduction rate of corals in the lab from 0.2 percent in the wild to more than 90 percent in a tube, and assisted evolution to breed super corals in the lab resilient to extreme temperatures.

What if we can create a competitive market of start-up companies that use a combination of these innovations to repopulate, say, one coral every 6 sec. on par with reforestation rates (the current rate using divers is about six to seven corals per hour), or even planting a million corals that survive one year in an inhospitable location? Obviously, this needs to be done smartly, with strict rules to ensure these experiments cause more good than harm for the environment.

Big prizes with such audacious goals can draw out new talent and ideas, bring in interdisciplinary expertise, engage communities, and give innovative companies the global stage to match the challenge facing corals. Recently, XPRIZE asked the crowd for ideas in designing an XPRIZE for urgently needed, scalable innovations to restore and protect coral reefs (<https://bit.ly/2LcDCjp>). Tech opportunity areas include: coral restoration—mechanized planting, jump-starting growth with 3D-printed settlement structures, endangered species recovery, regenerating degraded corals, nursery design, fertilization/reproduction; local coral protection—enforce laws on dynamite fishing or marine protected areas, improve water quality, combat algal growth, eliminate invasive species, prevent sedimentation or anchor damage; and climate resilience—temperature control, disease resistance, breeding and genetics, reef mobility, assisted evolution.

Many coral restoration techniques to date are labor intensive, using divers; they are top-down, academic and expensive (full restoration would be trillions of dollars). In contrast, with strategic philanthropy and the prize model, we can grow proven, investable solutions to coral conservation and restoration. We can jump-start a coral restoration economy and unleash the power of the global crowd on growing an inspiring future for corals. **ST**

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)) Industry Collaboration for Maritime Blockchain. Blockchain Labs for Open Collaboration (BLOC) announced, through its subsidiary Maritime Blockchain Labs (MBL), the establishment of a consortium to address traceability and transparency in the marine fuel supply chain, bringing together industry actors Lloyd's Register, Precious Shipping, Bostomar, BIMCO, International Bunker Industry Association (IBIA) and GoodFuels. MBL identified the bunker industry, with its multiple, complex transactions, as an ideal use case where blockchain technology can increase transparency, create better compliance and stronger governance. The project represents the initial stage of the Lloyd's Register Foundation-funded MBL initiative.

)) Storing Energy Produced from Offshore Wind. With Batwind, it will, for the first time, be possible to store energy produced from an offshore wind farm. The battery storage solution was presented in Peterhead, Scotland, by Batwind partners Equinor and Masdar. Electricity produced at the world's first floating offshore wind farm, Hywind Scotland, will be transported via cables to an onshore substation where the 1-MW batteries are placed and connected to the grid. Because wind is not constant, energy storage technologies will become increasingly important to secure grid stability. To make renewable energy more competitive and integrate even more renewables to the grid, new, smart solutions for energy storage are needed. According to the International Renewable Energy Agency, the installed costs of battery storage systems could fall by two-thirds by 2030.

)) IoT Makes Headway in Shipping Industry. NAPA teamed up with Danelec Marine, ClassNK and Inmarsat to debate the Internet of Things' (IoT) potential to reshape the maritime industry. "The availability of AIS data is already helping avoid some of the biggest challenges, such as rush-to-wait, and we're consistently seeing that increasing transparency of ship operation is a powerful motivating force in driving greater vessel efficiency," said Ilmo Kuutti of NAPA. A wariness toward data-sharing and transparency continues to be a barrier, but attitudes seem to be changing as the benefits of data became more widespread. The EU's MRV requirements will also drive a lot of technology uptake that will deliver valuable statistical data. The panel concluded that the main initial challenges for IoT adoption have been overcome, primarily because basic IoT uses existing sensors. Vikrant Sharma of ClassNK predicted that in the next five years there will be "more connected ships driven by lowering costs and capabilities to share more data. This is also likely to lead to more remote operations." But as Mark Warner of Inmarsat noted, "There's major polarization between the leaders and laggards in IoT implementation." The biggest issue holding back investment is perception of cost and the need for IoT skill sets to improve. The near future could see an open platform to access data from ships safely, easily and efficiently.

)) Public-Private Partnership on Ocean Plastic. The Institute of Marine Research, shipowner Torvald Klaveness, Kongsberg and the Norwegian Shipowners' Association have entered into a public-private partnership to develop a pilot project to map marine plastic and other environmental parameters vital to the health of the oceans. The partners will equip several vessels with advanced sensors to collect data for the Institute of Marine Research. Every minute, about 15 tons of plastic end up in the ocean. If this trend of marine plastic pollution continues, by 2050 there may be more plastic than fish in the sea.

)) Survey Says Big Data Needs Structure. A recent ShipServ survey revealed an industry-wide lack of structured, accurate and well-managed data that can provide critical insights on procurement trends, reducing the opportunity for maritime buyers to optimize procurement efficiencies and reduce costs and discouraging an increase in spend under contract with suppliers. Despite advancements in digitalization, the adoption of strategic procurement models in the maritime industry is currently poor, compounded by a considerable lack of clean data to produce impactful reports, insights and intelligence, according to ShipServ.

)) Pioneering Female Admiral Passes. Retired RAdm. Alene B. Duerk, the U.S. Navy's first female admiral (<https://bit.ly/2OsmFqj>), passed away July 21, 2018 at 98 years old. "It took one-hundred ninety-seven years and a forward-looking chief of naval operations, Elmo Zumwalt, to break with tradition before Alene Duerk became the first woman admiral in the U.S. Navy," said Naval History and Heritage Command Director Sam Cox. "But the credit goes to Duerk. From the crucible of caring for wounded sailors, Marines and prisoners of war during World War II in the Pacific, she blazed a trail of stellar performance in tough jobs, serving as an inspiration for an ever increasing number of women officers who have followed her path." In May 1970, Duerk was appointed director of the Navy Nurse Corps. Her selection to the rank of rear admiral was approved by President Richard Nixon on April 26, 1972. The first woman to be selected for flag rank, she was advanced on June 1, 1972. Duerk retired in 1975 but remained a strong advocate for Navy nursing. She was awarded the Naval Reserve Medal, American Campaign Medal; Asiatic-Pacific Campaign Medal with bronze star; World War II Victory Medal; Navy Occupation Service Medal, Asia Clasp; and the National Defense Service Medal with bronze star. **ST**

Mooring for Offshore Wind

Applications of Oil, Gas Technology for a Low-Carbon Future

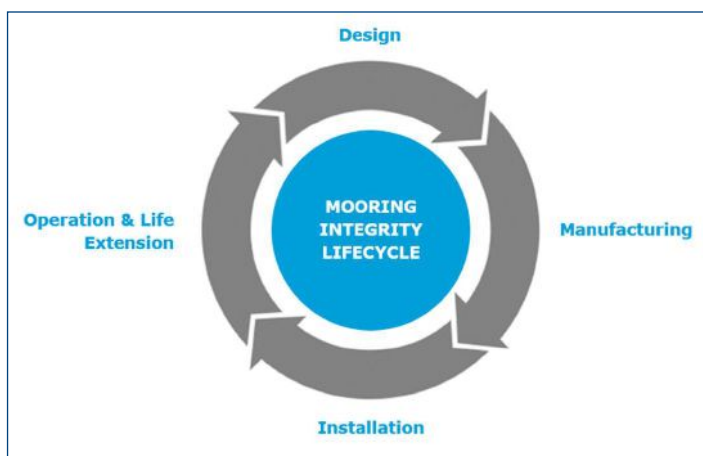
By Dr. Alex Argyros • Francois-Xavier Sireta



Floating wind turbines (FOWTs) are growing in credibility among researchers, developers and investors. Hywind Scotland, the world's first floating wind farm, demonstrates the technology is ready to accelerate the renewable energy mix. There is much overlap in the design, fabrication and installation of the platform, moorings and anchors used in oil and gas and floating wind systems. We know from the oil and gas sector that ensuring mooring system reliability is a challenge. In recent decades, several billion-pound failure incidents of

mooring systems have occurred. For example, a spate of brittle fracture failures in the drilling industry necessitated the need for improved requirements for chain manufacturing processes in the 1980s. The proliferation of permanently moored floating production units (FPUs) led to the discovery of out-of-plane bending fatigue in the mid-2000s—a previously unknown cause of failure.

To combat this, the oil and gas sector has steadily invested to further develop guidance aimed at enhancing mooring system reliability. There are two aspects to this:



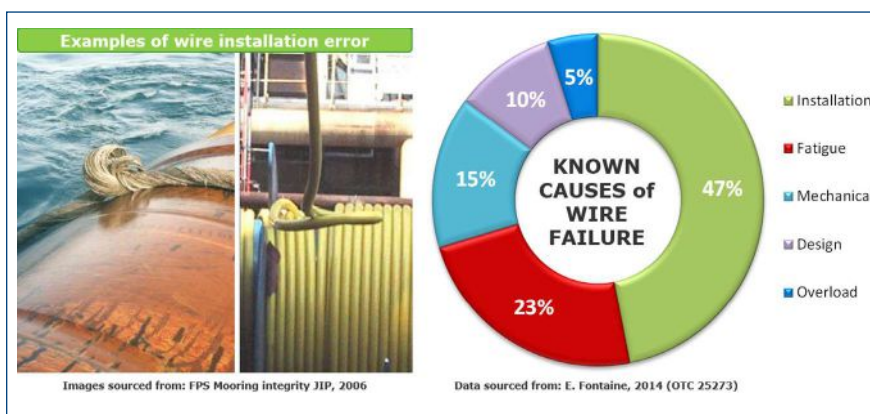
JIP (joint industry project) and will be launching its MIM recommended practice (RP) later this year, which encapsulates key learnings for both oil and gas and renewables sectors.

Floating Wind Turbines: A Scalable Technology

The scale of turbines has had an important part to play on the path to cost reduction for offshore-fixed wind. Larger turbines attract higher and cleaner winds, leading to greater and more predictable power capture. Larger turbines also enable reduction in the overall balance of plant costs as there are fewer units required. Such savings have helped see the levelized cost of electricity (LCOE) for the U.K. offshore wind sector hit a low £57.5 per MWh for two offshore wind projects.

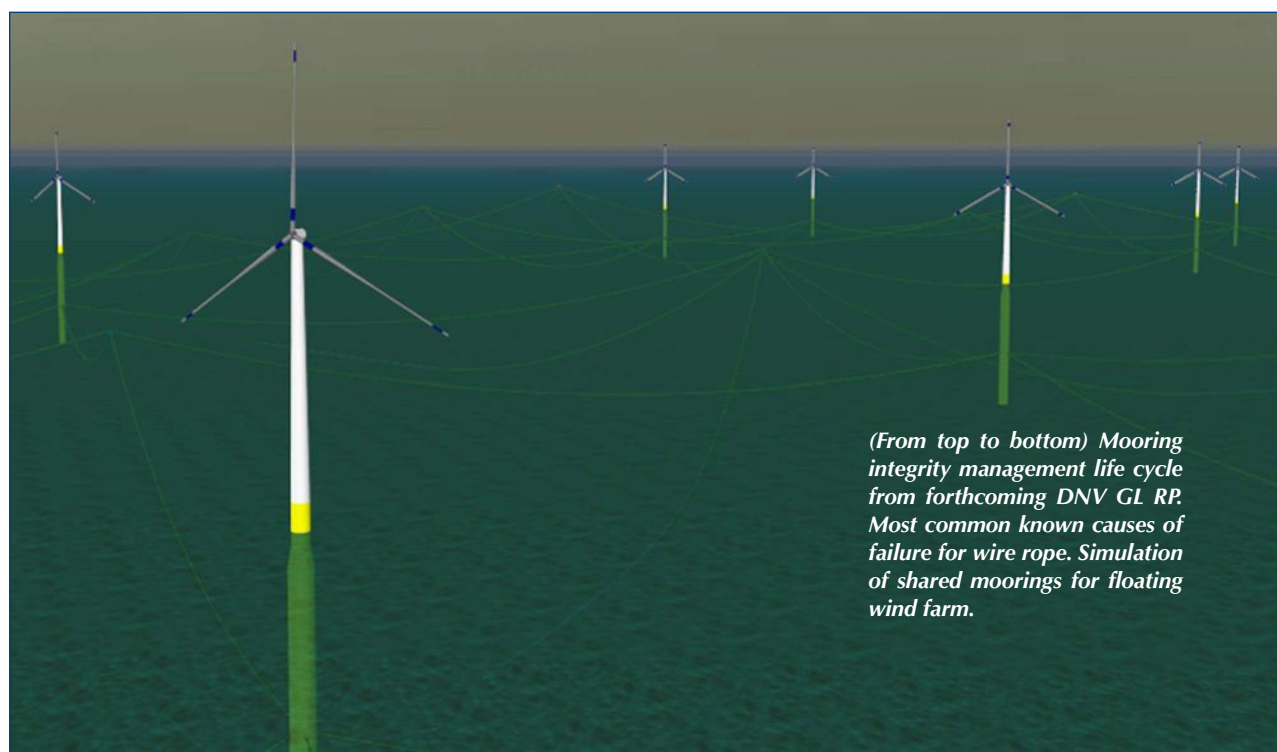
Larger turbines have also encouraged the rapid growth of the presently more capital-intensive (than bottom-fixed) FOWTs, where LCOE is estimated in the range of \$110 to \$125 (£85 to £95) per MWh, according to The Carbon Trust Review. Through intelligent platform design, for example, by using advanced control systems, larger turbines could be placed on smaller, more cost-competitive floating foundations due to the different scaling rules compared

to bottom-fixed structures. CAPEX savings are also expected from improved mooring and anchoring systems, for instance, through use of novel materials and shared anchor points. Both innovations pose additional challenges and risks for mooring system reliability, as these are unproven within the oil and gas sector.



the development of rules that specify design requirements for a target system safety level and the development of guidance for improved through-life mooring integrity management (MIM).

DNV GL has been advancing rule development with the industry for the last seven years through the Normoor



(From top to bottom) Mooring integrity management life cycle from forthcoming DNV GL RP. Most common known causes of failure for wire rope. Simulation of shared moorings for floating wind farm.

“While the consequence of a complete mooring system failure is lower for renewable devices, single-line failures can be more significant relative to the cost of the asset.”

The expanding renewable sector can learn much from the challenges and solutions in the oil and gas industry.

Mooring Design

There is a general consensus among oil and gas operators of the need to improve the reliability of permanent mooring systems by enhancing long-term integrity. Research states that the probability of a single-line failure of a permanent mooring per year per asset is about 2 percent. This means that for 10 assets operating for 25 years, half of these will likely experience a single-line failure.

Recent efforts to aggregate failure data have shown that the primary

causes of mooring system failure are degradation such as corrosion and wear, fatigue and installation error. For example, in the case for steel and fiber rope, half of incidents emanate from improper handling during installation. Overload or lack of strength is rarely the main cause of failure.

The design of mooring systems for FOWTs is based on the experiences and offshore standards available in the oil and gas sector. DNV GL developed the first standard providing specific design requirements for FOWTs (DNV-OS-J103).

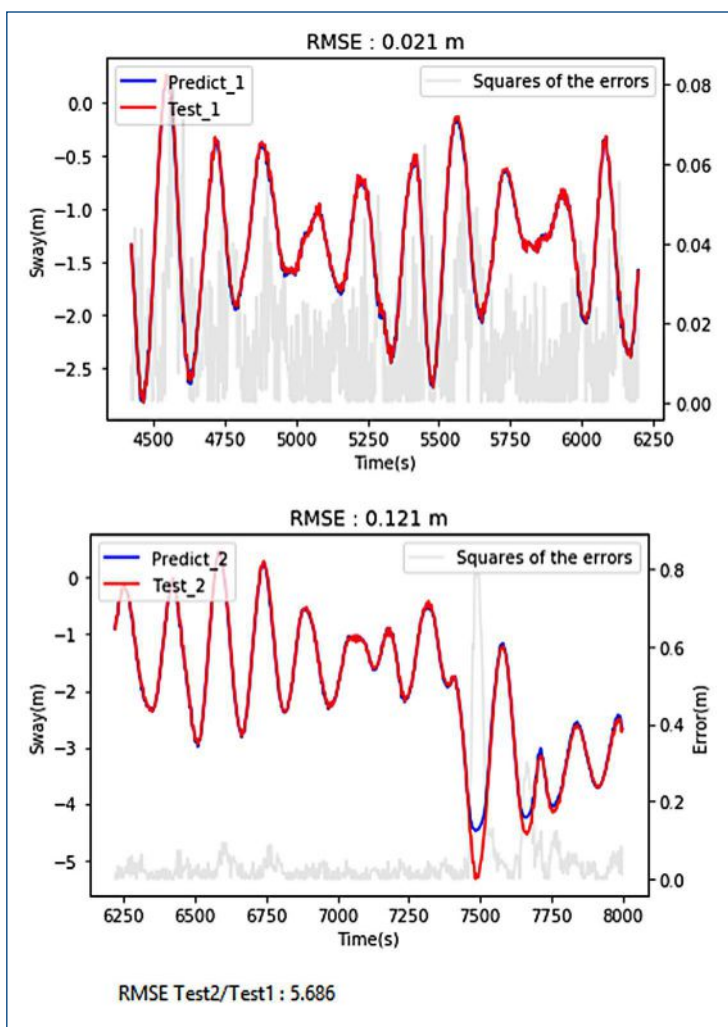
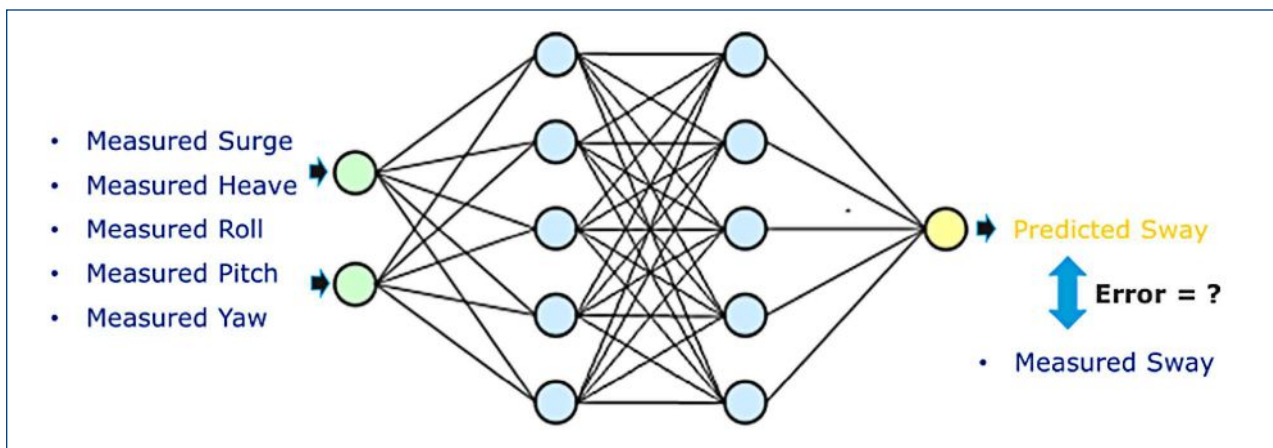
It is recognized that most renewable systems represent a different risk profile to large hydrocarbon production units. This is reflect-

ed in lower target reliability levels as defined by industry standards. However, there are additional challenges relating to the design of mooring systems for FOWTs. There is often less rigorous site characterization data compared to oil and gas. With the variability in adequacy of available design analysis software for different prototypes, it is a challenge to integrate the wind and wave fields adequately for mooring fatigue calculations. There is lack of redundancy in the mooring system, with many designs utilizing three legs. Assuming traditional mooring chain, the general mooring strategy for floating wind is having fewer and stronger, but heavier and less compliant, lines compared to the strategy for oil and gas, which is more and lighter, and more compliant, mooring lines.

Considering that the primary causes of failure do not relate to strength, this puts into question the use of nonredundant mooring systems. Restrictive budgets and schedules typically lead to mooring designs outside the norm of what is expected for offshore permanent mooring; for example, use of connector links, such as Kenter links and pear links, not suitable for offshore permanent mooring applications, or use of novel materials not proven in permanent mooring application. There are also inspection and monitoring challenges due to unmanned structures.

While the consequence of a complete mooring system failure is lower for renewable devices, single-line failures can be more significant relative to the cost of the asset. The different risk profiles will lead to contrasting approaches to mooring design and in-service integrity management.

A quantitative risk assessment is an essential step to identify optimal



(Above) Artificial neural network. (Left) Top: predictions from ANN and actual test signal for intact system. Bottom: failure happens at 7,500 s, and the error in ANN predictions increases.

Shared Station-Keeping. Shared mooring and anchoring is a novel area with additional challenges relating to design, installation and inspection. In a recent joint research project between DNV GL and Glasgow University to evaluate the feasibility of shared anchor technology, the following three areas for further development in technology were prioritized: anchors that retain structural integrity and stability when loaded in various directions (an EU project is now underway to fully understand shared anchor performance); advanced modeling tools to accurately represent behavior of multiple fully integrated FOWTs, including improved understanding of wake effects; and streamlined installation, maintenance and failure response procedures that limit operational disruption to other units.

New Materials. In oil and gas, mooring material procurement costs are similar to the average cost of single-line failures and pre-emptive replacements, so there is limited incentive to over-optimize material properties. Also, there is a reluctance to use untested mooring materials and components on high-value assets such as FPSOs.

FOWTs may provide an opportunity to test new materials in a comparatively lower risk environment. For example, low-weight/high-strength fiber rope is an alternative solution for the renewables sector. This can allow increased load capacity per mooring line while reducing the weight of the mooring system. This can potentially lower floating foundation CAPEX through fewer connection points and less demand on buoyancy. Further testing and in-service data are needed to enhance the understanding of long-term performance of fiber ropes.

Smart Mooring Monitoring. As FOWTs are unmanned, a remote maintenance approach is required. The use of sensor data in combination with analysis

mooring design and in-service integrity management strategies. This should study different line-failure scenarios considering the potential consequences and provide the basis for the development of an asset-specific MIM plan. The forthcoming DNV GL RP will provide guidance on this.

Innovation

The moorings sector is seeing innovation in three main areas: shared station-keeping, new materials and smart mooring monitoring.

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“In recent developments, artificial neural networks (ANNs) are able to detect changes in the floater motion pattern that could indicate a mooring line failure.”

models has significant potential for application in this sector. The oil and gas industry is setting the pace through the development of predictive maintenance systems that combine risk-based inspection, in-service sensor measurements and advanced simulation and analytics.

Similar approaches are being developed for structural monitoring of floater hulls, as well as condition monitoring of the windmill systems themselves, enabling operators to predict either structural or system failures and put predictive maintenance schemes in place accordingly that have the potential to radically reduce OPEX.

Advances in Oil and Gas Mooring Monitoring Technology

In several cases of mooring line failure in floating offshore units operating in the oil and gas sector, the failures were identified months or years after they initially occurred. Most assets being designed for single-line failure only, this means that the risk of a catastrophic failure of the whole mooring system is quite high if the failure of a single line cannot be detected reliably. To mitigate that risk, class societies such as DNV GL have introduced requirements for the use of line tension monitoring systems as part of the mooring class notations. However, most of the line tension monitoring systems available on the market today have proven unable to remain functional after more than two years in operation, due to the harsh conditions and loads to which they are exposed. For that reason, an alternative system for line failure detection is needed.

Systems are being developed to detect a single-line failure reliably based solely on GPS and motion sensor data installed on the asset. Those systems use the recordings from the GPS system and a gyroscope installed on board.

In recent developments, artificial neural networks (ANNs) are able to detect changes in the floater motion pattern that could indicate a mooring line failure. The ANN is trained using either numerical simulations of the intact system or actual field measurements and used to predict the intact displacement in real time along 1 degree of freedom. The monitored displacement is compared with the predicted displacement, and errors are reported. A mooring line failure can then be identified by an abnormal increase in predictions error.

There are various approaches to training the ANN. The use of numerical simulations has the advantage of allowing training on a large number of sea states, which ensures that the system should perform in any condition, the drawback being that no numerical model is perfect-

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Marine Protected Areas monitoring thanks to SeapiX



iXblue, a global leader in the design and manufacturing of innovative solutions for the navigation, imagery and positioning markets, is introducing SeapiX, its 3D MBES (Multi Beam Echo Sounder), dedicated to monitoring applications.

Aiming to provide water column and seabed indicators for the evaluation of marine environments, SeapiX is a flexible system that can be embedded onto autonomous floating systems such as buoys.

Existing acoustic systems are limited by their field of view (usually 7-12°) and spatial resolution (single beam devices) and cannot effectively assess the environmental characteristics such as biomass and seabed. When in use, they require hypotheses (biases) to be made by experts to estimate global values from a very partial measurement. They might also be installed on pan/tilt platforms that require high maintenance costs and energy consumption while still

suffering from a poor refresh rate for the global volume scan.

SeapiX intrinsic and pioneering characteristics – the system is a stabilized steerable dual Multi Beam Echo Sounder with 128 independent acoustic channels able to produce very fine (1.6°) elementary beams – enable theinsonification of a 120° by 120° pyramidal water volume. Depending on the volume that needs to be covered, SeapiX can be set-up from one to three SeapiX antenna units as shown.

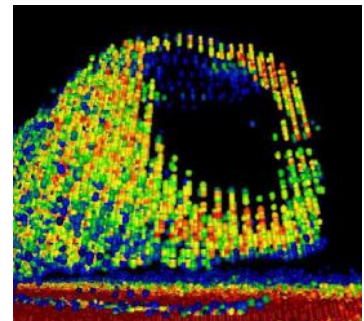
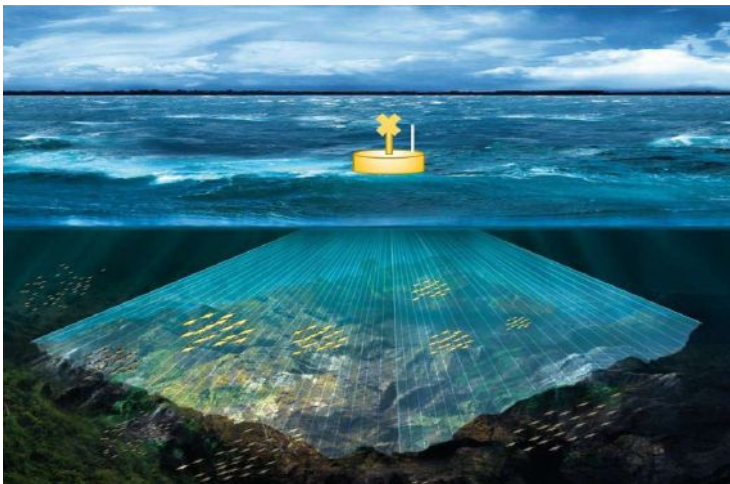
iXblue's SeapiX has been qualified on several fish species (mackerel, herring, cods, tuna...) and features a unique fish discrimination Geographical Biomass Analyzer (GBA) processing tool to classify acoustics detections. Indeed, the factory-calibrated antenna can also be recalibrated in-situ by end-users and provides accurate target strength (TS) values thanks to its multi split beam capability,

volume backscattering strength and biomass indicators such as NASC. Moreover, it monitors the global habitat by measuring seabed backscatter value and bathymetry.

All data provided by SeapiX is georeferenced and time stamped and can be easily exported to standard formats such as HAC, EVD (EchoView) or bathymetry files. In order to adapt to the platform design (autonomy, energy, data HDD), SeapiX is highly configurable: users can define scenarios to be ran, data to be recorded or exported as well as real time streams towards the control station.

It has been designed to reduce the operator duties and is easily fitted into a network of systems for large and remote areas monitoring. It is delivered with a GECDIS based plotter system for the display of acoustic swaths, echograms, GBA outputs, and seabed bathymetry/backscatter value.

Sponsored by iXblue



▲ 4D analysis of herring shoal close to seabed in EchoView.

◀ SeapiX provides a split beam calculation for its entire volume coverage of 120° X 120°.

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ly representative of the real system. Therefore, it can be challenging to make sure such systems perform well once fed with real measured data. The other alternative is to use field measurements for training. The challenge there is that it can take months or years before data are available for a sufficient range of sea states.

Alternative approaches using field measurements and on-the-fly training of the neural networks in real time on each encountered sea state, as well as hybrid numerical/field data training methods, are also being investigated.

Once trained, the ANN can make real-time predictions with very low central processing unit capacity, which means that the system can be either deployed on board on a standard computer or hosted in the cloud. In that second configuration, the sensor data need to be streamed to a cloud-based platform where the ANN will be hosted and run.

Pilot projects are ongoing for various assets, and once proven, such concepts have the potential to be game changers in the way mooring integrity management is handled.

Low-Carbon Future

DNV GL's 2017 Energy Transition Outlook predicts that primary energy supply will peak in 2025 as electricity grows its share of the energy mix and losses are reduced through the accelerated uptake of efficient renewable sources. The near future will see the world managing the shift to a renewable future without increasing

energy expenditures. Notably, wind and solar photovoltaic hold the most potential for cost-competitiveness.

Novel application of materials, sensors and data analytics have a key role to play in the commercial success of floating renewables. Key challenges arise from different project economics as well as the desired technology leaps, such as shared mooring and anchoring.

However, there is sufficient knowledge and established processes for mooring integrity management from the oil and gas sector to enable reliable applications of mooring technology for a low-carbon future. **ST**

Dr. Alex Argyros, CEng, holds a Ph.D. from Cambridge University. He is the moorings technical authority for Noble Denton marine services, specializing in the design and approval of moorings used in floating wind, wave energy, tidal energy and oil and gas applications.



Francois-Xavier Sireta, CEng, holds a master's degree from Ecole Centrale de Marseille (France). He is a technical lead in DNV GL's Offshore and Marine Services Department in Singapore, focusing on naval architecture, hydrodynamics, mooring and applications of digital technologies.



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Offshore Energy



Europe's leading offshore energy event, Offshore Energy Exhibition & Conference, will be held October 22 to 24 in Amsterdam and expects to attract more than 12,000 offshore professionals and more than 600 exhibiting companies.

Offshore Energy is an annual event focused on the complete offshore energy industry. It covers both the exploration and production of the conventional energy resources of oil and gas as well as renewables.

"This is a very good event where you get the chance to see across your own industry, and you have a chance to copy from the best," said Sonja Chirico Indrebo, vice president of strategy and innovation for new energy solutions at Equinor, during last year's event. "So, we are

looking at renewables, and we are also looking at how to decarbonize our oil and gas."

Bringing together companies from the whole offshore energy mix is the driving force of Offshore Energy.

There are diverse opportunities to meet, be it on the exhibition floor at company stands, during Offshore Energy Matchmaking, headed by Enterprise Europe Network, or at the many pavilions, such as the GSES Go Green Pavilion, where best practices for sustainability and circular economy from Boskalis, Heerema, Royal IHC, Peterson Offshore, 8020 Procurement and Theunissen Technical Trading will be shared. OOS International, Merford and TrustLube will also present circular product cases from the Global Sustainable Enterprise system of the NDI.



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“A fascinating mix of leaders from businesses, buyers, investors, engineers and other interested parties within the offshore energy sector will have the opportunity to meet each other at Offshore Energy...”

Another valuable stopping point during the event is the StartUp Zone that showcases early-stage start-ups with good technical ideas that make the offshore energy sector economical, safer, more efficient and more sustainable.

Explore. Inspire. Transform.

Next to the exhibition that covers an area of around 22,500 sq. m, the conference will feature a vast amount of speakers representing leading players in the offshore energy industry. The conference presents an extensive three-day program consisting of keynotes, thematic sessions, master classes, side events and, of course, Community Square, featuring topical talk-shows and informal idea sharing.

The theme of this year's show, which doubles as a call-to-action, is “Explore. Inspire. Transform.” The theme will be reflected on the exhibition floor and form a leading part of the extensive conference program.

The program offers a vast array of topics and formats, as Femke Perlot-Hoogeveen, conference manager, explains: “Offshore Energy 2018 brings four keynote sessions on gas, oil, offshore wind and marine energy. The nine thematic sessions address topics along the life cycles of oil and gas fields and offshore renewables projects. With sessions focusing on technical content or business intelligence, the conference caters to different target groups of energy professionals.”

As just one example, the thematic session “Subsea Cables Systems” will explore concurrent develop-

ments that are leading to increased research into subsea power systems and cables: electrification of offshore oil and gas platforms, subsea field development in oil and gas and the increasing number of offshore wind farms. This session will present the latest insights and technical challenges of powering offshore installations and transmitting power to shore and look at where subsea power for oil and gas and wind meet on the seabed.

Offshore Energy Awards

During the Offshore Energy Opening Gala Dinner, a black-tie event taking place October 22 prior to the opening of the exhibition floor, there will be a presentation of three industry awards: Best Innovation in Offshore Energy Award, Offshore Energy Young Engineer Award and Offshore Energy Public Outreach Award, the latter aimed at improving public awareness and understanding of a company's, organization's or project team's work, or of the offshore energy industry in general, which is often lacking in such a conservative market.

A fascinating mix of leaders from businesses, buyers, investors, engineers and other interested parties within the offshore energy sector will have the opportunity to meet each other at Offshore Energy, and it is precisely this balance between supply and demand that brings together a unique assortment of exhibitors and visitors to the event each year.

More information on Offshore Energy can be found at www.offshore-energy.biz. **ST**

Sounds Under Ice

Acoustic Equipment Records Polar Marine Life, Ice Noise

By Dr. Laurent Chauvaud • Laurent Dufrechou • Alice Vettoretti

Life underwater is noisier than you might think. Co-author of this article and biologist Laurent Chauvaud records underwater sounds in an attempt to better understand how ecosystems work and how they are changing in relation to climate change. As CNRS (Centre National de la Recherche Scientifique) research director in Brest, France, Chauvaud has been making regular expeditions to the Arctic and Antarctic for the last 15 years looking for indicators of the health of ecosystems. He is trying to determine what criteria can be used to measure whether an ecosystem is healthy or disturbed. These criteria must be as easy as possible to measure. He chose RTsys's robust underwater acoustic equipment for the job, particularly the EA-SDA14 embedded multihydrophone recorder.

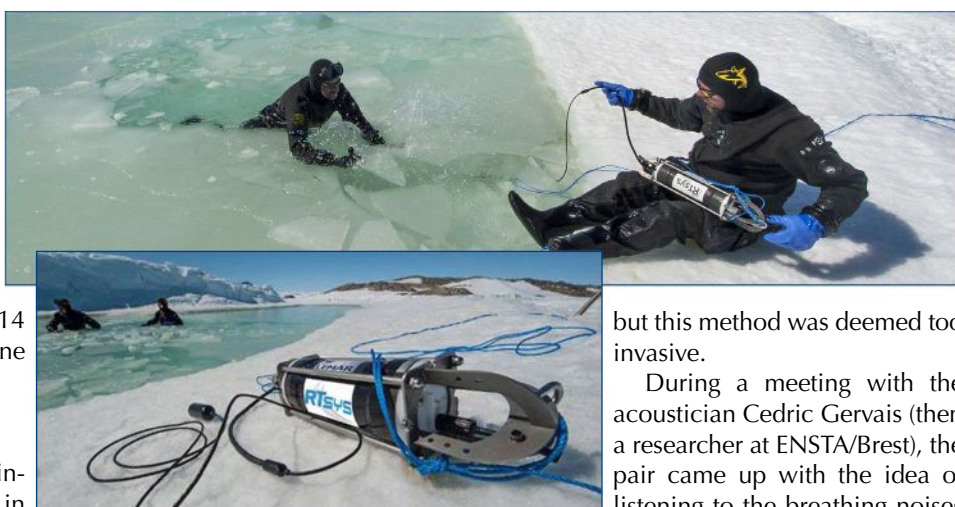
Listening to Scallops

Chauvaud is primarily interested in scallops living in the roadstead of Brest. Their shells' growth rings can be compared to the rings of a tree trunk, but are even more precise: one ring corresponds to one day.

Initially, to understand the formation of these rings, biologists would put accelerometers on the shellfish, like the ones in mobile phones that detect whether the device is upright or on its side in order to rotate the screen,



Scientific divers from the Franco-Quebec BeBEST laboratory use acoustic recorders to record underwater wildlife and the state of polar ice.



but this method was deemed too invasive.

During a meeting with the acoustician Cedric Gervais (then a researcher at ENSTA/Brest), the pair came up with the idea of listening to the breathing noises

made by scallops. The creature's respiratory movements, which are a reflection of its health and growth, generate noise that can be recorded and is an interesting indicator for researchers.

In addition, Chauvaud also very quickly turned his attention to the sounds made by spiders and maerl beds. The sounds made by these creatures provide him infor-

mation on the impact that trawling has on the seabed.

Polar Environment

Recorders off the coast of Brittany paint a very noisy picture, where disruption due to human activities has existed for a long time. Chauvaud and his laboratory team at BeBEST (Benthic Biodiversity Ecology, Sciences and Technologies) have undertaken Arctic and Antarctic expeditions to record polar scallops, sea urchins and other marine invertebrates in areas where human activity is less frequent.

Equipment that can withstand the harsh polar environment is of the utmost importance for experiments. RTsys has been supplying Chauvaud with robust and reliable recorders since 2014. RTsys engineers have developed tools that meet divers' and researchers' needs. In addition to being able to withstand seawater submersion, transportation and the cold and pressure at 50- to 60-m depth, the recorders must also be easy to use as the divers' movements are restricted by the thick wetsuits needed to protect them in -2°C water. Divers are satisfied with the quality of the batteries and the connection reli-



Under sea ice, the RTsys EA-SDA14 recorder works in water that is -2°C .

ability in extreme conditions, as well as the simplicity of the system.

RTsys has been working in partnership with biologists to add a push-button to its EA-SDA14 to make it easier to handle even when wearing diving equipment. This button makes it possible to check underwater whether the recording is working during the dive.

Temperature Shock

Chauvaud and his laboratory team at BeBEST used RTsys recorders for the first time during their 2014 Arctic expedition. Given how satisfied they were, they decided to use them during their 2015 and 2016 Arctic expeditions, as well as at the Daneborg marine station in southeast Greenland in August 2016. The biologists did not experience a single breakdown of equipment during the 2016 expedition.

RTsys provided the researchers with rechargeable recorders, which, unlike battery-powered recorders, do not need to be opened. This limits the risks associated with the device not being closed correctly and problems with measurements. They are also suitable for frequent use, as is typical of scientific expeditions.



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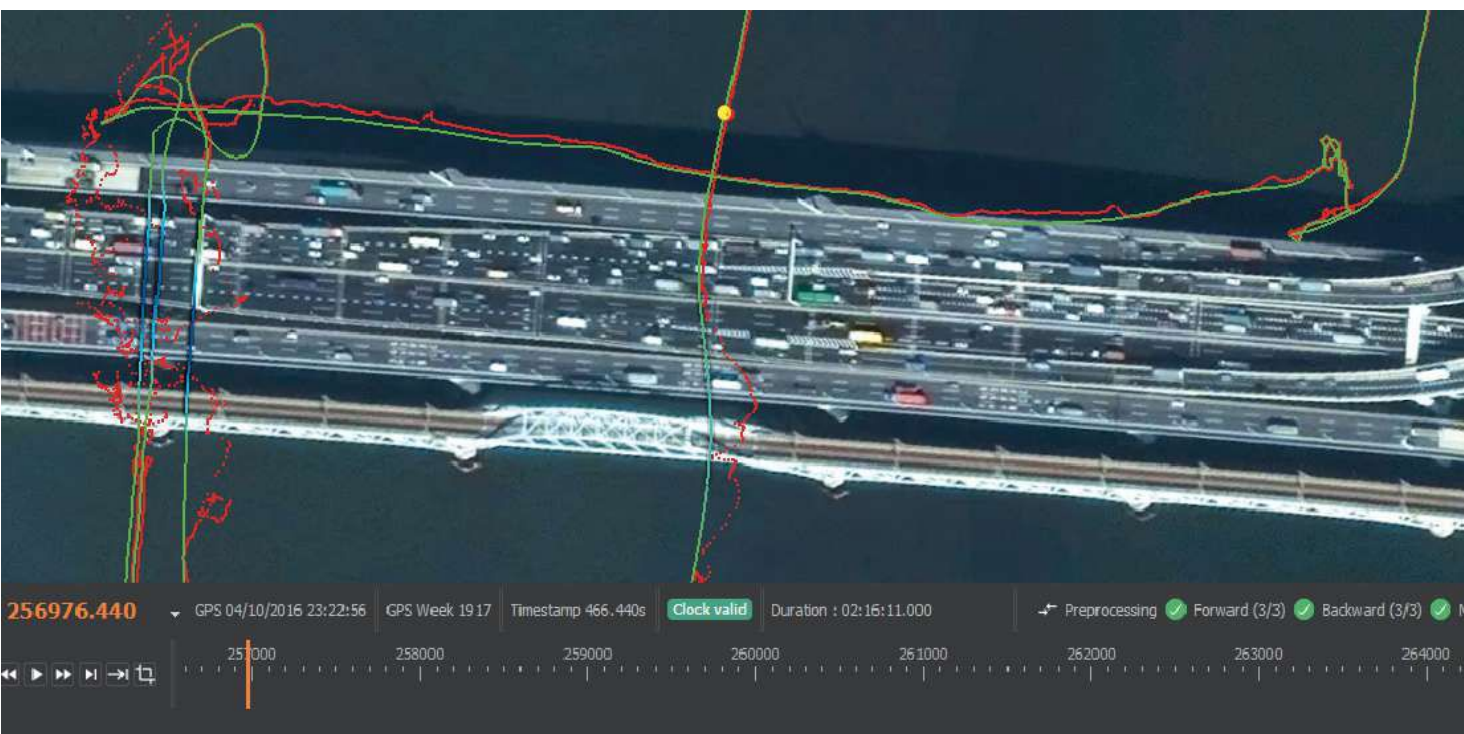


The image shows the JW Fishers Proton 5 Magnetometer, a yellow cylindrical device with a black cap, lying on a gravelly shore. Next to it is a black carrying case with a built-in LED screen displaying a dark image. The device has the text 'PROTON 5' and 'MARINE MAGNETOMETER' printed on it.

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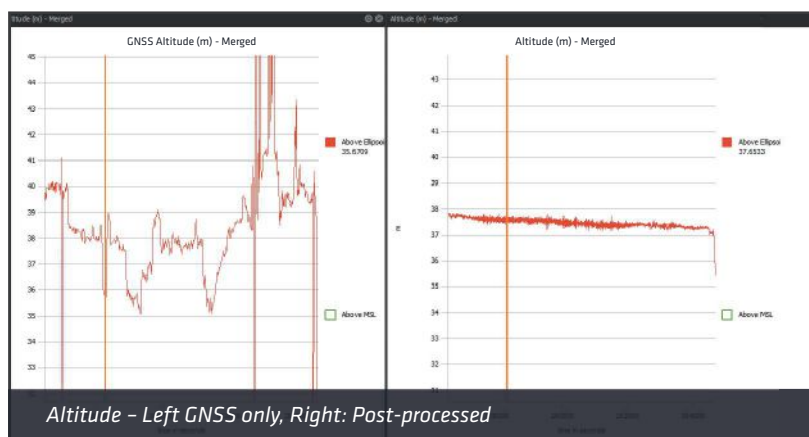
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Ice Movement

The RTsys EA-SDA14 is highly versatile, so researchers have been able to use the same equipment for recording various noises, even at very low frequencies. They have recorded noise made by wildlife such as bivalves (including scallops), bearded seals, walruses and minke whales, as well as noise from ice.

The first sign of an iceberg breaking away from a glacier is the noise

made by the ice dilating. This can be compared to the cracks that appear on an ice cube in a glass of whiskey. Other noises correspond to blocks breaking off and, lastly, the loud crash made by the ice falling into the water that comes with calving, when the iceberg breaks away from the glacier. Divers compare this noise to the grand finale of a fireworks display; they can feel the vibrations inside their chests.

A system made up of four synchronized hydrophones, which are placed 2 m apart from one another, is used to determine an iceberg's position. The divers have not experienced any difficulty using the EA-SDA14 system, which has four synchronized acquisition channels.

The device has opened up new possibilities and created new uses for acoustic recorders. According to researchers, possible uses include monitoring the state of the ice to learn about its position, volume and the time and date at which it breaks away. Chauvaud has been working on such research with glaciologists from Brittany, who now have a tool that meets their needs in remote detection work. Researchers are also thinking about the possibility of using the recorders over extended periods of time, for example over 12 months close to the Dumont d'Urville Antarctic Base, which would require very robust and reliable equipment.

Unknown Effects of Noise

The measurement of noise in the ocean could enable "underwater landscapes" to be mapped that include information on the physical environment and ice, information on underwater life, noise made by wildlife, and anthropogenic disturbance and its impact. For example, it is not difficult to imagine that the sonar impact of human activity close to the Daneborg Marine Station in Greenland, where only a few boats a year go by, is very different from the impact off the much more trafficked coast of Brittany.

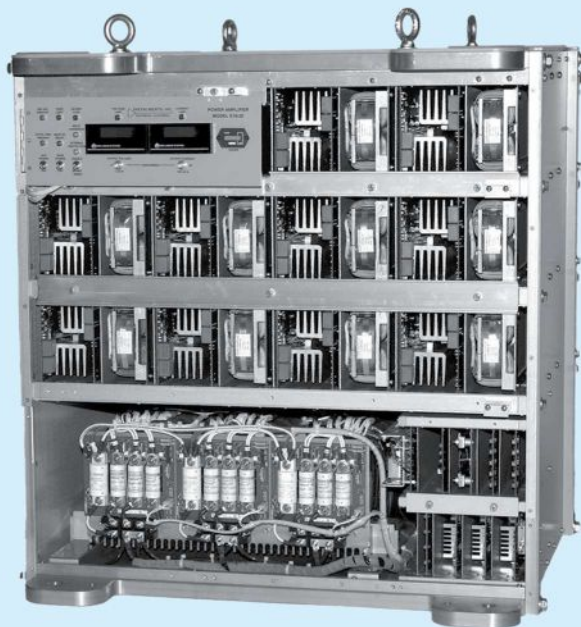
The development of offshore renewable energy is another source of noise, during construction as well as operation, so studying the effects on marine wildlife is highly relevant. While the impact on marine mammals is relatively well documented, the study of invertebrates is only carried out by three groups of researchers in the world, one of which is Chauvaud's laboratory at BeBEST.

Oceanopolis Aquarium Simulations

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“Constant underwater noise off the coast of Brittany is likely to have already led to a change in animal behavior. For testing, it is important to avoid inadvertent interference from further environmental noise, such as from pumps, ventilators or other outside noises...”

els on animal activity, Chauvaud and his BeBEST team carried out trials in aquariums using the same RTsys equipment.

Constant underwater noise off the coast of Brittany is likely to have already led to a change in animal behavior. For testing, it is important to avoid inadvertent interference from further environmental noise, such as from pumps, ventilators or other outside noises such as doors or cars that could disturb these experiments.

The researchers turned to Oceanopolis, a public aquarium in Brest that often participates in research projects, for a sufficiently quiet environment.

Biologists have been able to make very detailed and subtle observations in a controlled environment such as this; for example, they have found that scallops lose weight when there is a lot of noise because it disrupts their heart rate and day/night-time activity cycle. Scallops use a lot of energy when there is a sudden noise.

On the other hand, mussels are stimulated by noise. The researchers want to simulate noise in upcoming research. It will take place in an aquarium where they plan to test the impact of one boat going by per day, compared to 10 boats per day, and measure the effect on the growth and biology of scallops.

RTsys will produce noise sources for this research, such as simulating the noise of a passing boat. This research will build upon observations of the impact of noise on marine life. **ST**

Dr. Laurent Chauvaud is a senior researcher at CNRS with a Ph.D. in marine ecology. He directs the BeBEST laboratory.

Laurent Dufrechou is an acoustics and embedded systems manager and co-founder of RTsys. He has a master's degree in electronics.

Alice Vettoretti collaborates with RTsys as an independent science writer. She has master's degrees in oceanology and scientific communication.

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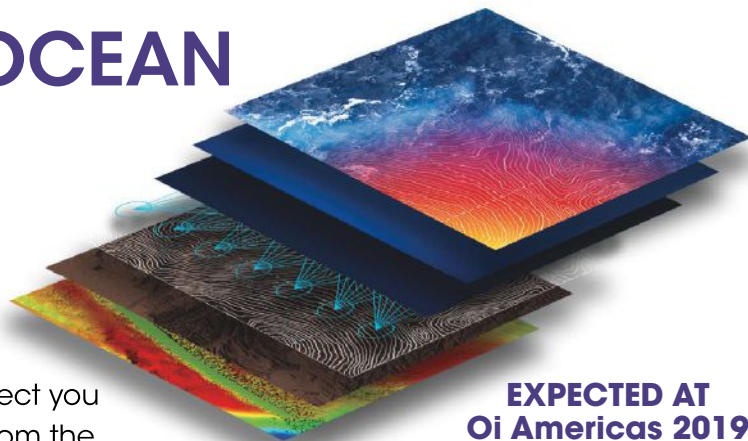
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EURONAVAL

EURONAVAL is the largest international exhibition for naval defense and maritime security and safety. Taking place every two years in Paris-Le Bourget, France, this year's exhibition will run October 23 to 26 and will bring together decision makers from navies and the international naval industry.

In 2016, there were more than 23,000 visitors and 400 exhibitors in a 15,000-sq.-m space and 129 official delegations from 64 countries.

In 2018, EURONAVAL is celebrating its 50th anniversary. With a new, more condensed format spanning four days and an international conference organized the day before the opening as a prelude, EURONAVAL wishes to respond more effectively to exhibitor and visitor expectations. This new edition will pay particular attention to strategic and technological issues, innovation and naval construction trades.

Strategic, Technological Issues

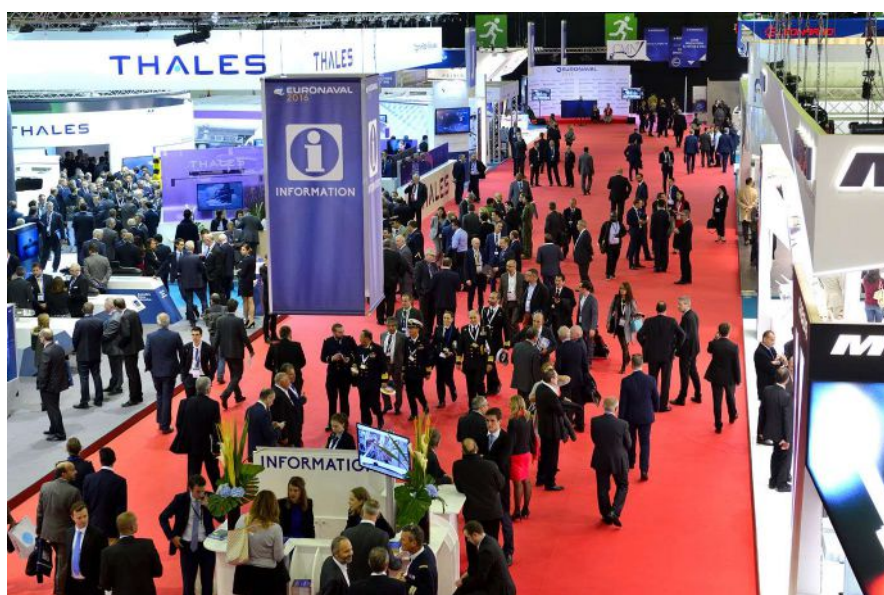
For the prelude to the exhibition, on Monday, October 22, an international conference will be held at the Maison de la Chimie in Paris (www.EURONAVAL.fr/68/presentation). It will bring together high-level speakers from industry, government ministries, navies and think tanks, to discuss the main topics of current and prospective naval defense. The conference, organized in partnership with the FRS (Foundation for Strategic Research) will focus particularly on the maritime



ambitions of powerful states, technological innovations, capability gaps and digitalization of maritime space.

As a privileged international meeting point for contractors, industrialists, experts and decision makers in navies from five continents, the exhibition is organizing a series of themed workshops to allow industrial entrepreneurs and institutional organizations to discuss major technological and operational issues.

Seven themes have been selected—Joint Operations: Air and Sea, Amphibious, Special Operations; Naval Warfare Domains: Surface, Submarine, Air, Mine, Electronic; Cybersecurity and Digitalization; State Action at Coast Guard Function; Underwater Drones and Robotics; Shipyard of the Future and Digital Vessels; and Naval



Past, Future Innovations

For 50 years, EURONAVAL has been the privileged witness to innovation and technological breakthroughs in the naval defense industry. For its 50th anniversary, EURONAVAL will present a retrospective exhibition of the main innovations that have marked naval defense and maritime safety. Entitled “50 Years of Naval Innovations,” this retrospective will enable visitors to relive half a century of this industrial and technological adventure, still in constant progression.

To promote the most promising start-ups in the sector and to increase their visibility, EURONAVAL will be inaugurating a 200-sq.-m area entirely devoted to them. Christened SEAnnovation (<https://bit.ly/2KKWiL1>), it will host around 30 start-ups selected from a call for applications. The organizers received more than 50 applications from international start-up businesses, representing the diversity of activities in the sector. The objective was to cover all aspects of the naval defense sector, encompassing vehicles of the future, predictive maintenance, communication, connectivity, cybersecurity and artificial intelligence for navies. SEAnnovation will be set up close to the Ministry of the Armed Forces and the GICAN (French Marine Industry Group) stands. The space will

“The objective was to cover all aspects of the naval defense sector, encompassing vehicles of the future, predictive maintenance, communication, connectivity, cybersecurity and artificial intelligence for navies.”

host round tables and pitches, punctuating the four days of exhibition. For the selected start-ups, this is an amazing opportunity to gain recognition with contractors in the naval industry, meet officers from navies from all over the world and build new partnerships.

Trade Ship

The naval industrial sector is in good shape and benefits from a number of advantages. It is, however, having difficulty recruiting and training future collaborators.

To promote the excellence of French industry and to recruit young talent, the EURONAVAL exhibition is opening a “Trade Ship.” This area will bring together professionals from different industries who will present and promote around 10 emblematic naval professions to encourage young people to take an interest in naval trades. In partnership with educational authorities and establishments, the EURONAVAL exhibition will help stimulate the next generation of naval defense. **ST**

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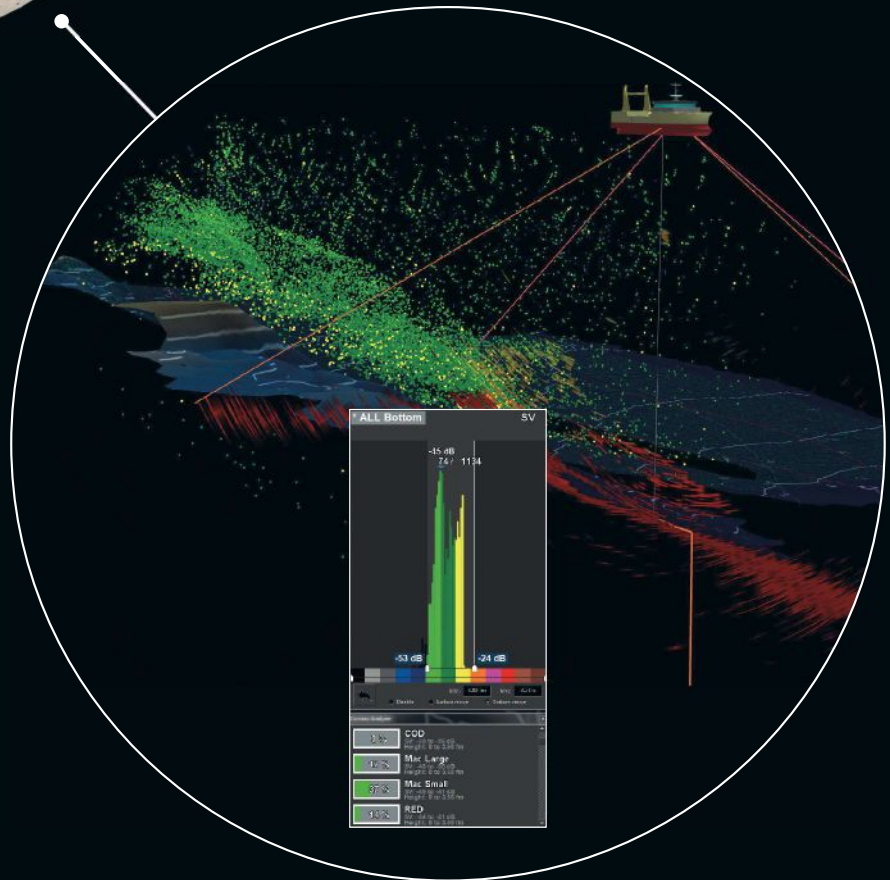


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OCEANS 2018 Charleston

From October 22 to 25, leading marine professionals from all over the world will gather in Charleston, South Carolina, to participate in one of the foremost events focused on marine technology and engineering—the OCEANS Conference, sponsored by the Marine Technology Society (MTS) and the IEEE Oceanic Engineering Society (OES).

Representatives from the biggest names in the industry will be presenting and participating in the event, while suppliers developing cutting-edge technology will offer demonstrations, hands-on workshops and corporate presentations. Four plenary sessions will feature organizations such as NASA, the U.S. Office of Naval Research (ONR), NOAA and regional and local leaders in the U.S. Southeast. More than 500 technical paper presentations will cover current industry trends, research and applications.

OCEANS CONFERENCE & EXPOSITION

There will be 100 exhibitors from premier research and supply companies such as Kongsberg, General Dynamics and Boeing. Abundant networking opportunities will be available

on site at the event and at local destinations, including the heart of downtown, historic Charleston.

Technical Program

For the technical program, this year's theme is "Healthy Oceans, Resilient Coasts, Robust Commerce... Strong Nations." It will explore how science and technology must inform and enable the challenges of a 21st century where environment, society and economics are highly interconnected.

OCEANS topics to be covered will include: Underwater Acoustics and Acoustical Oceanography; Sonar Signal/Image Processing and Communication; Ocean



Observing Platforms, Systems and Instrumentation; Remote Sensing; Ocean Data Visualization, Modeling and Information Management; Marine Environment, Oceanography and Meteorology; Optics, Imaging, Vision and E-M Systems; Marine Law, Policy, Management and Education; Off-shore Structures and Technology; and Ocean Vehicles and Floating Structures.

Local topics will also be covered, including: Enhancing Coastal Resiliency with New Technologies and Community Design; Maritime and Port Logistics, Resilience and Security in an Era of Ever-Bigger Ships, Deeper Ports, Increased Commerce and Stronger Storms; Building Coastal Resilience in the Face of Rising Seas and Intense Storms; Tools and Technologies for Better Assessing Ocean, Community and Human Health; Social Challenges Intensified with a Changing Climate; Educating a Workforce Ready for Future Technologies; and two Special Sessions: Measuring and Growing Your Blue Tech Economy and Tsunami Warning Systems.

This year will feature the inaugural Exhibitor Track, providing suppliers and end-users a more in-depth platform to connect, collaborate and discuss current issues, challenges and solutions in today's marine business. The exhibitor track, held in the middle of the exhibit hall, will hold themed round tables and corporate presentations.

Location

Charleston, South Carolina, is a perfect backdrop for hosting an extraordinary OCEANS Conference. The port city houses the headquarters of NOAA's Office for Coast-

"This year will feature the inaugural Exhibitor Track... a more in-depth platform to connect, collaborate and discuss current issues, challenges and solutions in today's marine business."

al Management, the federal agency tasked with the implementation of the Coastal Zone Management Program and supporting Digital Coast—the go-to source for data, tools, partnerships and training most needed by communities and industries for managing coastal and ocean resources.

The area also boasts active governmental, military and academic research initiatives, providing new perspectives and practices for the industry.

In addition to its industry pull, Charleston is a tourist's dream. The city was voted the top U.S. destination by the discerning readers of *Condé Nast Traveler* (2011 to 2017) and *Travel + Leisure* (2013 to 2017) magazines. Conference attendees will have plenty to see and do in Charleston. **ST**

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US Military Requests More Funding For Unmanned Systems

Proposed spending for unmanned vehicle systems by the U.S. military totals \$9.6 billion for 2019, an increase of 28 percent over last year, according to an analysis by the Association for Unmanned Vehicle Systems International (AUVSI).

Total funding requests for unmanned technologies across all defense agencies comprise about 1.4 percent of the Department of Defense fiscal year (FY) 2019 budget. Each military service—Navy, Air Force, Army—has requested a funding increase for unmanned systems.

The analysis finds that: the Navy requested the largest funding increase among the services, with about \$1 billion more compared to 2018; funding for counter-UAS systems almost doubles from the previous year, with approximately \$1.5 billion for FY 2019, and requests for maritime vehicles are approximately \$1.3 billion; more than half the projects that involve unmanned vehicles across all domains of warfare (air, ground and maritime) are supported by the Navy; and, of the seven core technologies that enable unmanned systems operations, the largest proposed investment in FY 2019 is for integrated sensors and payloads, followed by navigation and control systems.

Trump's Executive Order Repeals National Ocean Policy

U.S. President Donald Trump repealed the Obama Administration's National Ocean Policy with an executive order that emphasizes oil and gas drilling, although also mentioning environmental protection.

Republicans welcomed the move, having deemed Obama's National Ocean Policy "over-reaching," while conservationists are disappointed with Trump's new executive order, believing it rolls back much needed protections for U.S. waters.

New Research Findings On Protected Species in Atlantic

Results from the first phase of the U.S. Bureau of Ocean Energy Management's (BOEM) Atlantic Marine Assessment Program for Protected Species (AMAPPS I) are now available.

AMAPPS I was the first major assessment of protected species in the Atlantic since the Cetacean and Turtle Assessment Program in the 1980s and has greatly enhanced knowledge about the region's marine life and ecosystem.

AMAPPS is a comprehensive multi-agency research program on the U.S. Atlantic Outer Continental Shelf (OCS), from Maine to the Florida Keys, to assess the abundance, distribution, ecology and behavior of marine mammals, sea turtles and seabirds throughout the U.S. Atlantic OCS; to place them in an ecosystem context; and to provide spatially explicit density estimates to aid marine resource management decisions. Research highlights include: improved modeling calculations to help

scientists address how often various cetacean species could be detected; identification of persistent, higher concentrations of marine birds off the Outer Banks, off eastern Long Island and in the Martha's Vineyard/Nantucket region compared to other areas along the U.S. Atlantic; relatively high densities of loggerhead turtles were found in coastal waters from Cape Hatteras, North Carolina, to Long Island, New York, during the summer; and identification of a potential new spawning area for Atlantic bluefin tuna off the U.S. Northeastern Continental Shelf in an area called the Slope Sea.

AMAPPS I took place through an interagency agreement with NOAA's National Marine Fisheries Service and in collaboration with the U.S. Fish and Wildlife Service and the U.S. Navy.

The second phase, AMAPPS II, is taking place from 2014 to 2019 and continues to take direct aerial and shipboard surveys from northern Maine to Florida.

Researchers are also conducting acoustic surveys in U.S. coastal waters with hydrophones to record animal sounds.

The research applies to all three BOEM program areas: offshore renewable energy, conventional energy and marine mineral resource development on the Atlantic coast.

House Bill to Spur Innovation in National Labs

The U.S. House passed H.R. 5907, the NIMBLE Act, without opposition. The legislation, sponsored by Rep.

Randy Hultgren (R-Ill.), allows National Laboratories to more easily work with outside researchers by removing red tape in the Department of Energy approval process.

This legislation is part of a bipartisan effort to open up U.S. national labs to collaborate with more small businesses and be engines for national, regional and local economic growth.

Many small businesses cite the time it takes to enter into agreements as a major barrier when working with the labs. By cutting red tape and giving more discretion to laboratory directors, the NIMBLE Act should speed up the process for new businesses bringing ground-breaking ideas to the market, as well as give more access to smaller businesses and start-ups.

Containership Honors Late Hawaii Senator

The *Inouye*, the largest container ship ever built in the U.S., has been christened. It was built by Philly Shipyards for shipping company Matson Inc. and was named for Daniel K. Inouye, a former Hawaii senator, war hero and long-standing maritime champion.

"At a time when the U.S. maritime industry is fighting to keep its place among international competitors, this event was a momentous occasion," U.S. Maritime Administrator Mark H. Buzby said about the ship's christening. "Built for the Hawaii trade, the *Inouye* represents the blending of the most advanced technologies with proven American shipbuilding skills." **ST**



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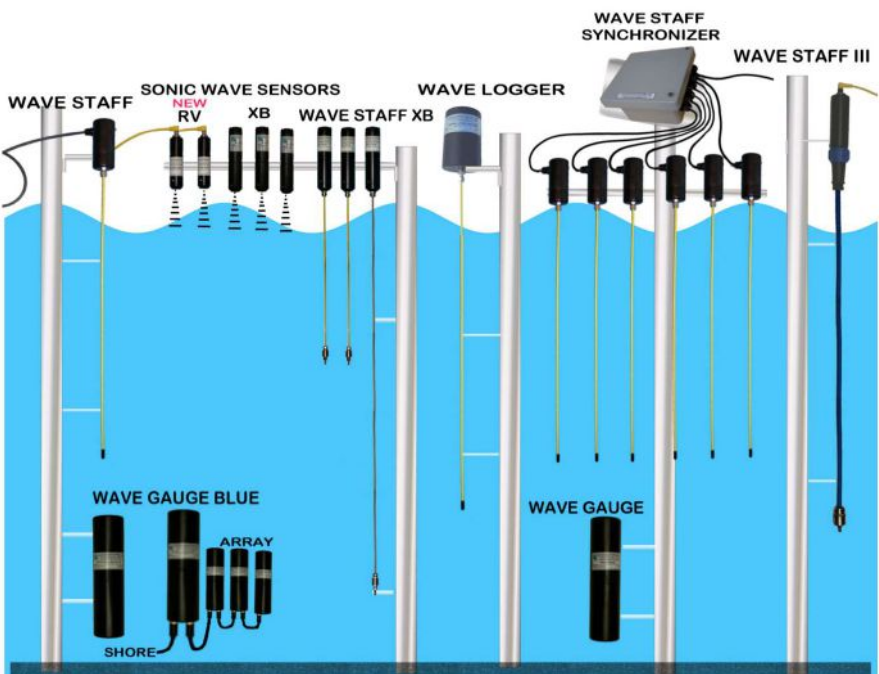
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Ship Exhaust Scrubber Installed on Liberian Ship

The Chelsea Technologies Group Sea Sentry wash water monitoring system for ship exhaust gas cleaning systems has been installed in a Shandong Pure Ocean Technology scrubber, which has been retrofitted to Liberian-flagged bulk carrier BAO *Glory*, at the Weihai Xinhong shipyard. The installation is one of the first scrubber retrofits to be carried out in a Chinese yard, a reflection of the acceleration in the global scrubber market.

Dubai Ranked Among Top Five in International Shipping Centre Development Index

Dubai has scored a new milestone in its bid to cement its leadership in the international maritime sector after it was selected as one of the world's top five in the International Shipping Centre Development Index (ISCD). Dubai is known for its infrastructure and world-class maritime and logistics capabilities. According to a report by the London-based Baltic Exchange and the Xinhua News Agency, Dubai has overtaken Hamburg, which fell from fourth to seventh place, confirming the emirate's reputation as a leading maritime shipping and logistics center.

New Production Facility Obtained For Diesel Outboard Engine Assembly

Cox Powertrain is moving into a 28,000-sq.-ft. production facility in Cecil Pashley Way, near Brighton City Airport. The building will be the assembly plant for Cox Powertrain's CXO300 diesel outboard engine, which goes into production in 2019. The U.K. engineering company currently employs 70 staff and plans to grow its workforce to meet the demand for its diesel engine and recruit an additional 78 staff before 2020.

Biomimetic Propulsion System Powers Record-Breaking Submarine

IMarEST's European International Submarine Races 2018 concluded with the Canadian École de Technologie Supérieure team taking the winning trophy with their submarine, Omer 11, and breaking the world speed record. The runners-up came from universities in the Netherlands and the U.S.

Omer 11 is the first human-powered submarine to be equipped with interchangeable propeller and nonpropeller propulsion systems. The biomimetic propulsion system, which was inspired by the wings of a penguin or sea turtle, reached a speed of 4.94 kt. to beat the world speed record, which had stood since 2009.

Marine-i Announces New Horizons Winners

Marine-i has announced the winners of its first New Horizons Awards, created to spotlight innovation in the marine technology sector.

The Business Growth Award was won by KML Ltd. The Technology Innovation Award went to ARC Marine, the first eco-engineering company in the U.K. that specializes in modular artificial reefs. The Cornwall First Award

was presented to Triskel Marine, one of the leading innovators in hybrid propulsion.

Rovco Plans to Double in Size Next Year

U.K.-based Rovco has announced plans to double its workforce as it prepares for further global expansion following a year of growth for the company. To accommodate its expanding team, the firm recently relocated to larger premises in Bristol, a 2,200-sq.-ft. space that will house a research and development laboratory for studies on underwater AI and live 3D computer vision.

Chinese Record-Breaking Ship is Equipped with ABB Turbochargers

ABB turbochargers support performance and fuel efficiency for one of the world's largest container ships, COSCO *Shipping Universe*, which has broken the record for China's largest container ship. ABB turbochargers have been selected for all main and auxiliary engines across six 21,000-TEU container ships that will be delivered for the Universe series by 2019. ABB turbochargers are in use across the COSCO Shipping Lines fleet.

World Ocean Council Gains Two New Members

The James Michel Foundation, established by the former president of the Seychelles, and Singapore's Tian Sian Shipping have joined the World Ocean Council (WOC), an international, cross-sectoral leadership alliance on ocean sustainable development, science and steward-

ship. Former President James A. Michel of the Republic of Seychelles, who will speak at the WOC Sustainable Ocean Summit in Hong Kong in November 2018, said WOC is the most efficient way to foster ocean sustainable development.

Damen Participates in Sustainable Design

Damen Shipyards Gorinchem, in cooperation with Netherlands Maritime Technology (NMT), is to coordinate the NAVAIS program, which began in June with the Innovation & Networks Executive Agency of the European Commission (EC) signing the grant agreement. NAVAIS aims to maintain the European shipbuilding industry's world-leading position in the design and construction of complex, value-added and highly specialized vessels while further integrating sustainability into designs.

Wave Buoy Network to Help Monitor Waves In Australian and Antarctic Waters

AXYS Technologies in partnership with Metocean Services International will supply Australia's Bureau of Meteorology with four TRIAXYS wave buoys. In support of the bureau's marine weather and ocean services, a wave observing system that enables continuous automated observation and reporting of hydrological surface waves at Kangaroo Island, South Australia, and Strahan, Tasmania, was required. The first two TRIAXYS wave buoys have been delivered and were to deploy in August. The remaining two buoys will deliver in the fall of 2018. **ST**

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Ocean Bottom Node Technology Deployed for Gulf of Mexico Survey

Fairfield Geotechnologies has been awarded a contract by BHP to acquire up to 1,004 sq. mi. of ocean-bottom-node seismic data in the Alaminos Canyon and East Breaks areas of the Western Gulf of Mexico. The survey, located in water depths from 2,500 to 7,250 ft., will employ two seismic source vessels and Fairfield Geotechnologies' newest ocean bottom node technology, ZXPLR. The survey will deliver seismic data for imaging and provide the long-offset, full-azimuth data necessary for high-resolution velocity model building.

New Mediterranean Observatory Uses Inductive Telemetry Recorders

A new Mediterranean observatory relies on inductive telemetry and temperature/pressure recorders. The observatory is called THMO (Texas A&M - University of Haifa Eastern Mediterranean Observatory) and comprises a shallow mooring (125 m) on the continental shelf and a deep mooring (1,500 m) 50 km from Haifa. Sound-nine's Enduro APT recorders with inductive telemetry are clamped to the wire rope mooring line at 11 depths. The two moorings have real-time RF communication with a shore station linked to the University of Haifa.

Partnership Facilitates \$2.5 Million Expansion of Port Allen Facility

CORTEC, a manufacturer of API chokes, valves and manifolds, and Louisiana Economic Development (LED) announced a \$2.5 million expansion of CORTEC's facility in Port Allen, Louisiana. CORTEC and LED began working on the expansion in March 2018, and it will be completed by the second quarter of 2019. The expansion will allow CORTEC to increase its space, equipment and capabilities and expand into specialized coatings.

New York City to Overhaul its Aging Maritime and Rail Distribution Systems

New York City Mayor Bill de Blasio, along with federal, state and local officials and industry experts, unveiled a \$100 million plan to overhaul the city's aging freight distribution systems through strategic investments to modernize maritime and rail assets and create new distribution facilities. The plan, called Freight NYC, intends to create nearly 5,000 jobs and a more sustainable and resilient supply chain network.

Fire Detection Company Recertifies With ISO 9001:2015 Standards

Sea-Fire Marine, specializing in fire detection and suppression systems for recreational, commercial and naval vessels, has recertified to ISO 9001:2015 standards. This comes on the heels of the company relocating its North American corporate headquarters into a state-of-the-art 30,000-sq.-ft. manufacturing space. The new 2015 ISO standard retains the same core values of a sound quality



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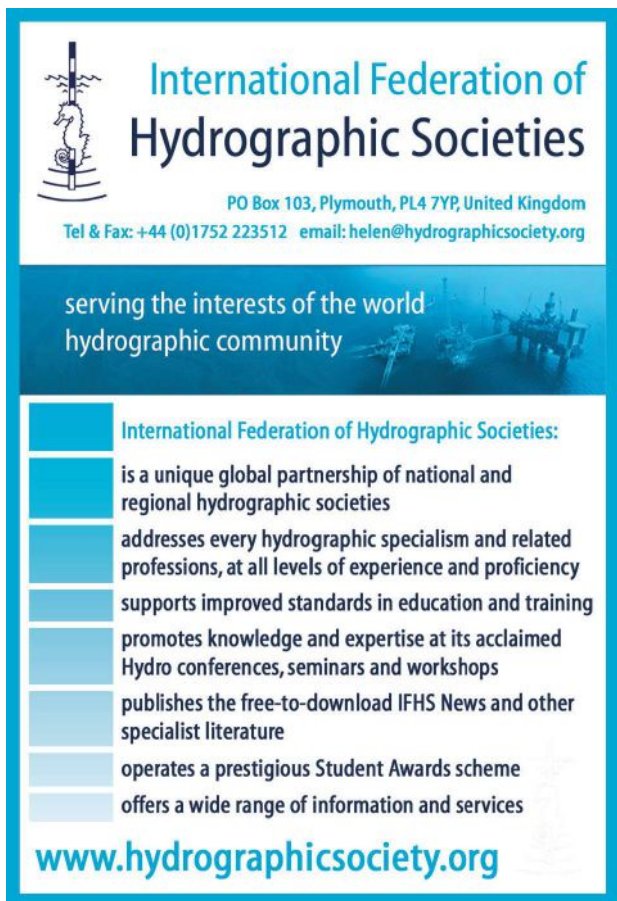
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management system (QMS) outlined in ISO 9001:2008 while adding a focus on risk assessment.

High School in Chile Receives Donated ROV

Ercomar, in conjunction with VideoRay, has donated a Pro 4 ROV to a high school in Maullin, Chile, where aquaculture is a major industry, to facilitate a safer work environment for the students when they enter the workforce after graduation. ROV operator courses will be added to the aquaculture curriculum, resulting in a certificate in aquaculture and underwater robotic operations upon completion of the course.

Tugboat and Barge Association Adopts Subchapter M Towing Safety Rules

The American Waterways Operators, a national advocate for the tugboat, towboat and barge industry, is welcoming the implementation of towing vessel safety regulations, Subchapter M, which took effect in July. The product of 15 years of collaboration between the towing industry and the U.S. Coast Guard (USCG), the regulations set baseline safety standards for towing vessels and offer two compliance options: a towing safety management system audited by a USCG-approved third party or annual USCG inspections.

Expedition Cruise Ships Outfitted with Sonars

FarSounder received an order for four FarSounder-1000 forward-looking sonars from Wärtsilä Valmar-

ine to be installed in new expedition polar-class cruise ships, giving them real-time 3D data that updates on their bridge as well as sonar systems with no moving parts that retrieve images from more than 1,000 m away. This will broaden the vessels' exploration capabilities by allowing for safe navigation in waters otherwise thought of as impassable.

8,000 Total Broadband Units Sold

KVH Industries announced that it recently shipped its 8,000th mini-VSAT broadband system.

The TracPhone V-series satellite communications antenna systems utilize advanced satellite technology, including the latest high-throughput satellites (HTS), to meet the growing demand for more onboard broadband connectivity.

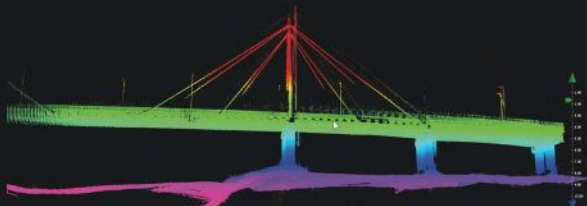
World Ocean Council to Host Coastal Planning Event at Global Climate Summit

A World Ocean Council (WOC) event to be held at the Global Climate Action Summit in San Francisco this month will advance business leadership in adapting ports and coastal infrastructure to changing sea level and major weather events. The purpose is to create a capacity-building program to prepare SIDS governments and their port owners, operators and users to overcome resource constraints and institutional barriers and catalyze private sector engagement for port adaptation, including finance. **ST**



New in SonarWiz 7.2

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- ▶ Acoustic Color Image Tool for multi-frequency backscatter
- ▶ New Color Legend for Plan View
- ▶ Enhanced Helm Display and Auto Vessel Creation
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Field Service Mobile App

A new app developed for field technicians offers service companies an efficient view of assigned tasks, with the ability to update work orders in real time using features such as voice-to-text recordings to increase productivity. MyTaskit.

New Optical Ferrule Size

The 1.25-mm ferrule provides single-mode and multi-mode options with low insertion losses for subsea applications in extremely high-density pin configurations, while affording exclusive precision alignment capabilities. BIRNS Inc.

Modular Wireless System

The ZigBoat can monitor everything from bilge water to movement on deck, all tracked on a smartphone, using the Gateway core module. The unit is 4 x 4 x 1.1 in., runs off 12 to 24 VDC and has a backup battery life of three to five years. Glomex Marine Antennas USA.

Vertical Screen River Radar

The FR1908VBB processor outputs dual video signals in high resolution. Target detection ensures awareness of all targets in the environment. Six NMEA input/output

ports allow interfacing with the rest of the helm, and a direct connection to a VDR or SVDR is also available. Furuno USA Inc.

Directional Drilling PowerTool

HDDPT is software for horizontal drilling that enables safe and efficient pipeline drilling, reaming and installation through minimizing excavation complexity, preventing borehole collapse and monitoring drilling or pulling operations. Technical Toolboxes.

Magnetic Mount Antenna

The TW7875 magnetic mount GNSS antenna is capable of receiving GPS L1/L5, GLONASS G1, BeiDou B1, Galileo E1/E5a and NavIC L5 and is especially designed for precision dual-frequency positioning. It employs multipath signal rejection with a low axial ratio and provides a linear phase response and tight phase center variation. Tallysman Inc.

Fluorescent Mooring Ropes



Tipto Winchline has a phosphorescent tracer yarn in the outer jacket, with a load-bearing, seven-strand core. Lankonect is a synthetic fiber rope connection that replaces a cow hitch or shackle. Lankoforce 12-strand rope has reflective tape braided into the Dyneema jacket. Lankhorst Ropes.

Portable Deck Box

Launch Box is a compact waterproof deck box with Wi-Fi capability, GPS time synchronization and extended power to icListen or any 24-V Ethernet device. It transmits data wirelessly up to 100 m and can be used with a single hydrophone or to cre-

ate multihydrophone arrays through smart cables. Ocean Sonics Ltd.

Long-Range Acoustic Recorder

MULTHY is a recorder coupled to an acoustic antenna equipped with 16 omnidirectional hydrophones. It is less than 20-m long, and multiple hydrophones with digital processing reduce noise and improve signal quality, recording up to 100 kHz. RTsys.

Rugged Sunlight Readable Monitor



SRMH-13.3U is a 13.3-in. screen with full HD resolution and more than 1,500 nits of brightness, five times brighter than a standard monitor. The monitor features a powder-coated steel enclosure and an operating temperature range of 32° to 158° F. TRU-Vu Monitors Inc.

Multi-Function Display

The new flagship MFD system, Axiom XL, is an all-in-one sonar module, with RVX1000 3D chirp sonar with dual transducer ports and RealVision 3D high-powered chirp sonar. The unit has oversized, full-HD displays available in 16-, 19-, 22- and 24-in. sizes. Raymarine Inc.

Task-Based Competency Feature

A new feature in the Videotel Performance Manager provides the ability to structure task-based competency assessments for seafarers on any given subject and monitor skills development, with results available to shore staff in interactive reports. KVH Videotel.

SonarWiz 7.2 Release

New functionality includes interactive 3D contact reporting, improved interpretation of elevation data, an acoustic color image tool for multifrequency backscatter, an enhanced helm display, side scan pitch and roll corrections and more

soft license options and bundles. Chesapeake Technology Inc.

Rack Mount Cases

Pelican-Hardigg V-Series cases use a full-boxed 19-in. steel rack with a square hole pattern for easy hanging of electronics with tab mounts. Cases are rated for 170 lb. and include a manual purge valve to equalize air pressure in the case to prevent vacuum-lock. OrionCase Enterprises LLC.

Wet Wide-Angle Lens

The UWL-09Pro has a wide field of view and a zero minimal focus distance, with six multilayered precision optic elements organized in six groups. The lens can be used with lens mounts of other dimensions using an optional adapter. Fantasea Line.

USB Digital Accelerometer

Model 633A01 allows vibration measurements via USB plug-and-play capability. Features include piezoelectric ruggedness and ex-

tended dynamic range; broad frequency and dynamic range; ability to record and send data to off-site specialists; and embedded calibration. IMI Sensors, a PCB Piezotronics Div.

Heavy-Duty Flow Switch

The FLT93 Series Switch is a flow/level sensor with a NEMA 4X enclosure for use with heavy marine seawater, acidic or alkaline fluids and wash-down cycles. The switch indicates both flow and temperature or level sensing, with dual 6A relay outputs assignable to flow, level or temperature. Fluid Components International LLC.

Contaminant Control Material

The 3M Self-Stick Liquid Protection Fabric provides a temporary and conformable surface covering that adheres to most surfaces but removes easily and leaves no residue. A key feature is its nonwoven surface, which traps contaminants rather than allowing them to land, which minimizes spreading. 3M. **ST**

ROS L300 LED Spot or Floodlight Offers Full-Range Dimming and Deep Water Brilliance

A rugged new housing design features a 42 LED array and produces 7,500 lumens illumination. The L300 is depth rated to 6000 meters.



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Decom North Sea Award Winners

The winners of the 2018 Decom North Sea Awards have been announced.

Sponsored by The Oil and Gas Technology Centre (OGTC), the Outstanding Innovation category was won by BiSN for its Wel-Lok M2M well sealant technology.

The Excellence in Collaboration award, sponsored by Port of Cromarty Firth, was presented to Shell U.K. Ltd. – Boskalis – Veolia-Peterson for demonstrating how collaborative working and sharing best practices can maximize recycling of assets and drive sustainability in the industry.

Mark Bayman, who recently retired from the position of decommissioning manager (technical) at OPRED, was presented with the Contribution to the Decommissioning Sector accolade.

Decom North Sea also announced the new Decommissioning Leadership Group, whose members will drive strategic direction and the delivery of the organization's objectives, relating across the scope of decommissioning activity.

Shell Deepwater Discovery In Gulf of Mexico

Shell has made a large, deep-water exploration discovery in the U.S. Gulf of Mexico with its Dover well (100 percent Shell). The Dover discovery is Shell's sixth in the Norphlet play and has encountered more than 800 net ft. of pay (244 m). The discovery is located approximately 13 mi. from the Appomattox host and is considered an attractive potential tieback.

Shell's Appomattox host has now arrived on location in the U.S. Gulf of Mexico and is expected to start production before the end of 2019.

Offshore Trials for Subsea Cementing System

DeltaTek Global has achieved two successful onshore field trials of its SeaCure system, resulting in subsequent offshore trials with two North Sea operators this summer as part of a project backed by the Oil & Gas Technology Centre.

SeaCure is a subsea cementing system delivering stabbed in inner string cementing for subsea wells.

The three offshore trials will be in live North Sea wells operated by Chevron and Siccar Point Energy, down to a water depth of 5,000 ft. The trials are expected to lead to a full product launch in September.

Offshore Vessels For Maritime Security

Sovereign Global has developed a maritime security solution providing governments, NGOs and multinational corporations with an owned or chartered fleet of highly versatile, hybrid-fuel and cost-efficient offshore patrol and COMINT vessels, complete with crew and

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The OPV55 series is equipped with next-generation recognized maritime picture (NG-RMP); fast-response interdiction vessels; subsea security sonars; intelligence, surveillance and reconnaissance (ISR) devices; live satellite imagery; unmanned airborne systems (UAS); and MARPOL oil spill response equipment. Flexible mission modules and modular manning quarters make customized mission configurations possible. For COMINT operations, an extended mast is added to carry the payloads for Iridium SATCOM interception monitoring and radar systems.

SMD Plough Works In Baltic Sea Project

Soil Machine Dynamics Ltd.'s (SMD) multimode pre-lay plough delivered to Greek offshore contractors Assodivers Ltd. earlier this year has successfully completed its first offshore job in the Baltic Sea.

The multimode pre-lay plough is the newest addition to SMD's power cable installation and protection product range. This plough has configurations for boulder clearing, trenching and backfill. The boulder clearance pass clears a 13.0-m-wide route, including surface and submerged boulders.

The trenching pass creates an engineered Y trench profile with a secure power cable pocket for subsequent lay process. The backfill pass moves the cut spoil excluding boulders back over the product for maximum cover.

All three modes have responsive and controlled steering and a fully integrated sensor suite for as-built survey of performance.

Mapping the Jobs Of the Future

A project to develop a new U.K. oil and gas skills strategy has been launched following widespread industry and government support for the findings in OPITO's UKCS Workforce Dynamics Review.

OPITO has appointed Robert Gordon University's (RGU) Oil and Gas Institute to support the development of the strategy over the next several months.

This will involve an industry survey and workshops to help develop a blueprint to support skills diversification and digital transformation.

The Workforce Dynamics Review found that if the sector achieves ambitions around the energy transition, oil and gas production and exports, around 40,000 people will need to be recruited into the sector over the next 20 years, and 10,000 of those will be in roles that don't currently exist.

RGU's Oil and Gas Institute will engage with industry and stakeholders to gather data to assess existing and new skills required for job families and to create skills demand maps. A survey will investigate the industry's demand for future skills and capability requirements. Workshops will involve industry specialists, young professionals and apprentices. **ST**

NEW class of ROV Propulsion



Powerful and silent subsea thrusters from Copenhagen Subsea A/S have been developed with reliability as the highest design priority.

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US Navy Chooses Naval Strike Missile

The U.S. Navy has selected the Naval Strike Missile (NSM), offered by Raytheon Co. and Kongsberg Gruppen, to meet its over-the-horizon requirement for littoral combat ships and future frigates.

Raytheon and Kongsberg will manufacture and deliver weapon systems under a \$14.8 million contract for offensive missiles loaded into launching mechanisms, and a single fire control suite.

NSM is a long-range precision missile that strikes heavily defended land and sea targets. The missile, which can defeat enemy defenses up to 100 nautical miles away, uses advanced seeker and target identification technology.

Omniphobic Coating Will Improve Vessel Fuel Efficiency

The U.S. Office of Naval Research (ONR) is sponsoring work by Dr. Anish Tuteja of the University of Michigan to develop a new type of "omniphobic" coating. This chemical coating is clear, durable, can be applied to numerous surfaces and sheds just about any liquid. The rubber-like combo can be sprayed, brushed, dipped or spin-coated onto numerous surfaces, and it binds tightly.

Of particular interest to the Navy is how omniphobic

coatings can reduce friction drag on ships, submarines and unmanned underwater vessels.

Up to 80 percent of a ship's fuel at lower speeds, and 40 to 50 percent at higher speeds, goes toward maintaining its speed and overcoming friction drag. Tuteja's omniphobic coating could be a solution.

The coating could also protect high-value equipment like sensors, radars and antennas from weather.

Tuteja and his research team studied vast computer databases of known chemical substances, then entered complex mathematical equations based on each substance's molecular properties to predict how any two would behave when blended. After analyzing hundreds of combinations, they found the right mix.

The coating is undergoing further testing and should be ready for small-scale military and civilian use within the next couple of years.

Australia Gets Hyperbaric Equipment for Sub Rescues

The Royal Australian Navy (RAN) and the Australian government have granted the license to operate new \$19.7 million AUD hyperbaric equipment, which means that, for the first time, the whole crew of an Australian submarine can be treated at once.

The equipment, a transfer-under-pressure chamber and recompression treatment suite, was received from JFD, part of James Fisher and Sons plc, as part of an existing escape and rescue contract.

Up to 88 people can now receive life-saving medical treatment in the hyperbaric equipment suite and pressurized transfer chamber at any one time. When you consider that a *Collins*-class submarine has a crew of 48 to 60, this new capability represents an important milestone for submarine rescue in Australia.

The hyperbaric equipment suite is able to withstand and operate effectively in rough, continuous seas with swells of 5 m. This capability is critically important as the new kit is the final step in a submarine rescue, which begins with rescuing the crew from a disabled submarine and transferring them safely into a JFD free-swimming, piloted rescue vehicle that carries them safely to the surface and onto the deck of a rescue ship. The submariners are then moved through the transfer-under-pressure chamber and into the hyperbaric equipment suite, with doctors monitoring their wellbeing and helping them overcome any life-threatening effects resulting from being rescued from pressurized waters.

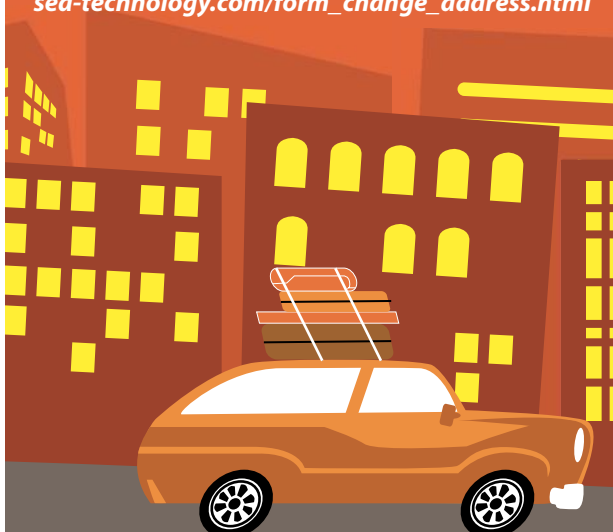
Diver Vision Display System In Naval Development

Coda Octopus Group Inc. has entered into a cooperative research development agreement (CRADA) to transition the prototype of the Divers Augmented Vision Display-Head Up Display system (DAVD-HUD) into a complete system that is ready for operational use with U.S. Naval Surface Warfare Center Panama City Division (NSWC PCD).

A four-phase, multigenerational development program will run through 2025. **ST**

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Slow-Speed Engines Better for Long Term

The Swedish Club warns that vessel operators should always look to the long term when specifying the type of engines to be installed across the fleet. Latest statistics from the club show that vessels propelled by medium/high-speed engines have a claims frequency 2.5 times higher than slow-speed engines, with an average claims cost close to \$650,000.

"Main Engine Damage," the latest loss prevention report from The Swedish Club, sheds light on an expensive category of damage that is all too frequent. Statistically, a vessel will suffer one to two incidences of main engine damage during its lifetime.

The report shows that bulkers and tankers are the best performers for claims cost. Most of these vessels have slow-speed engines. Conversely, passenger vessels/ferries have the highest frequency of main engine claims. Often, these vessels have multiple medium-speed engine installations. The same is also true for Ro-Ro vessels.

Lubrication failure is still the most expensive and frequent cause of damage, followed by incorrect maintenance and/or repairs.

The publication includes loss prevention advice from the major engine manufacturers MAN Engines and Wärtsilä.

Emission-Free Fuel Cell Power Plant for Ships

ABB and Ballard Power Systems have signed a memorandum of understanding to develop a next-generation fuel cell power system for sustainable marine e-mobility.

The fuel cell power system, to be jointly designed, developed and validated, will help accelerate the industry-wide adoption of sustainable solutions for marine e-mobility and help shipowners meet the increasing demands for clean operations.

ABB and Ballard Power Systems will leverage the existing kilo-

watt-scale fuel cell technologies and optimize them to create a pioneering megawatt-scale solution suitable for powering larger ships. With an electrical generating capacity of 3 MW (4,000 hp), the new system will fit in a single module no bigger in size than a traditional marine engine running on fossil fuels.

The proton exchange membrane fuel cells (PEM) convert the chemical energy from hydrogen into electricity through an electrochemical reaction. They involve no combustion, converting fuel directly to electricity, heat and clean water.

With the use of renewables to produce the hydrogen, the entire energy chain can be clean.

Foss Looks to Software To Tighten Operations

Foss Maritime has begun to centralize its fleet management and operations with Helm CONNECT, a marine software platform.

Foss intends to better organize and streamline operations across core business units and wholly owned subsidiaries along the U.S. West Coast and in Hawaii and Alaska.

Foss will centralize its vessel dispatching, billing, maintenance, compliance and personnel management in the Helm CONNECT software platform.

Seattle-based Foss Maritime has one of the largest tug and barge fleets in the United States.

Smaller REMUS Enables More Applications

Hydroid has collaborated with Nortek to create a compact, portable AUV capable of single-person operation that would open up new possibilities for deployment.

The REMUS M3V is an AUV of A-size form factor (0.91 by 0.12 m).

The compact size of the M3V makes it ideal for many applications, including marine life research, underwater assessment of oil and gas installations and offshore wind

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turbines, oil spill response, and military applications. The A-size form factor means the REMUS M3V can be launched from the air, on the surface and even submerged below the sea.

The REMUS M3V has Nortek small-form Doppler velocity log (DVL) sensors and related equipment to help accurately measure the AUV's velocity and altitude relative to the seafloor down to 300-m depth.

Joint Subsea-Surface Survey Operations Demo

The ability for multiple unmanned subsea and surface systems to work together on joint survey missions, controlled from shore, has taken a step closer to operational reality following a two-week trial in Scotland's Loch Ness.

Sonardyne International Ltd.'s USBL acoustic positioning and AvTrak telemetry systems enabled a USV to locate, track and command and control a UUV. Position and mission status updates were trans-

mitted to shore via surface communications. The mission also included through-water transfer of data collected by a Sonardyne Solstice multi-aperture sonar on the UUV to the USV using Sonardyne's BlueComm optical modem.

The demonstrations, involving the National Oceanography Centre's (NOC) Autosub Long Range (ALR) and ASV Global's C-Worker 5, were the culmination of the three-year Autonomous Surface and Sub-surface Survey System (ASSSS) project, led by ASV Global, with partners Sonardyne, NOC and See-Byte Ltd., supported with funding from Innovate UK and the Defence Science and Technology Laboratory.

The need to collect more data from the marine environment means that marine autonomous systems need to be at sea for longer. Pairing a UUV or AUV with a USV means that positioning accuracy can be optimized on missions lasting weeks, if not months, without the need for manned surface vessel support. By using optical

and acoustic communications systems, the survey data can also be accessed more economically and missions can be updated on the fly, according to what is found, without the UUV having to surface or needing to be recovered.

RockFLEET for VMS

Rock Seven's RockFLEET global tracking and messaging system, has been selected as one of four approved devices in a mandated scheme to install a vessel monitoring system (VMS) to all commercial fishing boats in Queensland, Australia. All commercial fishing and charter boats will require a vessel tracking device to be fitted and operational by 2020. Net, crab and line boats, meanwhile, will need to have a VMS in place from January 1, 2019. Rock Seven's partner Option Audio will manage the installation and ongoing management of the units in-country.

RockFLEET is the only Iridium-based solution available for Queensland's fishing vessels. **ST**

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environmental monitoring

FAU, NASA to Monitor Algae in Lake Okeechobee

A massive, toxic algae bloom occurred in Lake Okeechobee in 2016 in the St. Lucie Estuary. Scientists with Florida Atlantic University's (FAU) Harbor Branch Oceanographic Institute (HBOI) are partnering with NASA to learn more about algae levels in the lake through the deployment of a Sea-PRISM, one of NASA's water quality monitoring instruments.

SeaPRISMs are above-water radiometers that look at the color of water and use algorithms to determine chlorophyll, turbidity and cyanobacteria levels.

The device will take hourly readings and send the information via cell signal to NASA, which will validate and publish the data online.

Ecosystems, Food Webs Study

On January 9, 2018, a Teledyne Webb Slocum Glider with an inte-

grated ASL acoustic zooplankton fish profiler (AZFP) with three frequencies (38, 125 and 200 kHz) was deployed for three weeks in the Terra Nova Bay (Ross Sea, Antarctica) to obtain mesoscale and submesoscale measurements of oceanographic processes and simultaneous biological distributions and abundance.

From the data, the researchers will examine the interactions between multiple trophic levels (phytoplankton, zooplankton and fish) and their relationships to the physical hydrographic driving forces such as sea ice and currents.

The AZFP can differentiate key species, such as copepods, crystal krill and Antarctic silverfish. The glider was also instrumented with a CTD, a WET Labs BB2FL ECO puck to measure phytoplankton biomass and an Aandera Optode dissolved oxygen sensor. The hydrographic data are available through RU-

COOL (Rutgers University Center for Ocean Observing Leadership) and THREDDS (Thematic Real-time Environmental Data Distribution Services). This project will pave the way for cost-effective, automated examination of food webs and ecosystems in regions all over the global ocean, serving a wide range of users.

Tracking Temp, pH Changes In Gulf of Maine

The Gulf of Maine is a productive, complex and semi-enclosed "sea within a sea." Changes in temperature and pH threaten many of the Gulf's resources. Schoodic Institute and the U.S. National Park Service are working together to understand these changes and their impacts in Acadia National Park. They have deployed a Sea-Bird SeapHOx pH sensor to collect continuous data just off one of the park's islands, near one of the major currents in the Gulf of Maine.

The SeapHOx provides data to help investigate changes in biodi-



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versity and abundance of intertidal and marine organisms along Acadia National Park's iconic rocky coast, as well as elsewhere in the Gulf.

Extreme Sea Levels Predicted To Rise Along Coasts

A new study predicts future global warming will lead to an increase in extreme sea levels, with consequent flood risks to coastal infrastructure and human populations.

Extreme sea levels occur through a combination of high tides and extreme weather events, which can generate storm surges and high-wind waves. These phenomena are exacerbated by progressive rises in mean sea level and predicted increases in tropical cyclone activity.

For the first time, researchers have taken account of all these processes to assess future risk of extreme sea levels to the year 2100.

The National Oceanography Centre was part of the international research team from Italy, Greece, the Netherlands and the U.K. that found that extreme sea level events

that occur on average once every 100 years at the present day would occur almost annually along most global coastlines by the end of the century. The research team also calculated that the impacts of extreme sea level were significantly reduced in scenarios where CO₂ emissions were mitigated compared to a business-as-usual scenario, largely due to reduced thermal expansion of the oceans and lower rates of glacier and ice sheet melting.

The new results will help coastal planners in areas such as coastal defense upgrades.

Buoys to Monitor Turbidity For Dredging Project

Ocean Scientific International Ltd. (OSIL) has provided Dragados UK with a turbidity monitoring solution to report on the dredging activities of the Aberdeen Harbour Expansion Project. OSIL supplied two 1.9-m buoy platforms, equipped with standalone turbidity sensors, and was on site for installation. The buoys are set up to trigger an alarm

if a buoy reports a rise in readings above the predetermined threshold and will provide continuous sediment monitoring during dredging operations.

The turbidity monitoring will run in conjunction with other planned mitigation strategies to monitor and protect the marine fauna in the area.

WERA Ocean Radar Systems Aid Tsunami Warnings

In May 2017, a mini-tsunami hit the Dutch coast with a flood wave more than 2-m high. About 50 km southwest of Zandvoort, there are two WERA ocean radar systems installed at Monster and Ouddorp to measure currents around the entrance of the Port of Rotterdam, providing coverage up to 70 km offshore. After reprocessing the WERA raw measurements, current signatures generated by the approaching tsunami-like wave can be seen clearly more than 40 min. before the wave flooded the coast near Zandvoort. The mini-tsunami had an effect similar to a full tsunami. **ST**

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contracts

Great Lakes Dredge & Dock Corp., Oak Brook, Illinois, received a \$69.8 million award on the San Jacinto River in Houston, Texas, the first major Houston-area flood control project after Hurricane Harvey that will restore a 2 mi.-long stretch of the San Jacinto River to its pre-Harvey state. U.S. Army Corps of Engineers Galveston District.

Tuco Marine Group, Faaborg, Denmark, delivered an 11-m crewboat, the ProZero, which performed more than 35 kt. during sea trials, for an increase in transit speed of 11 kt. compared to the previous crew boat. The increased transit speed was achieved without additional fuel consumption. Emilsen Fisk.

TechnipFMC, London, England, has been awarded a three-year master services agreement in Brazil for subsea services including subsea equipment and flexible pipelines, plus maintenance services, technical assistance, installation support and engineering analysis of operations. Petróleo Brasileiro S.A. (Petrobras).

M2 Subsea, Aberdeen, Scotland, will provide inspection services for the Balmoral floating production vessel (FPV) and carry out the 2018 inspection of the vessel's hull, flowlines, umbilicals, risers and subsea template using the Mohican ROV at a depth of 140 m. Premier Oil.

BIO-UV Group, Lunel, France, announces approval of its initial public offering (IPO) with a final share price of €3.84. The number of shares allocated under the global placement is 2,321,430 new shares, representing a total of €8.9 million; 375,380 shares were allocated to the public under the open price offer, for an amount of €1.4 million. Euronext Growth.

JMP Marine, Miami, Florida, will supply flexible impellers for OEM products with a proprietary blend of materials comprising a special wax

infusion and brass inserts. Resistant to salt, oils and chemicals, the impellers are heat-resistant to 180° F for reliability and wear-resistance. Albin Pump Marine.

Modulift, Poole, England, will supply seven 40-t spreader beam units along with sheathed spiral strand mooring lines to the Aoka Mizu floating production storage and off-loading (FPSO) site in the Lancaster field, located offshore in the West of Shetland area. Bridon-bekaert Ropes Group. **ST**

meetings

OCTOBER

October 1-3—Commercial UAV Expo Americas, Las Vegas, Nevada. 207-842-5646, KMcDonald@divcom.com or www.expouav.com.

October 1-3—Shallow Survey, St. John's, Canada. 709-778-0556, Paul.Brett@mi.mun.ca or www.shallow-survey.com/Home.

October 1-5—PLOCAN Glider School, Gran Canaria, Spain. carlos.barrera@plocan.eu or <http://glider.school.eu>.

October 3—Marine Data Management Workshop, Southampton, England. sgaf@bodc.ac.uk or www.oceannet.org/marine_data_standards/workshops.html.

October 3-4—Global Hydropower Latin America Congress and Exhibition, Santiago, Chile. +44 207 394 3090, dkvasnitsyna@vostockcapital.com or www.latinamerica.hydrocongress.com/en.

October 3-4—International Conference on Marine Renewable Energy and Maritime Hydrogen Technology, Florø, Norway. maria@maritimsfj.no or <https://bit.ly/2GW2Eo2>.

October 3-4—OilComm and FleetComm, Houston, Texas. 713-343-1875, tle@accessintel.com or www.oilcomm.com.

October 3-5—NOIA Fall Meeting, San Antonio, Texas. achapman@noia.org or www.noia.org/2018-noia-fall-meeting.

October 8-12—Sea Tech Week, Brest, France. jacqueline.rosecdespres@lequartzcongres.com or www.seatechweek.eu.

October 9-10—Dynamic Positioning Conference, Houston, Texas. <http://dynamic-positioning.com>.

October 9-10—RECSO EnviroSpill, Abu Dhabi, United Arab Emirates. +44 203 463 1023, marco@bme-global.com or www.recsoenvirospill.com.

October 9-11—Sea Tech Week, Brest, France. Jaqueline.rosecdespres@lequartzcongres.com or www.seatechweek.eu.

October 9-11—Teledyne Marine Technology Workshop, Cannes, France. margo.newcombe@teledyne.com or www.teledynemarine.com/events/TMTW2018.

October 22-24—Offshore Energy Exhibition & Conference, Amsterdam, Netherlands. +31 (0) 10 209 2600, ns@navingo.com or www.offshore-energy.biz.

October 22-25—OCEANS'18 MTS/IEEE Charleston, Charleston, South Carolina. info@oceans18mtsieeecharleston.org or <http://charleston18.oceansconference.org>.

October 23-26—Euronaval, Paris, France. acmicca@euronaval.fr or www.euronaval.fr.

October 24-27—SNAME Maritime Convention, Providence, Rhode Island. <http://smc18.snameconvention.com>.

October 29-31—World Congress of Ocean, Qingdao, China. david@wcon.con.com or www.bitcongress.com/WCO2018.

NOVEMBER

November 4-8—International Wa-

ter Conference, Scottsdale, Arizona. 412-261-0710, eswp@eswp.com or <https://eswp.com/water/overview>.

November 5-9—BlueTech Week, San Diego, California. 619-450-4600, grmurphy@themaritimealliance.org or www.bluetechweek.org.

November 6-8—Esri Ocean GIS Forum, Redlands, California. 888-377-4576, Confregis@esri.com or <https://bit.ly/2JJVwML>.

November 6-8—Seawork Asia, Shanghai, China. +44 1329 820492, marketing@mercatormedia.com or www.seaworkasia.com.

November 7-8—OPITO Global, Kuala Lumpur, Malaysia. +44 (0) 1224 211045, events@bigpartner-ship.co.uk or www.opito.com/opi-to-global.

November 7-8—Naval Submarine League Annual Symposium, Arlington, Virginia. 703-256-0891 or www.navalsubleague.org/events/annual-symposium.

November 13-15—CLEAN GULF, New Orleans, Louisiana. <http://2018.cleangulf.org>.

November 14-15—Design Sciences Series Workshop on Modular Adaptable Ships, Washington, D.C. 703-836-6727, asnehq@navalengineers.org or <https://bit.ly/2GFvcih>.

November 14-16—Offshore Wind R&D Conference, Bremerhaven, Germany. <https://bit.ly/2qdXkCf>.

November 14-16—Sustainable Ocean Summit, Hong Kong, China. summit@ocean-council.org or <https://sustainable-oceansummit.org>.

November 18-20—Pacific Marine Expo, Seattle, Washington. 207-842-5666, cdimmerling@divcom.com or www.pacificmarineexpo.com.

November 20-22—Australian

Ocean Renewable Energy Symposium, Crawley, Australia. aor-es2018-oceans@uwa.edu.au or <https://aores2018.com.au>.

November 26-27—Maritime Information Warfare, London, England. +44 (0)20 7827 6000, events@smi-online.co.uk or www.maritimewarfare.com/seatech.

November 28-30—International WorkBoat Show, New Orleans, Louisiana. 508-743-8567, info@workboatshow.com or www.workboatshow.com.

DECEMBER

December 4-7—World Maritime Technology Conference, Shanghai, China. +86 21 6473 2729, ssnaoe@ssnaoe.org or <http://wmtc18.ssname.com.cn>.

December 5—ASTM International Workshop on Autonomous Shipping, Vessel Automation and Maritime Cyber Security, Washington, D.C. 610-832-9677, symposia@astm.org or www.astm.org/F25Workshop2018.

December 5-6—ASNE Combat Systems Symposium, Washington, D.C. 202-340-6554, CSS2018@navalengineers.org or www.navalengineers.org/Symposia/Combat-Systems-Symposium-2018.

December 6—Congress on Ocean Policy, Washington, D.C. <https://rnrf.org/2018cong>.

December 8-13—National Summit on Coastal and Estuarine Restoration and Management, Long Beach, California. 703-524-0248 ext. 5, clewis@estuaries.org or <https://estuaries.org/Summit>.

2019

JANUARY

January 15-17—SNA Annual National Symposium, Arlington, Virginia. 703-960-6800, navysna@aol.com or <http://navysnaevents.org/national-symposium>.

January 16-18—The Unmanned Systems Expo, Rotterdam, Nether-

lands. +31 (0)6 19791096, info@tusexpo.com or www.tusexpo.com.

January 23-24—Coastal Futures, London, England. bob.earll@coastms.co.uk or <http://coastal-futures.net>.

January 28-30—International LiDAR Mapping Forum, Denver, Colorado. wemison@divcom.com or www.lidarmap.org.

FEBRUARY

February 5-7—Underwater Intervention, New Orleans, Louisiana. 703-259-6118, ui@naylor.com or www.underwaterintervention.com.

APRIL

April 8-11—SubOptic, New Orleans, Louisiana. 703-444-0845, knielsen@stfevents.com or www.suboptic2019.com.

April 9-11—Ocean Business, Southampton, England. +44 (0)1453 836363, hdavis@divcom.co.uk or www.oceanbusiness.com.

JUNE

June 17-19—MAST Asia, Tokyo, Japan. +33 663 232 473, eike.eickhoff@mastconfex.org or <https://mastconfex.com/asia2019>.

June 29-July 10—La mer XXL, Nantes, France. +33 7 69 01 95 65, c.deschamps@ilago.eu or www.lamerxxl.com/en.

SEPTEMBER

September 9-13—London International Shipping Week, London, England. <http://londoninternationalshippingweek.com>.

September 16-20—OceanObs'19, Honolulu, Hawaii. 202-448-1245, cyanoff@oceanleadership.org or www.oceanobs19.net.

2020

FEBRUARY

February 4-6—EUROMARITIME, Marseille, France. +33 1 56 59 15 07, anne-charlotte.micca@gican.asso.fr or www.euromaritime.fr.

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

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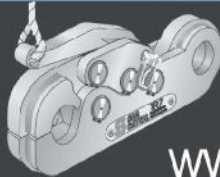
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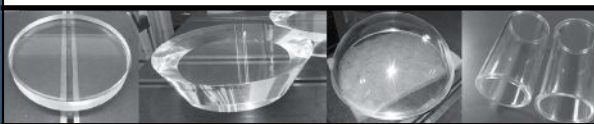
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JANUARY

Annual Review & Forecast

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

***Oceanology International*, March 13-15, Excel London, U.K.

***Canadian Hydrographic and National Surveyors' Conference*,
March 26-29, Victoria, Canada

MARCH

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

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

***Offshore Technology Conference*, April 30-May 3, Houston, TX

***AUVSI XPONENTIAL 2018*, April 30-May 3, Denver, CO

***OCEANS '18 MTS/IEEE Kobe / Techno-Ocean 2018*,
May 28-31, Kobe, Japan

MAY

Communications, Telemetry, Data Processing

***BlueTech Expo*, June 4, Washington, DC

***CLEAN PACIFIC 2018*, June 19-21, Portland, OR

***UDT 2018*, June 26-28, Glasgow, U.K.

JUNE

Seafloor Mapping/Sonar Systems/Vessels

JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

***SNA West Coast Symposium*, August 23, San Diego, CA

AUGUST

Geophysical Exploration/Seafloor Engineering

***Dynamic Positioning Conference*, October 9-10, Houston, TX

***SEG 2018*, October 14-19, Anaheim, CA

SEPTEMBER

Ocean Resources Development & Coastal Zone Management

***AWEA Offshore WINDPOWER 2018 Conference*,
October 16-17, Washington, D.C.

***Offshore Energy 2018*, October 22-24, Amsterdam,
The Netherlands

***EURONAVAL 2018*, October 22-26, Paris Le Bourget, France

***OCEANS '18 MTS/IEEE Charleston*,
October 23-25, Charleston, SC

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

***International Water Conference*, November 4-8, Scottsdale, AZ

***Naval Submarine League Annual Symposium*, November 7-8,
Arlington, VA

***CLEAN GULF*, November 13-15, New Orleans, LA

***International WorkBoat Show*, November 28-30, New Orleans, LA

NOVEMBER

Undersea Defense/Antisubmarine Warfare

***SNA Annual National Symposium*, January 15-17, Arlington, VA

DECEMBER

Diving, Underwater Vehicles & Imaging

***Underwater Intervention 2019*, February 5-7, New Orleans, LA

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Horseshoe Crabs: Essential but in Peril—Dr. Win Watson and Dr. Chris Chabot

Dr. Win Watson and Dr. Chris Chabot are professors at the University of New Hampshire (UNH) and Plymouth State University (PSU), respectively. They have published 21 papers together concerning horseshoe crab biology, and, with New Hampshire Sea Grant support, they are investigating the impacts of biomedical bleeding on horseshoe crab behavior and physiology.



Not many things in our world are “perfect,” but horseshoe crabs (*Limulus polyphemus*) come close. They have demonstrated perfect design by proving themselves for approximately 450 million years. They are found both in warm water in Florida and cold water in Maine. They have been captured in deep offshore waters and shallow estuaries and can even survive for a few days out of water. They are truly remarkable creatures, but humans have not treated them very well, and, as a result, there is concern about their future. We have used them as fertilizer and offered bounties to have them removed from clam beds, and we are using them as bait for the whelk and eel fisheries.

Despite all this, they continue to save our lives because their blood provides us with a substance that can be used to detect toxins.

In the 1960s, Jack Levin and Fred Bang showed that horseshoe crab blood contains a substance that produces a highly sensitive response to the endotoxins in the cell wall of harmful bacteria. When the amoebocytes in horseshoe crab blood come into contact with these endotoxins, a measurable reaction occurs even with a minuscule amount of endotoxin. Since the 1970s, the *Limulus* Amoebocyte Lysate (LAL) test has become a global standard, and all injected medicines and many im-

plants are tested for contamination using LAL. Thus, horseshoe crab blood provides millions of patients protection from life-threatening, gram-negative bacteria during medical procedures.

Horseshoe crabs are also excellent model animals to use for investigating neurobiology and behavior. In fact, in 1967, Haldan Keffer Hartline won the Nobel Prize for work on the fundamental processes underlying vision, largely based on horseshoe crab research. More recently, Dr. Bob Barlow and his colleagues demonstrated that there is a circadian clock in their brain that enhances the sensitivity of their eyes at night. Moreover, we recently demonstrated that they also have separate clocks that control circatidal rhythms, allowing them to anticipate each high tide, emerge from the sediment and forage for food or mate. They are also suitable for biotelemetry investigations because it is easy to attach devices to their carapace.

What can we do to protect this very valuable, overexploited resource? First, work to find better, more sustainable, alternative bait for whelks and eels. Second, continue to pursue an alternative assay for gram-negative bacteria that is as powerful and cost effective as LAL. Third, until that is available, insist on improving the methods used to harvest horseshoe crabs and bleed them for LAL.

Over the past few years, with the help of PSU and UNH students, we have been investigating the impacts of biomedical bleeding on horseshoe crabs from the Great Bay Estuary in New Hampshire.

For some experiments, we hold the animals in enclosures adjacent to the Jackson Estuarine Laboratory and measure their movements using waterproof accelerometers attached to their shells. The advantage of this approach is that we can periodically take blood samples to assess one aspect of their health, hemocyanin

levels (similar to human hemoglobin). In another study, we attached ultrasonic transmitters to their shells and then released them back into their natural habitat. These sensors transmitted information about their activity to data receivers moored throughout the estuary.

What have we learned? First, the bleeding process often used by biomedical companies, involving time out of water and exposure to warm summer temperatures, has a larger negative impact than bleeding alone. Second, after bleeding, many animals are less active, their hemocyanin levels drop, and these effects last for weeks, reducing their tendency to migrate into shallow water to mate or forage for food. Third, mortalities often occur after bleeding, typically in the animals with the lowest initial hemocyanin levels. Finally, there are large seasonal fluctuations in hemocyanin levels, with low values in spring and early summer and higher values in late summer and fall.

Our data indicate changes could improve the harvesting and bleeding process.

First, refrain from harvesting animals before and during spawning season, when they are least healthy and when we need them to be healthy to reproduce and sustain the population. Second, throughout the process, from boat to facility and back again, keep them cool and moist to help reduce mortalities and the behavioral and physiological deficits induced by this bleeding process. Finally, consider providing a food supplement post-bleeding to facilitate recovery of normal levels of hemocyanin, and perhaps amoebocytes too, prior to releasing the creatures back into their natural habitat.

These changes should help make the necessary horseshoe crab biomedical fishery more sustainable and, thus, prevent us from eliminating this incredibly valuable living fossil from our planet. **ST**

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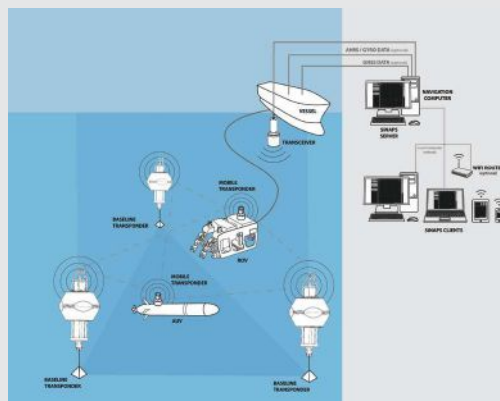
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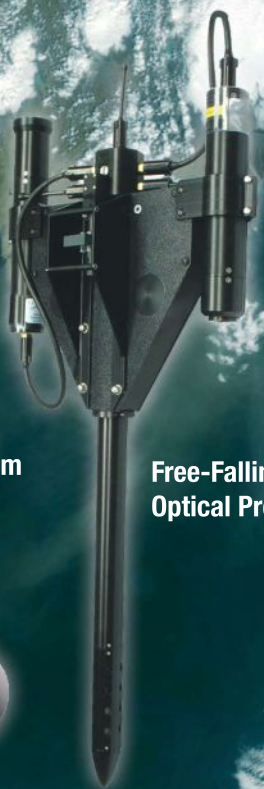
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