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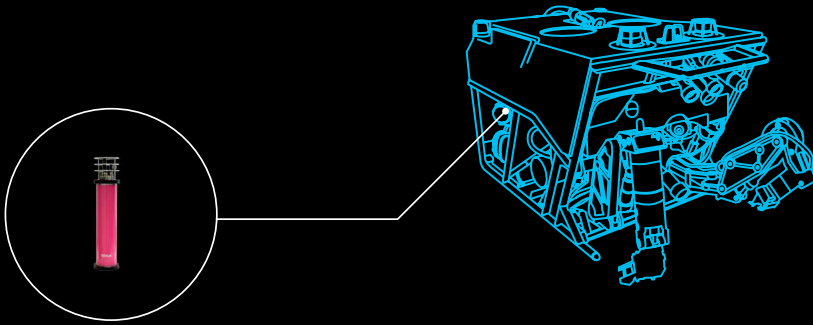
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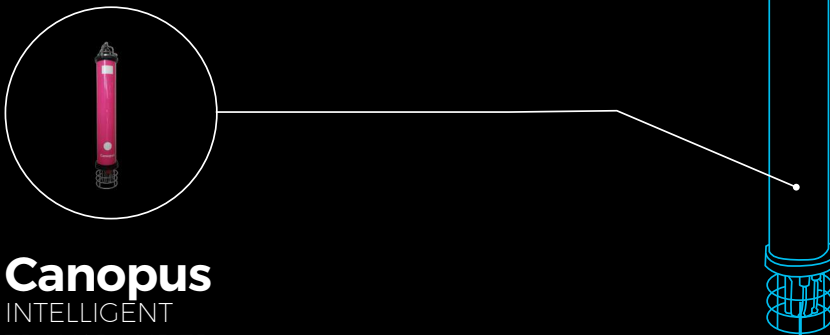
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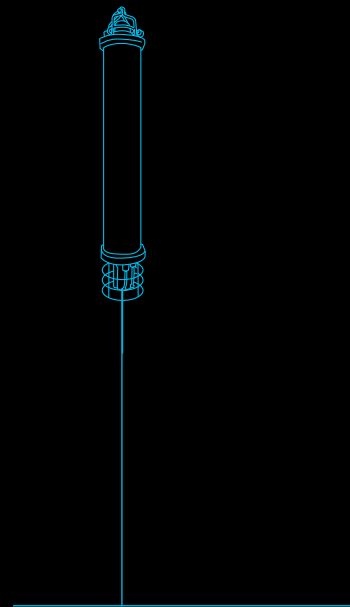
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**\*\*Canadian Hydrographic and National Surveyors' Conference**,  
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## MARCH

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

## AUGUST

Geophysical Exploration/Seafloor Engineering

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

## SEPTEMBER

Ocean Resources Development & Coastal Zone Management

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

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**\*\*OCEANS '18 MTS/IEEE Charleston**, October 23-25,  
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## OCTOBER

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The MOL *Maxim* works under a rainbow at the Garden City Terminal near Savannah, Georgia. (Georgia Ports Authority/Stephen B. Morton)

### NEXT MONTH

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# Challenges, Opportunities: The 2018 Port Landscape

No one can deny that the last few years have held some twists and turns for the global ports industry. The challenge of operating in an industry—not to mention a wider global economy—still recovering from one of the most persistent downturns in recent memory has had a palpable effect on terminal operations and development across the world.

But a sunnier global economic outlook, combined with potentially transformative changes taking place in Asia, mean that the coming years may be even more impactful than the last—and operators will have to take measured steps to ensure that they can adapt to new operating realities. These changes are mainly expected to be macroeconomic, but technological innovation will also play a part. The year 2018 will see continued R&D in the use of emerging technologies in the ports world, including automation and blockchain. Although there is no expectation that any of these technologies will be game changing this year, a clearer picture will begin to emerge of commercial applications for ports and their benefits to the industry. This means that port operators will have to lay down a strategy for technological uptake within their hubs—or risk being left behind.

For emerging markets, an ongoing eastward reorientation of global trade—triggered by China's Belt and Road Initiative—is likely to throw up an array of challenges that will demand navigating in a way that ensures profitability and commercial sustainability. The Belt and Road will be transformational for the shipping industry, and the impact is already being felt on East-West trade routes. Measured at around \$150 billion a year, covering roads, railways, pipelines and more, it is clear that the Chinese government is making good on its promises to improve infrastructure across the developing world. Further, it is estimated that China has invested \$20 billion alone in ports and terminals in the past 15 months.

For the West, there is a risk of focusing too much on geopolitical ambitions at the expense of understanding the economic and commercial transformations that are about to take place. Consolidation of port ownership is likely to be an abiding trend in the coming years. Indeed, recent figures from Drewry Maritime Research already bear that out. Their findings show that following the merger between COSCO and China Shipping in 2015 and subsequent acquisitions and investment, the combined entity is poised to become the biggest container terminal operator by capacity by 2020.

Success in this changing market will not be a matter of happenstance. It is crucial that operators lay down a strategy for where their fortunes lie in the Belt and Road era, in terms of where threats to their business may arise and in how they can ensure a competitive edge. These considerations are complicated by the fact that calls by some vessels may be guided by Chinese policy considerations instead of solely by commercial rationale.

Securing financing to kick-start modernization will also be a crucial issue to contend with—and particularly in emerging and frontier markets where risks and uncertainties can preclude a bank's involvement. Further, it may reasonably be argued that Chinese companies currently hold an advantage in securing funding from Chinese banks.

These factors are creating a truly unprecedented complexity in operations for ports. Despite the challenges, it is important to remember that, at its heart, Belt and Road will support increased trade and hold the potential for real commercial opportunities. The port operators who succeed in the coming years are likely to be those who look at these challenges and dive in—head on—in a proactive, forward-looking way. **ST**

**)) US, Russia Partner in Arctic.** In *ST*'s December 2017 issue, Paul Fuhs, president of the Marine Exchange of Alaska, wrote an article calling for the U.S. and Russia to cooperate on regional vessel management in the Arctic as shipping traffic continues to increase with melting ice. This idea has materialized with the two countries having recently proposed a system of two-way routes for vessels to follow in the Bering Strait and Bering Sea. The nations jointly developed and submitted the proposal to the International Maritime Organization (IMO) to establish six two-way routes and six precautionary areas. The routes are being recommended to help ships avoid the numerous shoals, reefs and islands outside the routes and to reduce the potential for marine casualties and environmental disasters. The proposed two-way routes will be voluntary for all domestic and international ships. No additional aids to navigation are being proposed to mark the recommended two-way routes, and the routing measures do not limit commercial fishing or subsistence activities.

**)) Success with Syntactic Foam 3D Printing.** A team of materials scientists at NYU Tandon School of Engineering have developed the first process to 3D print components of syntactic foam, an extremely strong and lightweight composite. Their breakthrough holds particular promise for submersibles because it will enable manufacturers to print components with complex shapes capable of surviving stresses at greater depths. Syntactic foams, a mixture of billions of microscopic hollow glass or ceramic spheres in epoxy or plastic resin, are widely used in submersibles because of their remarkable buoyancy and strength. The team will now focus on optimizing the material properties for various applications, such as underwater vehicles capable of functioning at specific depths.

**)) Scotland Competitiveness Study.** Xodus Group is undertaking an international study on behalf of Scottish Enterprise to determine competitiveness and innovation in the Scottish subsea market and benchmark capabilities with regions across the world. Over the next 12 months, the findings will help to shape a range of projects and activities in support of Scottish Enterprise's Subsea Engineering Action Plan. Following initial analysis of Scotland's competitive advantages, Xodus will conduct a comparison of key international subsea hubs. This will include an examination of each region's capabilities, such as company bases, supportive policies, research funding, institutes and the industry



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bodies available for developing these strengths. Xodus will deliver results under focus areas such as project life cycle, key individual technologies, subsea processing and specific non oil and gas industries. Scotland currently accounts for 14 percent of the global subsea market, comprising more than 600 companies, generating an estimated annual turnover of £7.5 billion.

**)) Underwater Acoustic Comms Market to Reach \$2.86 Billion.** According to a new report on the underwater acoustic communication market, the market is expected to grow from \$1.31 billion in 2017 to \$2.86 billion by 2023, at a CAGR of 13.8 percent during the forecast period. The major factor driving the growth of this market is the increase in the adoption of underwater acoustic modems in the oil and gas and naval defense sector. Moreover, there is an increasing demand for reliable, high-capacity underwater acoustic networks. Environmental monitoring currently holds the largest market share, driven by the oil and gas industry seeking solutions to detect leaks and pipeline breaks. Defense also holds significant market share, particularly in the U.S. and Canada in relation to UUVs.

**)) Former ST Editor Dick Burns Passes.** Richard "Dick" Francis Burns, former associate editor of *Sea Technology* magazine, died of congestive heart failure in Potomac Falls, Virginia, on January 24, 2018 at the age of 86. Burns was appointed to the U.S. Naval Academy and studied naval architecture and marine engineering at MIT. He was a commander at Portsmouth Naval Shipyard from 1967 to 1969 and, from 1969 to 1972, served on the Joint U.S. Military Mission Aid to Turkey as a senior advisor for the construction of two destroyer escorts. For his work in Turkey, he received the Joint Service Commendation Medal. Following retirement from the Navy, he was a senior engineer at Vitro Corp. and then an editor at *Sea Technology*, where he wrote about everything related to the sea, from changes and innovations in the Navy to an interview with "The Shark Lady" Dr. Eugenie Clark in the February 1992 issue. Burns completed more than 17 triathlons and the Marine Corps Marathon and skied the legendary Tuckerman's Ravine at Mt. Washington. He is survived by his wife of 58 years, Mary K. Burns; his sister Katharine Burns; his four children, Richard Burns, Jr., Chris Burns, Moira Burns, MD, and LTC Colleen Kesselring, U.S. Army (retired); and three grandchildren. His body will be laid to rest at Arlington National Cemetery. **ST**



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# Optimizing the Ship-Building Process

## Voyage Simulations, Historical Data Improve Vessel Design

By Matthew Patey

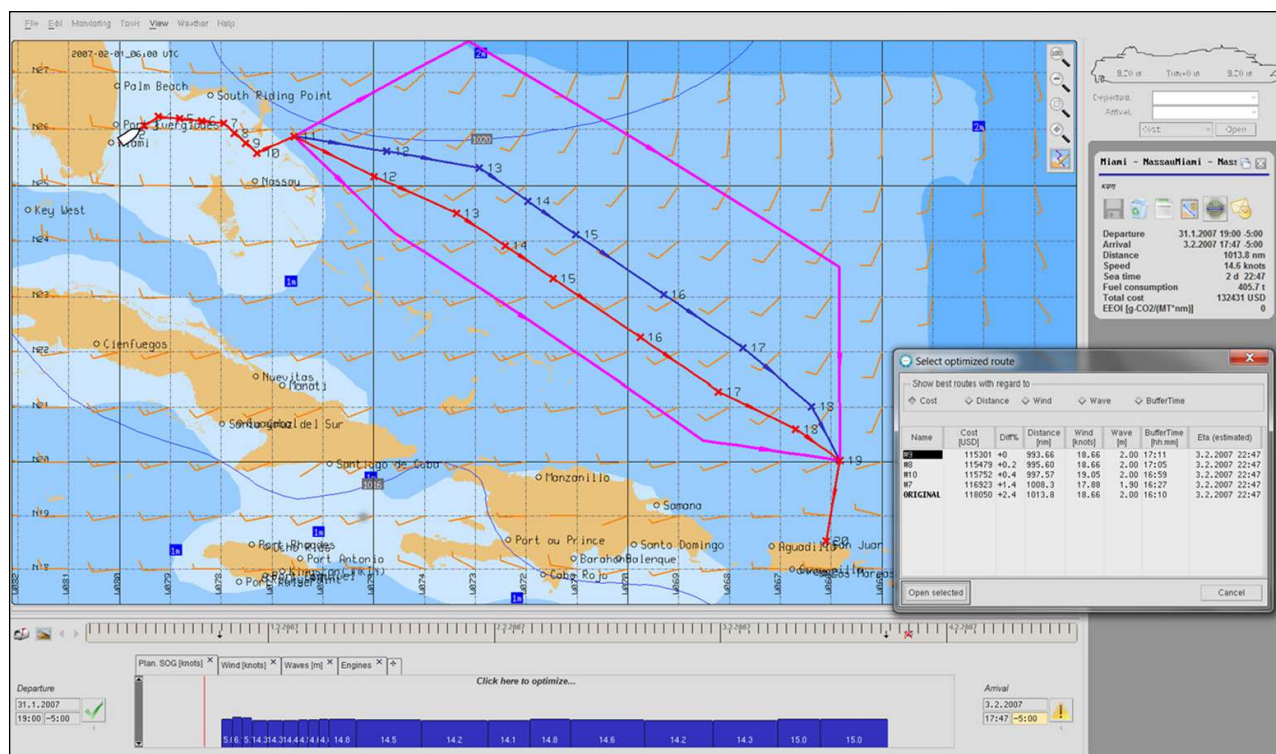
The naval architecture and marine engineering company Foreship has been leading the field in applying “in-wave” analysis to factor real sea states into hull form optimization. Notably, it has used CFD analysis to support a case for the superior performance of bows featuring vertical stems over their bulbous counterparts at far lower wave heights than has previously been acknowledged. Real sea states have also provided useful input for finite element method software when considering slamming and structural design issues.

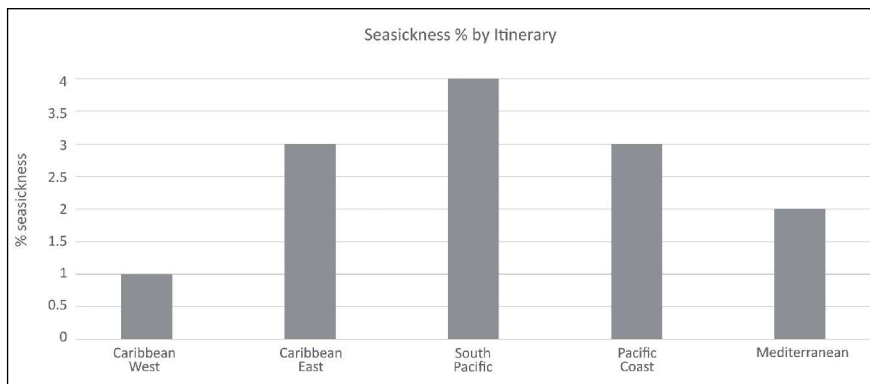
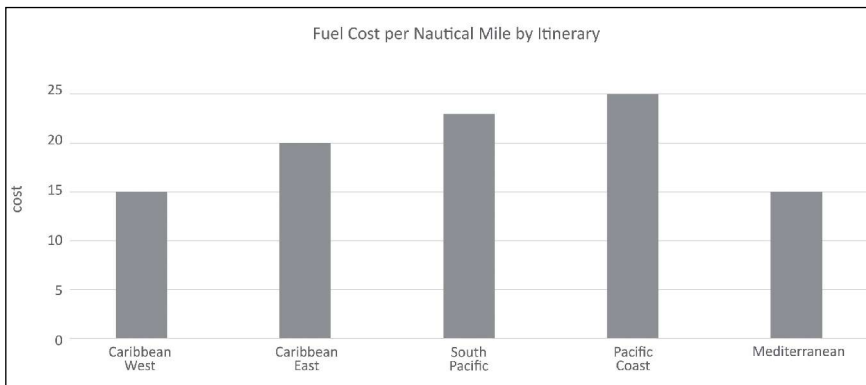
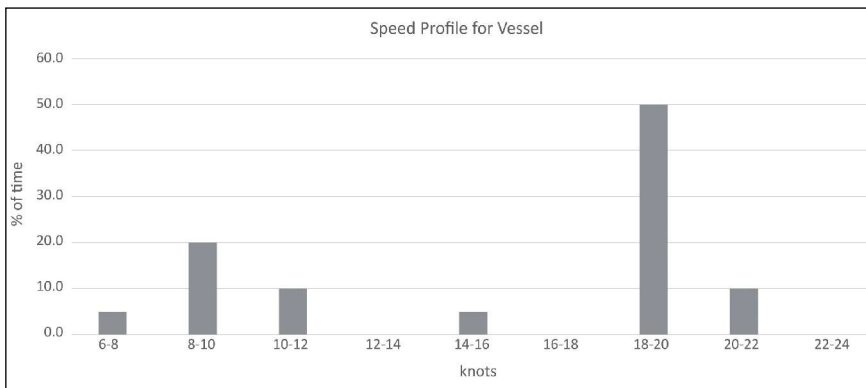
However, CFD methods are only one part of Foreship’s strategy designed to introduce real-world experience at an early stage in ship design. The Finnish company’s continuing discussions with core cruise ship customers has

been pushing forward with a completely new operability analysis and voyage simulation initiative to secure performance gains at the early design stages.

Foreship is optimizing the ship design for the best performance in real operational conditions. Performance in this case means fuel consumption and comfort on board.

*This map shows the plotting of the initial route for a voyage simulation, along with allowed route deviation boundaries and wind and wave conditions at the current location of the vessel. This is used to set up the voyages for the simulations, which are then run using Foreship’s customized routines in NAPA software.*





***The bar graphs show typical results comparing vessel performance on different itineraries and the speed profile of the vessel.***

Data inputs include the hull, the propellers, the rudders, the general arrangement and the main engines to calculate fuel consumption and motions on board the vessel during simulated voyages. Voyages are from port to port, start on a given day at a given time and have a target arrival date and time and an initial routing.

Realistic conditions are created by using hind-cast environmental data of the wind, waves and currents on the actual route the vessel will follow and using simulations of how the vessel will be operated. That includes decisions on the engines that minimize fuel consumption and what route to follow to avoid bad weather.

It is easier and more accurate to assess the impact of design changes on fuel consumption and comfort using

a single, consistent approach based on the same model and realistic weather conditions and a realistic route than to deal with these issues separately. Considered separately, each type of environmental data has inaccuracies, and there is a risk of inconsistency between analyses and communication failures between different design disciplines.

Foreship's initiative relies on established ship design and construction software, but introducing operating data such as voyage route planning at an earlier stage than is customary.

Even though we are using well-known software in this application, we are not aware of others doing this sort of study at any stage using any system. There are organizations with voyage simulation software that don't design ships, and there are designers who don't include operational simulations.

It is also the case that some software packages in use are limited, and simply cannot consider weather routing.

## Process

The effects of design decisions on fuel consumption and comfort on board can be evaluated quickly and realistically to give the most accurate picture possible of how the ship will perform before it actually goes into service. From hind-cast data we get the wind,

current and wave conditions during the voyage. These are used in the fuel consumption and motion calculations. The engine operating mode and the route the vessel follows are optimized for minimum fuel consumption and minimum motions, which would reflect the decisions made by the crew on board the vessel to save fuel and keep the vessel safe. With many years of data we can simulate voyages simply by changing the departure date.

Using this approach, the full impact of a design change can be considered in a single analysis. If the widening of the hull were being considered, for example, the effects on fuel consumption, speed, engine profile and passenger comfort could be simulated, and the different possibilities for engine configurations investigated very quickly. We could assess any change in the design—for example, the size of fin stabilizers and bilge keels from both the fuel consumption and comfort perspective—but also how best to operate the vessel and how this would change with changes in the vessel design.

The voyage simulation approach establishes the operational profile of the vessel and the weather conditions under which it can safely, comfortably and most profitably operate. It includes any design or operation decision that affects fuel consumption and comfort on board in the same analysis, and requires formal responses from designers to operational questions that, at their very core, may formerly have been considered of either indeterminate factor or even background noise. These are questions such as: When is the best time to cruise the South Pacific; do we need to make the vessel bigger to extend the operating season; what should this itinerary's departure and arrival times be; what combinations of engines do we really need; and how long will it take to return to port if we lose one propeller?

Even if the design is fixed, the use of voyage simulations will give owners a much more realistic picture of the operational capability of the vessel than previously possible.

***“Feedback from operations will help in the decision-making process during future newbuild and conversion projects. In fact, this is the most valuable design data you can get.”***

The operability analysis can also be easily updated throughout the entire design process as the design changes and new performance data become available. The model can be tuned further as data from onboard systems are compiled from the operation of the vessel. This feedback from operations will help in the decision-making process during future newbuild and conversion projects. In fact, this is the most valuable design data you can get and should be used in future designs.

By using operational data from a reference vessel, i.e., similar type ship as the new design, the operability analysis methods can be calibrated with existing data for the reference ship and applied more

accurately in the new design. Issues such as marine growth, for example, have a significant effect on the fuel consumption, but depend on the route and cleaning schedule for the hull. These are data best obtained from real operational experience. Through the integration of real performance data in the operability analysis, a much more realistic assessment of the new vessel's performance can be made. Then the vessel design can be optimized not only for the actual environmental conditions but also for the way the vessel is expected to be operated.

A number of Foreship's well-known cruise ship clients have expressed interest in Foreship's new operability analysis service, and at least two have sanctioned a full-scale operability study as part of new construction projects. These operability studies are in the early stage, and follow up of the performance model will be conducted over time.

Because operability analysis enables seeing the effects of changes more easily, it is easier to make changes and optimize ship design. This will result in a better ship in the end because operability analysis can be used to give practical and accurate answers about the effect early design decisions will have on the fuel consumption and comfort of a vessel. **ST**

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# Drone Docking Underwater

## *Acoustics-Based System Extends Drone Performance*

By Marc Richard • Raphaël Bourdon • Alice Vettoretti

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**W**ith the continuing development of underwater drones (AUVs) comes the questions of how to facilitate their launch, recharging and data retrieval. In 2016, two industry players, Naval Group, a European naval defense company, and RTsys, a specialist in underwater acoustics, pooled their skills to offer a new and innovative way to launch and recover drones using an underwater docking station. This system allows us to imagine new uses for AUVs, with the possibility of leaving them permanently submerged for continuous monitoring and the possibility of more rapid deployment.

From the beginning, the project had multiple challenges: how to guide the target to its base, recharge it underwater, prevent biofouling while submerged for months at a time, retrieve data, and program missions. These challenges were met in just 10 months in 2016, resulting in a seabed station and docking kit that can be adapted to almost all drones currently on the market.

### **A Homing Device**

For the drone to find its station at the end of its mission and enter it with precision, it was necessary to develop a homing device. This device is based on a positioning system exclusively using underwater acoustics, thus overcoming turbidity issues. Asked to design this technological component, RTsys created a system that uses real-time acoustic data processing, which enables the drone to quickly adjust its position during the various approach phases. In effect, the station transmits acoustics pings, then, using triangulation algorithms, the drone can locate the docking station. It modifies its trajectory to enter the station with a precision on the order of a few centimeters.

At the heart of this docking station is the implementation of two algorithms based on underwater acoustics, one for bidirectional positioning and the other for long-range, low-speed communication. In this way, the AUV can position itself relative to the station and also transmit positioning information over a distance greater than

5 km, requiring power amounting to only a few tens of watts. This enables a multifunctional, smaller system that facilitates integration into various drone models, particularly the most compact.

Contrary to the majority of existing underwater positioning systems, which have a latency time, the homing kit gives the drone a reaction time on the order of 10 milliseconds. The drone, in the station approach phase, can adapt its altitude and course in real time, for example, to compensate for the current. On return, the drone also transmits an acoustic signal that informs the user connected to the station of the drone's approach. This positioning system allows the station and the drone to know their relative positions in real time.

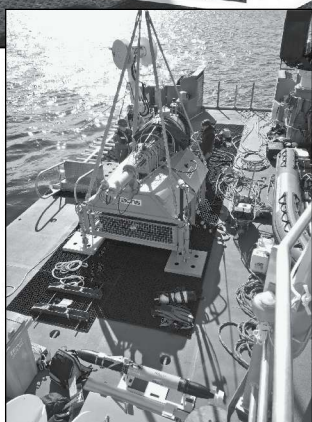
To complete the system, Naval Group has developed, with the Prolexia company, a 3D modeling system so that the user can display the drone's movements in real time. Decision makers will be able, if necessary, to abort the mission by sending a mission cancellation acoustic command.

### **Underwater Wi-Fi**

Another challenge to be met was to transmit data between the drone and the docking station without a connecting cable. Underwater, electromagnetic waves are highly attenuated. To overcome this problem, Naval Group and RTsys developed a system similar to Wi-Fi. Based on electromagnetic waves and lossless integration techniques, this communication between the station and the drone allows the station to retrieve the data from the mission. Next, the exchanges between the docking station and the user, on land, are made in a more classic manner: by wire. This underwater Wi-Fi also allows transmission to the drones of the information required for programming the next mission.

### **Contactless Recharging**

In order to recharge the drones without contact, Naval Group has developed a technology based on a thin elec-



**The Naval Group docking station and RTsys Comet AUV.**

tromagnetic tab, with the aid of the French company BrightLoop. Glued to the drone before immersion, this tab transmits the energy from the docking station to a coil connected to the drone's battery. The station itself can be powered via an electric cable connected to land, but other solutions are possible, for example, a lithium-ion battery station recharging the drone (with a smaller battery) for dozens of missions. Also envisaged is an energy production installation near the station, for example, a micro-watermill or a tide engine system.

### A Nest Protected from Biofouling

When the drone is parked inside the station between missions, a major problem is how to prevent corrosion and biofouling on the drone. Fish can enter the docking station, and biofilm, larvae and invertebrates tend to grow on the drone, risking disruption of its operation. To prevent this, the station developed by Naval Group is under a bell, open to the bottom. When the drone returns, this space fills with a liquid that inhibits corrosion and repels fish; it forces the seawater downward. This liquid is ecological and dissolves in seawater, in accordance with regulations. Before the drone's next mission, this liquid is pumped back into the station. Seawater reenters the bell, and the drone is released. It is possible to store the drone for a long period of time at the docking station without exposing it to an aggressive environment, an unprecedented engineering feat.

### Successful Testing

In the autumn of 2016, the engineers of Naval Group and RTsys tested the docking station in the ocean, near Brest, France, at the Celadon (Naval School of Lanvéoc)

test site. These experiments proved that the drone can find the base and enter the docking station.

After each mission, with journeys of several kilometers, the drone was able to find the station, which has a diameter of barely 1 m. Approximately 20 tests were performed, and they were satisfactory in terms of performing the mission, returning to the base, retrieving the data, recharging and programming the following mission.

### Adapts to Most Drones

The trials at sea focused on the implementation of the RTsys Comet AUV, a small drone approximately 1.8 m long with a weight of 30 kg. Cheap and easy to use, it can be launched by just one operator. Small drones are more sensitive to currents, but the tests with the Comet AUV yielded excellent results.

Regardless of size, the docking system developed by Naval Group is designed to adapt to almost all drone models. Even with the largest drones, the results should be stable.

The existing underwater positioning solutions, in particular those using short baseline technology, are often quite large or have relatively high latency. By basing both communications and guidance on acoustics, we were able to create a multifunction system with a single transducer. The homing kit is a compact and economical solution that works in turbid water and is easy to adapt to numerous drone models for a wide range of applications.

### Varied Uses

The applications initially envisaged are those requiring a permanent presence, notably, monitoring around ports and sensitive areas, detecting anomalies and measuring water quality for offshore facilities. At oil production sites, for example, the drones could be deployed regularly to check the condition of the equipment and foundations, or even to monitor leaks in the case of an alarm. Currently, when drones are used, they are deployed from boats. This operation can be difficult when the sea is rough and risks damage to the drone.

Further, for scientific observation, a drone associated with a docking station has advantages in terms of measurement frequency or area studied. Contrary to a fixed seabed station that can take measurements or video of a surrounding environment of, say, tens of square meters, a station equipped with a drone can cover distances up to 100 km.

The docking station developed by Naval Group and RTsys consists of a base placed on the seabed with a docking kit. Users can choose the drone they need and equip it as they like, for example, with sensors and cameras. Applications for such a system will be numerous, including long-term monitoring and environmental study. **ST**

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Marc Richard is the drone R&D projects manager at Naval Group.

Raphaël Bourdon is chief technology officer and co-founder of RTsys. He has a master's degree in electronics.

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

# Removal of Rust Staining Caused by Crevice Corrosion

*Enviroklean Reduces Manpower, Materials Cost for Maintenance*

By Graham George • Sheldon Landsberger

**I**t is well known that exposure to the changing elements in the marine environment causes many ongoing corrosion-related issues to ships and various metallic structures, such as barges, drilling rigs, ballast tanks, bridges, supporting vessels and even concrete structures with rebar reinforcement. Concrete may experience erosion, exposing the supporting rebar structure and causing corrosion and rust staining as iron oxide leaches from the affected steel.

The splash zone, which generally references areas that are continuously exposed to both water and air in a wet/dry environment, promotes the extreme conditions that initiate the corrosion phenomena. In many cases, crevice corrosion is the general cause for the unsightly rust staining of various surfaces, which can eventually lead to pitting, the failure of the protective coating and the more extreme stages of corrosion. As corrosion progresses, wall loss and possibly hydrogen embrittlement may affect the integrity of these structures, causing greater, more expensive repairs or even replacement. General rust staining is caused by fluid passing over the rusted or corroded areas where leeching occurs and transporting the iron oxide in liquid form, causing in many cases unsightly and unwanted staining.

Navy, Coast Guard and Merchant Marine vessels are particularly susceptible to this corrosive environment. Historically, the general solutions are limited and include

either: painting over the issue to hide the unsightly staining of the specific area, or the refurbishment of the problem area, which includes removal of the existing coating, preparation, material selection and then recoating.

A total refurbishment of the stained area is in most cases very expensive and often time consuming. Painting over the rust staining is unnecessary and often causes additional problems such as increased weight due to the added coating, thereby increasing flammability concerns.

Concealing the problematic area is often false economy as the integrity of the actual stained coating is intact. Simply covering the issue utilizes many man-hours and expensive material costs that hide rather than solve the problem. These combined issues have plagued the integrity of various structures and surfaces for centuries.

Specifically, Navy and Coast Guard vessels that encounter longer patrolling times in the open seas and oceans and aging steel structures require constant maintenance utilizing human resources



*(Top right) Scale embedded on steel flange with its before and after weight related to rust treatment. (Photo Credit: Nuclear Engineering Training Laboratory, University of Texas) (At right) USS Zumwalt during cleaning. Note the left side of the ship after cleaning with EPDI's Enviroklean.*





*Before rust removal on the USS Nitze.*

and expensive maintenance material costs. Historically, there have been several efforts to predict corrosion rates, as well as other cathodic protection methods, including but not limited to the use of a combination of aluminum alloy and aluminum-infused coatings acting in a sacrificial manner to protect the steel or structure.

### Safe Chemical Solutions

Enviroklean Product Development Inc. (EPDI), founded in 2009, manufactures and is licensed to provide specialty chemicals, NORM (naturally occurring radioactive materials) solutions, waste remediation services, cathodic protection and corrosion solutions to the energy industry, Department of Defense and various other clients.

While there are many commercial products available that attempt to mitigate or eliminate corrosion, EPDI manufactures a range of proprietary chemicals that are superior and are uniquely formulated and designed to successfully and safely remove various levels of corrosion including rust, rust staining, mildew, carbon, grease and oil from steel, fiberglass, concrete and various coated and uncoated surfaces and equipment.

In addition to rust and rust stain removal, experiments were conducted in 2015 at the University of Texas for the removal of radioactive scale from a steel flange using EK2012 (EK S&C). After 20 hours, the EPDI product EK2012 successfully removed 20.7 grams of the rust scale and 96 percent of the radioactivity. It has been scientifically confirmed that rust scale and calcium both act as hosts to specific radioactive isotopes such as Radium-226, Radium-228 and Lead-210, which may add additional unwanted problems when present.

EPDI has successfully conducted rust removal in

numerous, various situations and locations, such as on board the U.S. Navy ships USS *Arleigh Burke*, USS *Nitze*, USS *Iwo Jima* and USS *Midway*; Sherman tanks located at the museum in Scofield barracks in Hawaii; and the Aloha Liberty Bell.

In 2016, the Department of Defense requested that EPDI supply the product Enviroklean to clean construction debris staining from the entire structure of the USS *Zumwalt* while it was located in Norfolk, Virginia, before this remarkable, technically advanced ship was commissioned. The total product cost for cleaning the entire ship was less than \$5,000 and was performed in less than one week. The alternative solution was to replace the entire ship's coating, which would have taken months and at a cost of several million dollars.

Enviroklean was simply sprayed onto the surface of the rust-stained area and gently agitated with a brush for 3 to 5 minutes and then rinsed clean with water, leaving a clean coating with no unwanted or unsightly residues.

EPDI has successfully developed a range of unique chemical products that have been proven to work in the laboratory environment, as well as on USS Navy ships, vessels and other marine equipment for quick rust removal in a highly efficient and safe manner.

Enviroklean's chelating action is designed to remove the rust staining caused by crevice corrosion, making it easier to locate the source of the staining or leeching, which in most cases is crevice corrosion. Enviroklean is environmentally friendly, nontoxic, nonflammable, contains no VOCs, is a nonbioaccumulating formula that does not leave any appreciable residues, and can be used on various surfaces and coatings. By removing the surface staining, it is easier to locate the source of the rust staining to initiate a corrosion repair, reducing maintenance costs and preventing further staining and corrosion issues. Enviroklean is a more cost-effective solution than traditional maintenance methods. By utilizing EPDI products and methods, human resources as well as material costs are substantially reduced. **ST**

Graham George (ggeorge@epdi.biz) is the founder and chief technical officer for Enviroklean Product Development Inc. He initially studied at the Ford TTI, London, England, in the 1970s and has more than 40 years of experience in mechanical, chemical and corrosion engineering and product design. He has written and co-authored multiple published peer-reviewed papers. For more information and to review published works, visit [www.epdi.biz](http://www.epdi.biz).



Dr. Sheldon Landsberger (s.landsberger@mail.utexas.edu) is a professor in the Nuclear and Radiation Engineering Program in the Department of Mechanical Engineering at the University of Texas. He has published more than 220 peer-reviewed papers and more than 160 conference proceedings, mainly in nuclear analytical measurements and their applications in nuclear forensics, natural radioactivity and environmental monitoring of trace and heavy metals. Since joining EPDI as a consultant in 2011 he has been involved in laboratory measurements for rust/scale and radioactivity removal.



# CANOPIUS

## Taking LBL to the next generation



Since its creation, iXblue has always put forward different approaches to address subsea positioning issues, combining innovative concepts, proprietary technologies and solutions that aim to make its products easier to use, affording substantial savings. A full range of recognized products is now available offering the iXblue «touch»: performance, unique features, unrivaled ease of implementation, perfect cross-integration, and compatibility with third-party products.

Take, for example, Gaps, the first USBL to incorporate an INS, which gives it unique features and characteristics, or Ramses and

its Sparse Array/SLAM operating mode, or iXblue's comprehensive range of Fiber-Optic Gyroscope (FOG) navigation systems. Some of these products have indeed become industry standards.

In order to enhance its offer and provide a more global response to the requirements of its customers, iXblue needed to take things a step further with its acoustic offer and to add a system layer to ease the management of all products deployed for a given application. This is how a new global subsea positioning system was developed.

### CANOPIUS

The iXblue family of acoustic transponders welcomes a new member in the shape of the Canopus beacon, which takes the range to new peaks of performance and ease of use and opens up a vast fields of new applications in the area of subsea positioning. New features include inter-beacon and inter-product acoustic communication, a series of internal environment sensors (P, T, SV, attitude...) with the possibility of long-term recording, the capacity to be interfaced with an external sensor, a very significant increase in battery life, which is even longer if Sparse Array mode is used, the unified iXblue user interface with WiFi, and many more features to be implemented over the months to come thanks to a modern, scalable electronic platform common to various iXblue products.

### RAMSES

To get the most out of Canopus, the other components of the positioning system are also being upgraded. The new generation of Ramses built on this architecture benefits from the latest developments iXblue is working on, and offers the inter-product acoustic communication capabilities, the environment sensors which may be necessary, and the entire range of new features developed for Canopus (iXblue WiFi user interface, recording, power management...). A complete and flexible LBL solution also makes its appearance, enhancing the Sparse Array mode which was already made very popular by the previous version of Ramses. Gaps USBL system itself has benefited from the telemetry functionality since the release of its latest software pack (#8).

### SUPERVISION SOFTWARE

A positioning system becomes increasingly complex to manage as the number of products of which it is made up grows. Determined to make its products easier to implement and to offer customers a genuine system-based approach, iXblue had to provide an answer to this key user requirement and offer a tool which is truly fit for purpose. The result is the Supervision software suite, built up of different operational modules, accompanied by a set of tools which provide the operator with assistance throughout the project lifetime.

# Analyzing Changes in Coastal Areas Using Satellite Data

## *Landsat Images Enable Coastal Monitoring on Istanbul's Coast*

By Asli Sabuncu • Dr. Asli Dogru • Dr. Haluk Ozener

Remote sensing is the only technology available for obtaining a synoptic view of large areas, uniformly in time and space, so it is well

suited to coastal monitoring. The coast is a unique natural environment between the sea and the land surface, and destruction and damage occur to coastal areas due to improper usage, which adversely affects the balance of nature. Approximately 60 percent of the world's population lives on coasts and in coastal environmental systems, and a large number of cities are located near harbors and ports.

In Turkey, the length of the main shoreline is 7,266 km, and there are a further 1,067 km of island shores, making a total length of 8,333 km. The distribution of the length of these coasts is as follows: the Black Sea, 1,701 km (20.4 percent); the Sea of Marmara, 1,441 km (17.3 percent); the Aegean Sea, 3,484 km (41.8 percent); and the Mediterranean, 1,707 km (20.5 percent).

Coastal areas are exposed to environmental and socioeconomic pressures, such as settlements, agriculture, tourism, climate changes, natural disasters and sea accidents, over both the short and long term. Changes may result from natural causes, including geomorphological structures, changes in sea levels, coastal slope, wave height, tides and groundwater level, as well as human impacts, such as sand extraction, urbanization, land use and groundwater usage.

Current pressures are increasing coastal zone vulnerability, and the detection of changes to coastal areas can be used as the basis for generating usage policy and vulnerability maps of coastal areas.

In this study, temporal shoreline changes have been studied in the northern part of the Black Sea coast near Istanbul, which includes the Kilyos Saritepe Campus of Bogazici University, using Landsat images captured between 1986 and 2015.

| The area differences for the coast between 1986 and 2015. |                                  |                                  |                                  |                                  |
|-----------------------------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Class/Year                                                | 1986-2001                        | 2001-2007                        | 2007-2015                        | 1986-2015                        |
|                                                           | Area Diff.<br>(km <sup>2</sup> ) | Area Diff.<br>(km <sup>2</sup> ) | Area Diff.<br>(km <sup>2</sup> ) | Area Diff.<br>(km <sup>2</sup> ) |
| Coast                                                     | + 0.1989                         | - 5,1768                         | - 2,7117                         | - 7,6896                         |

### Data Sets

In this study, Landsat 5 and Landsat 7 satellite images have been used to monitor the coastline changes that have oc-

curred at Kilyos Saritepe Campus. All the satellite images are dated between August 5, 1986 and August 31, 2007 for Landsat 5 and between July 21, 2001 and July 28, 2015 for Landsat 7. All the Landsat 5 and Landsat 7 satellite images were downloaded from the U.S. Geological Survey website (<https://landsat.usgs.gov>) and possess 30-m spatial resolution with 11-byte radiometric resolution.

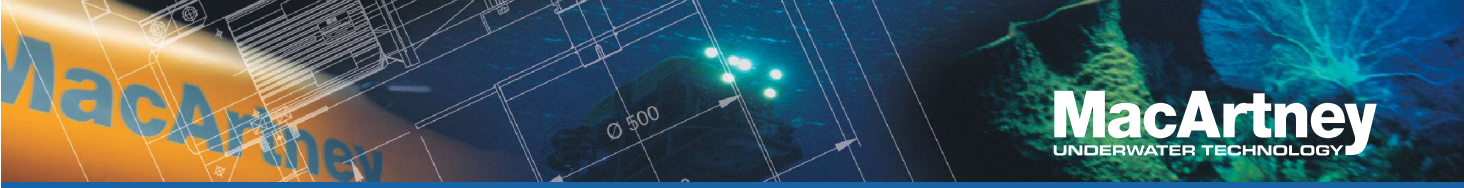
Before downloading the satellite images, some significant standards were determined and defined. All satellite images were obtained from the same season in order to minimize the phenological effect. A further important parameter was that all the images have low cloud coverage in order to eliminate errors due to radiometric and atmospheric conditions.

### Study Area

The study area is situated in Istanbul in the Marmara region of Turkey, at the border of the Bogazici University Saritepe Campus near Kilyos on the Black Sea. Istanbul is the most populated city in Turkey, covering a total area of approximately 5,450 sq. km and, according to the 2013 census, containing a population of approximately 14 million. The coordinates of the study area are: 41°14'44.29" N to 41°14'47.99" N and 29°0'51.41" E to 29°0'20.74" E, and the study area is 50 km west of the Strait of Istanbul.

### Methodology

A remote-sensing application was used to classify the satellite images and determine changes to the study area. In the last 20 years, remote-sensing applications have become commonly used methods for land use/land cov-

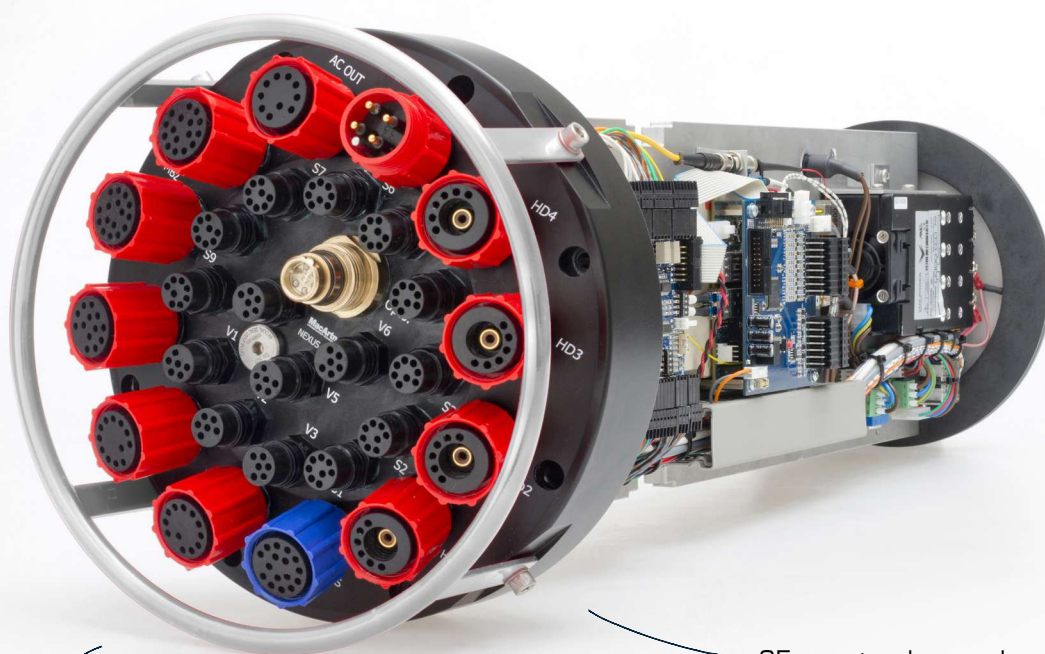


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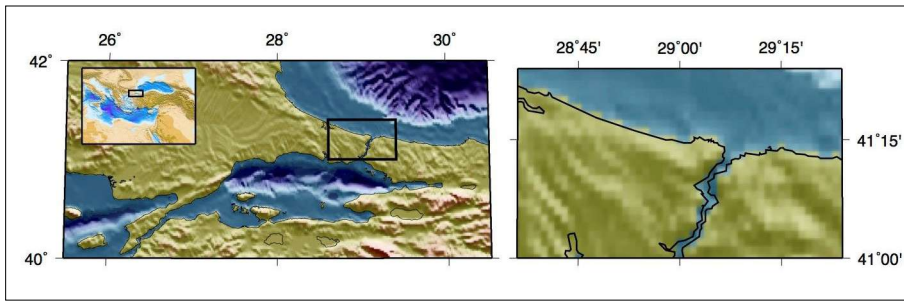
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For the supervised classification, different methods were employed: minimum-distance, parallelepiped and maximum-likelihood classification. In the minimum-distance classification, the mean vector of each region of interest (ROI) uses and calculates the Euclidean distance from each unknown pixel to the

mean vector for each class, and all pixels are classified to the closest ROI class. In the parallelepiped algorithm, decision boundaries use an n-dimensional parallelepiped within the image data space. The dimensions of the parallelepiped are defined based upon a standard deviation threshold from the mean of each selected class. In the supervised classification, the maximum-likelihood algorithm is the most commonly used and is based on the assumption that the training data statistics in each band are normally distributed. The maximum-likelihood algorithm calculates a Bayesian probability function from the inputs for classes established from training sites, and each pixel is then assigned to the class to which it most probably belongs.

Landsat 5 and 7 images for 1986 and 2007, and 2001 and 2015, respectively, were classified separately. In the first step, the unsupervised classification method was performed and the ISODATA algorithm was applied to the data, which enabled some classes to be distinguished and easily detected. In the next step, supervised classification (maximum-likelihood, parallelepiped and minimum-distance algorithms) methods were applied. The maximum-likelihood classification is the most accurate and reliable method among all the supervised classification algorithms used to classify satellite imagery.

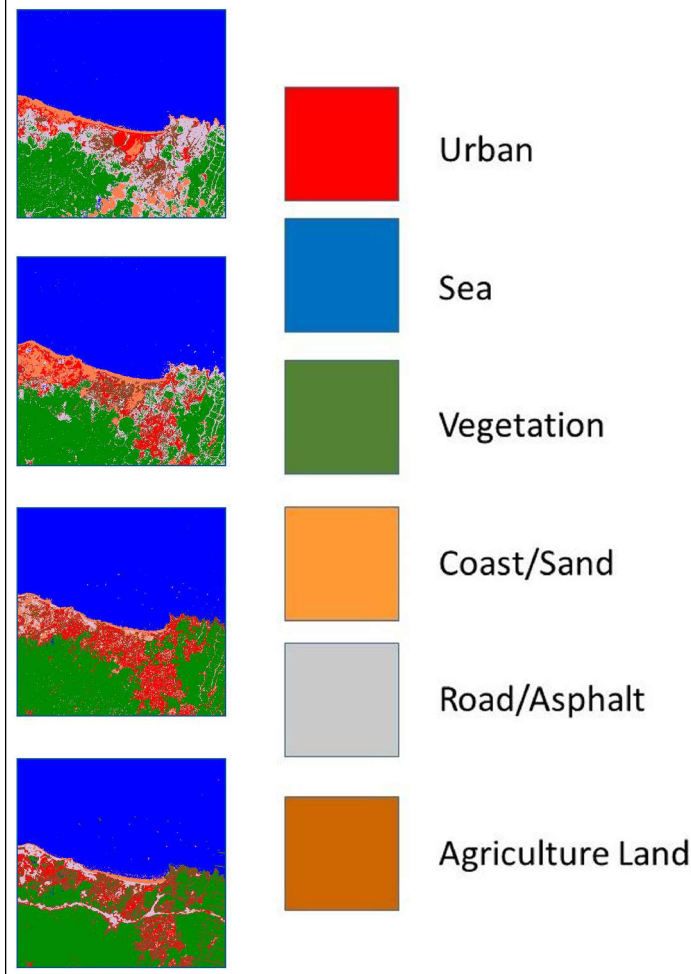
## Results

The land-use classes obtained from the maximum-likelihood classification were determined by examining the images both spectrally and spatially.

The major ground-cover types identified in the study area were: urban, sea, vegetation, coast/sand, road/asphalt and agriculture. The percentage and square-kilometer coverage of these areas were computed, and the classes with the largest areas were vegetation and sea.

Vegetation areas, including forested land and all types of vegetation, made up the largest percentage of the study area, with 21, 24, 28 and 27 percent in 1986, 2001, 2007 and 2015, respectively, after the sea/water class. Vegetation coverage increased slightly between 1986 and 2007 by 15.28 sq. km; however, it then decreased by 0.69 sq. km between 2007 and 2015. In 2015, the third Bosphorus Bridge, the so-called Yavuz Sultan Selim Bridge, together with its connecting roads and associated constructions, can be easily observed on the satellite images, and this infrastructure is associated with the changes in vegetation noted.

The coastal area in 1986, 2001, 2007 and 2015 was



**(Top)** The study area of Saritepe Campus in Kilyos, Istanbul. **(Bottom)** Maximum-likelihood classification of all data for change detection between 1986 and 2015.

er (LULC) studies. The algorithm selected for land cover classification was a pixel-based method that consisted of unsupervised and supervised classifications. In addition, the supervised classification has subclassification algorithms, termed minimum-distance, parallelepiped and maximum-likelihood classification.

Generally, the Iterative Self Organizing Data analysis technique (ISODATA) algorithm was used for unsupervised classification, which is useful for images in which land use/land cover is not well known or is undefined. ISODATA is an iterative and self-organizing algorithm that begins with a specified number of arbitrary clusters and repeats the process.

11.78, 11.98, 6.80 and 4.09 sq. km, respectively, and based on the findings of this study, the total area of coast has decreased by approximately 7.69 sq. km between 1986 and 2015. Comparing the four analyzed sets of images, it can be easily observed that coast and vegetation areas in 2001 were much larger than in 2015, a reduction due to sand mining and the destruction of vegetation during construction activities.

## Conclusion

Coastal areas are crucial, but also fragile natural resources around the world. With the advent of remote-sensing techniques and improving satellite data specifications, the process to determine changes to coastal areas is more reliable and efficient. It is clearly apparent that remote-sensing applications are a convenient way to reduce labor costs and time when undertaking coastal assessments, which in some cases are difficult or impossible to measure on the ground. In addition, satellite images are relatively cheap or may be freely available, and in scientific and commercial case studies these images have been frequently used in deformation analysis. This study indicates how remote-sensing technology can be utilized in determining coastal zone land use/land cover activities in a selected region over a specified period of time.

The study has demonstrated how Turkey's coastal areas are constantly changing due to natural or artificial effects (human activities). Different types of data, such as satellite images, orthophotos, environmental data and global positioning system data, can aid in the establishment of appropriate coastal zone management policies in order to protect coasts and shorelines effectively. Interdisciplinary studies play an important role in understanding the dynamics of deformation on the seafloor and coastal areas.

Lack of coordination between government agencies (at the local, regional and national levels) and conflicting (or lacking) regulations cause problems in conservation and

determining and implementing appropriate use of coastal areas. There is a need for integrated coastal management for the sustainable use of these areas. The infrastructure that will enable data and findings obtained from scientific studies to be gathered and updated in one system must be established for all coastlines in Turkey. The establishment of an integrated coastal management infrastructure that can be governed digitally should be considered as a very important task at the national level. As a first step, a multihazard assessment must be done with all these data, and the identification of hazard management stages for each coastline (such as Kilyos in this study) must be taken as the second step. Access to coastal information will bridge the gap between scientists, policy makers and the general public in order to enable effective decision making from all stakeholders for coastal management. **ST**

*Asli Sabuncu received a master's degree in geodesy from Bogazici University, Istanbul, Turkey, in 2010. She is currently a Ph.D. candidate in the Department of Geomatics Engineering at Istanbul Technical University. Her research interests are remote sensing and its applications, GPS, precise-leveling applications and crustal deformations.*

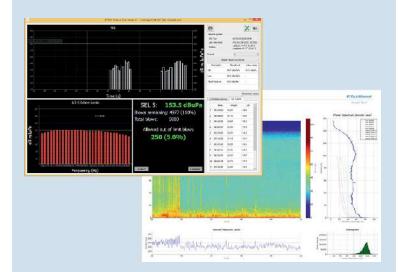
*Dr. Asli Dogru received her B.S. degree (1999) and M.S. (2002) in geodesy and photogrammetry engineering and Ph.D. (2008) in geomatic engineering from Istanbul Technical University. During her Ph.D. thesis, the NSF-funded GEON project (Cyberinfrastructure for the Geosciences) financially supported her. She is currently an associate professor at the Geodesy Department of Kandilli Observatory and Earthquake Research Institute (KOERI), Bogazici University, Istanbul. She is a member of the Turkish Chamber of Surveying Engineers and the American Geophysical Society.*

*Dr. Haluk Ozener graduated in 1988 from Istanbul Technical University having studied geodesy and photogrammetry engineering, and he completed his M.S. (1992) and Ph.D. (2000) in geodesy at Bogazici University. He is now the director of KOERI and has been head of the Geodesy Department at Bogazici University since 2010.*



## UNDERWATER LISTENING SYSTEMS

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# Remote Data Collection Near Marine Glacier Fronts

## *Unmanned Vehicles for Autonomous Sensing, Sampling in the North Pole*

By Gabriele Bruzzone • Angelo Odetti • Massimo Caccia

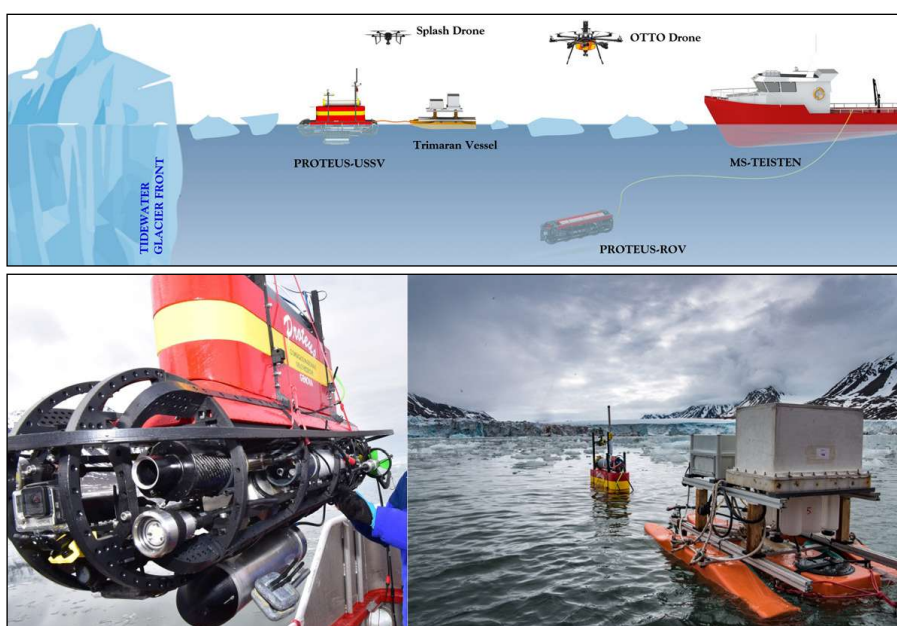
The Field and Interaction Robotics research group at the Institute of Studies of Intelligent Systems for Automation of the Italian National Research Council (ISSIA-CNR) has 25 years of experience in theoretical and applied research aimed at the design, development and deployment of autonomous vehicles, especially in the marine sector, bringing robotics to the service of marine and polar scientists. Romeo/R2 ROV, Charlie USV, Shark USSV, e-URoPe ROV, P2- ROV and PROTEUS USSV/ROV have extensively been used for collecting data during scientific campaigns performed in various areas, including polar regions.

The Unmanned Vehicles for Autonomous Sensing and Sampling (UVASS) research project, coordinated by ISSIA-CNR, aims to contribute to polar climate research by collecting data from inaccessible sea-ice-air interface areas. UVASS integrates ecological approaches and robotics to develop technological tools to safeguard the ecosystem. The robotics goal is to improve the effectiveness and efficiency of scientific research by exploiting technological innovation.

### Arctic Warming

The global warming process, entailing the climate's rapid mutation, developed in the 20th century. This change is largely attributed to the increasing emissions in the Earth's atmosphere of huge amounts of greenhouse gases and other factors mainly due to human activity.

The Arctic region is heating up faster than other places on Earth, bringing about rapid local and global environmental change that is increasingly evident in the observa-



*(Top) Unmanned vehicles used in the 2017 data acquisition scientific campaign of the UVASS project. (Bottom) PROTEUS (left), and PROTEUS towing the trimaran vessel (right).*

tions of many geophysical and biological properties. The interactions between atmosphere, ocean, cryosphere and biosphere are responsible for the phenomenon known as "Arctic amplification" (the Arctic region has warmed more than twice as fast as the global average). The rapid Arctic warming has contributed to dramatic melting of Arctic sea ice and spring snow cover, at a pace greater than that simulated by climate models.

The complex system of interactions involving heat exchanges and the water cycle (vapor and liquid) in the Arctic Ocean that is generated by climate change is at

the base of the instabilities inducing large uncertainties and errors in climate models. Monitoring the processes occurring in the Arctic region is crucial to better understand the phenomena occurring, identify the damages caused by climate change and identify appropriate strategies to counteract the process.

### Svalbard Archipelago

The Svalbard Archipelago in the Norwegian Arctic Sea is used by scientists for exploring the impact of possible climate changes. The retreat of tidewater glacier fronts in this area has been particularly pronounced in recent decades and has led to the release of huge volumes of cold and freshwater and an accumulation of sediments near the sea-ice interfaces. Particularly interesting is the case of the Kongsfjorden, an Arctic glacial fjord located on the west coast of Svalbard (79°02'44.95" N, 11°34'57.03" E), where high sedimentation rates have been recorded in the past few years. In the inner part of this fjord, many glaciers reach the sea with marine fronts that form a high vertical wall of ice protruding above seawater. Direct measurements in the proximity of glacier



***PROTEUS, OTTO and Splash unmanned vehicles operating near the Blomstrand-breen glacier.***

fronts are often lacking because the possibility of sudden falls of massive ice blocks makes data acquisition in these areas extremely dangerous. Navigation is even forbidden in this area due to safety reasons.

### UVASS Project

The goal of UVASS is to collect data necessary to study the important processes that are involved in the energy balance at the surface of the glaciers, which is controlled by the mutual interactions between the atmosphere, seawater, freshwater originating from the melting ice and the surface of the glacier.

ROVs, USSVs (unmanned semisubmersible vehicles) and UAVs (unmanned aerial vehicles) are involved in the UVASS project for performing air, water and ice data sensing and sampling close to the marine fronts of glaciers. A preliminary scientific data collection campaign was carried out by ISSIA-CNR in 2015 in Kongsfjorden, Norway, where the scientific community of Ny Ålesund is the northernmost year-round settlement on Earth. For the first time, a USSV (Shark) was specifically adapted and used to perform the discrete sampling of waters and

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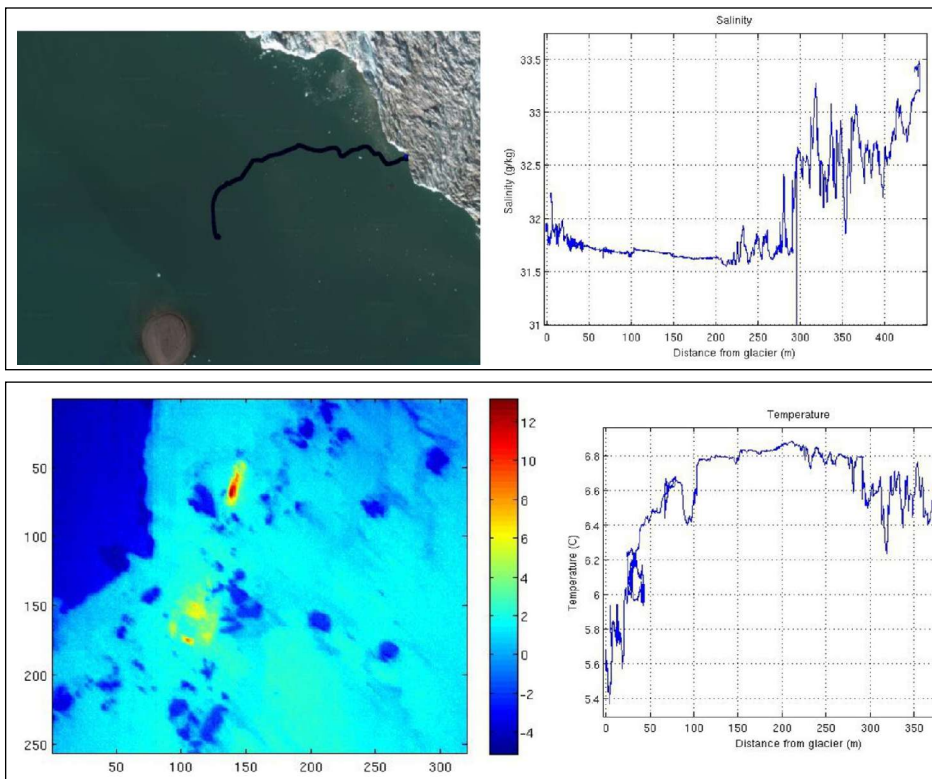
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that can be assembled at field to handle various tasks. PROTEUS's core can be operated as an ROV when tethered to a mothership. It can also be transformed into a USSV by removing the tether cable, adding a battery pack below the vehicle and installing on its top a module composed of foam, GPS and a radio communication system.

One of the most important features of PROTEUS is its open-frame chassis made in HDPE. Highly flexible and impact resistant, the frame is designed for quick installation and shifting of tools, equipment and sensors. Its thrusters are also interchangeable, displaceable modules designed by IS-

*(Top) Path followed by PROTEUS (left) and a salinity trend of data acquired near the Blomstrandbreen glacier (right). (Bottom) Sample image acquired by the thermal camera mounted on board OTTO (left) and a temperature profile simultaneously acquired by PROTEUS (right).*

the sensing of CTD multi-parameter probe data in the area close to the Kronebreen glacier.

A subsequent, more complex data acquisition campaign involving simultaneous operation of three unmanned vehicles was performed during the campaign completed in summer 2017 (from June 13 to June 26) by ISSIA-CNR in cooperation with researchers from other institutes of the National Research Council (IAMC, ISMAR, ISAC, IBIMET) and Tuscia University. This campaign gathered data to improve the understanding of major chemical, physical, biological and meteorological phenomena occurring near the waterfronts of the tidewater glaciers.

The campaign exploited the unique characteristics of the newly developed unmanned marine vehicle (UMV) PROTEUS (Portable ROBotic TEchnology for Unmanned Surveys) and two aerial drones, all operated from a boat floating at a safe distance of 500 m from the glacier's front.

## PROTEUS

The UMV PROTEUS, designed and built by IS-SIA-CNR, is a portable (45 to 70 kg, 1.5 m long, 0.35 to 0.5 m wide, 0.35 to 1.5 m high), highly modular and reconfigurable vehicle. It is an innovative hybrid composed of a core vehicle and various portable modules

SIA-CNR. In this way, the vehicle can be turned into different kinds of UMVs (ROV, USSV) but also reconfigured upon each expedition according to specific needs.

Thanks to its open hardware and software architectures, PROTEUS can easily be fitted on board with different sensors and actuators according to the specific mission. The presence of modular elements of buoyant foam on top of the frame makes it possible to quickly balance the trim to compensate for variations in weight.

The onboard computing system is installed in a movable stainless steel canister based on an SBC (single-board computer) and three PC/104 modules providing digital, analog and serial I/O. The I/O channels allow the SBC to communicate and interact with the various sensors and actuators installed on the vehicle. DC-DC converters, motor servo-controllers and a fiberoptic transceiver are installed in the canister, while the power supply relies on a system of converters contained in an aluminium anodized canister that can be moved on the vehicle to better balance the intrinsic stability of the vehicle.

During the 2017 campaign, PROTEUS was mainly used as a USSV and remotely controlled by means of a guidance camera mounted on top of the vehicle. It was equipped with manifold sensors and samplers, which were used to perform water data collection in the stretch of sea facing the Kronebreen and Blomstrandbreen glaciers.

In June 2017, PROTEUS was equipped with: an underwater video camera; LED lights; GoPro camera; a Tritech Micron echosounder for acquiring bathymetric data; an Idronaut Ocean Seven 305 CTD multiprobe sensor; a small sensor for measuring pressure, temperature and fluorescence of chlorophyll, named T-FLAP and developed by Tuscia University; and a Turner Cyclops-7



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turbidity sensor. All the data collected by these sensors were integrated in real time with PROTEUS's telemetry (to synchronize and geolocate all data).

During the surveys, the communication system allowed the collected data to be accessible in real time to the scientists so that they could modify the sampling area according to the previously acquired data and the vehicle's position.

A small trimaran vessel was towed by PROTEUS during its wide-area surveys. This trailer was used to host particularly heavy or bulky sensors: an automatic water multisampler provided by IAMC-CNR for the study of microbial biomass and bacteria respiratory activity; a plankton multisampler; and a Sea-Bird SBE 19plus v2 multiprobe sensor, provided by ISMAR-CNR.

## Drones

Besides PROTEUS, two drones were also used during the surveys for different purposes: OTTO and Splash. OTTO is an octocopter drone originally developed by Italdron and later modified by ISSIA-CNR, characterized by a high payload capacity and able to perform high-quality professional flight missions in high flight-safety conditions to achieve specialized operations in critical areas. In this mission, it was equipped with various video cameras, a FLIR A35 thermal camera and an aerial multisensor (humidity, temperature and air quality sensors) system provided by IBIMET-CNR.

The OTTO drone collected pictures and videos of the area and exploited the various sensors mounted on board to acquire data, enabling reconstruction of the characteristics of the air column overlying the area inspected by PROTEUS. This enables reconstructing a thermal pattern and performing a cross-check of the data coming from air measurements and from the CTD mounted aboard PROTEUS.

The Splash drone was used to record videos and images of the coordinated operations performed by PROTEUS and OTTO for documentary and dissemination purposes.

## Results

All ISSIA-CNR's unmanned vehicles are equipped with a sophisticated control system that allows various working modes (manual, semiautomatic and automatic) and can be remotely controlled by means of a radio link and a control station (command console). All three vehicles were remotely operated by personnel on board a small (31-ft.) workboat, *MS Teisten*, which was kept at a safe distance from the glacier front. A customized plywood platform (2.5 by 2.5 m) was mounted on the stern of the boat for drone take-off and landing.

The marine data acquired by PROTEUS, together with the atmospheric data collected by OTTO, allow scientists to obtain a complete characterization of the whole water-air column close to the glacier fronts.

All the collected data will be available shortly on the Italian Arctic Data Center (IADC) website at <http://arctic-node.dta.cnr.it/cnr>.

From a robotics point of view, the scientific campaign carried out in Kongsfjorden in 2017 demonstrated that

unmanned vehicle technology is mature and can be of great help to scientists involved in acquiring atmospheric and marine data near tidewater glaciers.

The adoption of a reconfigurable and portable robotic tool like PROTEUS, designed with an eye to usability in polar regions, has brought a huge advantage to the scientific research. Lessons for future data acquisition efforts are one of the most important results of this campaign.

To see part of the campaign in action, a video showing PROTEUS and OTTO operating June 23, 2017 near the Blomstrandbreen glacier is available at <http://bit.ly/2hxLpL4>.

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## References

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*Angelo Odetti is a research fellow at ISSIA-CNR and a Ph.D. student at DITEN-UNIGE. He is a marine engineer and naval architect with a background in air cushion technology research. He designed the general layout and structural and naval components of the e-URoPe, P2ROV and PROTEUS. He participated in the 2017 Svalbard mission.*



*Massimo Caccia is the director of ISSIA-CNR, with a focus on UMVs and mobile robots for ship structure inspection. He is involved in the EC projects EXCELLABUST, EXCELLABUST in marine robotics, FLAG-ERA Robocom++ and BRIDGES (Bringing together Research and Industry for the Development of Glider Environmental Services).*



## **Supreme Court Makes Decision On WOTUS Challenge Jurisdiction**

In January, the U.S. Supreme Court issued a decision concerning rule-making over the definition of “waters of the United States” (“WOTUS”) under the Clean Water Act (CWA), or the WOTUS Rule. According to Van Ness Feldman, the WOTUS Rule, which redefined jurisdictional “waters of the United States” under the CWA, has far-reaching implications for project development across energy, water, agricultural, construction and transportation sectors.

Although the Supreme Court’s decision merely resolves a jurisdictional dispute between the federal courts of appeals and the federal district courts over which court has jurisdiction to hear challenges to the WOTUS Rule, the decision will result in the lifting of the existing stay of the WOTUS Rule, opening the door to disparate approaches to jurisdictional determinations under the CWA across the country.

The decision has significant implications for the fate of the WOTUS Rule and how federal agencies review permit applications that may affect jurisdictional waters under the WOTUS Rule. In particular, the numerous legal challenges to the WOTUS rule that were previously raised in district courts are likely to resume, but pending resolution of those challenges, implementation of the WOTUS Rule—which expands federal control over several types of water bodies—would be legally permissible.

## **Five Recipients Get Ocean Awareness Awards**

The National Marine Sanctuary Foundation announced more than \$140,000 in Ernest F. Hollings Ocean Awareness Awards to protect endangered species, engage children in science and increase awareness about U.S. national marine sanctuaries.

The foundation selected five recipients for this year’s awards. Two projects—Space to Sea: A Photographic Journey into Stellwagen Bank National Marine Sanctuary and Robust Citizen Science Data for West Coast National Marine Sanctuaries—support the foundation’s goal to inspire stewardship of natural and cultural resources through U.S. marine and Great Lakes sanctuaries.

Three projects, funded with support from NOAA’s National Marine Fisheries Service—School and Community Leatherback Sea Turtle Project, Killer Whale Tales: Kids Making a Difference Now, and Global Action Explorers: Empowering Students for Action on Ocean Acidification—bring awareness to endangered and protected marine species, in partnership with NOAA’s Species in the Spotlight initiative.

## **BOEM Issues Guide for Offshore Wind Design Approach**

The U.S. Bureau of Ocean Energy Management (BOEM) now has draft guidelines for the use of a “de-

sign envelope” approach in construction and operations plans for offshore wind energy facilities in the U.S. In order to take advantage of the rapid pace of technological development in the offshore wind industry, offshore wind developers have asked BOEM to adopt this practice, which is standard in some European countries, for permitting offshore wind energy projects. This would afford developers a degree of flexibility and allow them to make certain project design decisions—such as which turbines to use—at a more commercially advantageous time later in the project development process.

Last August, the Trump Administration announced Executive Order 13807 to streamline the review and permitting of infrastructure projects. The design envelope approach would allow BOEM to analyze the environmental impacts of the proposed project in a manner that could reduce or eliminate the need for subsequent environmental and technical reviews. The use of a design envelope is not mandatory. Design envelopes are an optional tool for prospective developers.

## **Trump Acknowledges Need To Invest in US Ports**

In his first State of the Union address, U.S. President Donald Trump called on Congress to pass an infrastructure bill that generates \$1.5 trillion in infrastructure investments and streamlines permitting for major capital projects from 10 to two years, or possibly less.

In his focus on America’s “crumbling infrastructure,” the president placed a heavy emphasis on safe, reliable, modern transportation infrastructure, including roads, bridges, highways, railways and waterways.

He also talked about two other issues important to ports: international trade deals and investing in workforce development and training.

Seaport cargo activity accounts for 26 percent of U.S. GDP and more than 23 million American jobs, and generates more than \$320 billion annually in federal, state and local tax revenues. The American Association of Port Authorities (AAPA) has identified \$66 billion in federal port-related infrastructure investments over the next 10 years. These federal investments are necessary to supplement the approximately \$155 billion in capital improvements that U.S. port authorities and their private sector partners are planning between 2016 and 2020.

## **Trump Announces Pick For USGS Director**

U.S. President Donald Trump has nominated Dr. James Reilly of Colorado to be director of the United States Geological Survey (USGS). Reilly currently serves U.S. and allied militaries as an expert on space operations, and he is a technical advisor supporting the National Security Space Institute of the U.S. Air Force. Previously, Reilly held management positions in academia, as well as at TAEUS Corp. and PhotoStencil Corp. in Colorado Springs. He had a 13-year career at NASA. Prior to NASA, he was chief geologist at Enserch Exploration Inc., working projects around the world, including in Antarctica and on the continental slope of the Gulf of Mexico. **ST**

# international

## **Oil Salvage Operation Extracts 400 Tons Of Heavy Fuel Oil from Singapore Shipwreck**

A Miko Marine Moskito hot tap tool and oil recovery system was used to extract 400 tons of heavy fuel oil from the tanks of the sunken cargo vessel *Thorco Cloud*. The wreck lies in two sections 1,730 m apart and 70 m deep in the middle of the eastbound traffic lane of the Singapore Strait.

The heavy oil in the fuel tanks and trapped compartments has been a major pollution hazard since the collision in December 2015. Bumi Subsea provided ROVs and the vessel *Surf Allamanda*, owned by Bourbon Offshore, which served as the work platform during the oil salvage operation.

## **Hybrid Drive Systems Constructed in Estonia Pave the Way for New Law Enforcement Vessels**

PBES and NORIS Automation GmbH entered a partnership on the hybrid drive systems for Europe's first battery hybrid patrol vessel. The 45-m-long vessel is under construction at Baltic Workboats Shipyard in Estonia, and it will have 273 kWh of PBES Power 65 battery modules, which offer reduced sound and heat signatures. The PBES energy storage system is designed to integrate with the NORIS electrical infrastructure on the vessel.

## **International Insurance Provider Thomas Miller Acquires Technical Consultancy Brookes Bell**

Insurance services provider Thomas Miller acquired Brookes Bell, a technical and surveying consultancy with offices in Liverpool, London, Glasgow, Shanghai, Hong Kong and Singapore. Brookes Bell provides services in emergency response, casualty investigation, salvage and wreck removal, scientific cargo expertise, forensic engineering and expert witness services. The firm is also a leader in research and development of ship design support to enhance maritime safety and technology.

## **Australian Organization Partners with Saildrone to Acquire USVs for Research**

The Commonwealth Scientific and Industrial Research Organisation (CSIRO Australia) formed a partnership with San Francisco-based ocean technology start-up Saildrone to bring three USVs to Australia. CSIRO will use the Saildrone USVs to measure ocean temperatures, salinity and carbon, which is critical information for understanding the role of the oceans in the climate system. The three Saildrones will provide unprecedented access to parts of the ocean, particularly the Southern Ocean, that are otherwise unstudied.

## **Scottish Production Optimization Company Secures Investment from EV Private Equity**

Aberdeen-based Enpro Subsea secured investment from EV Private Equity to grow its production optimization business into new and existing international markets and develop its range of production optimization and in-

tervention technologies. Enpro began 2018 with projects ongoing in the U.K. Continental Shelf, West Africa and Gulf of Mexico. EV Private Equity is providing support as part of its pledge to invest \$200 million into fast-growing North Sea businesses.

## **Legacy Locker Program Allows Reuse Of Recovered and Recycled Subsea Equipment**

Systems Engineering & Assessment Ltd. (SEA) and Spirit Energy are promoting the recycling of subsea production equipment under SEA's Legacy Locker program. The companies are recycling two Aker third-generation subsea control modules (SCMs), following the decommissioning of Spirit Energy's Ann field. SEA's refurbishment of the equipment means the modules will be fully functional and available for reuse through Legacy Locker, a repository of new and refurbished equipment that is tested, refurbished, recertified or reverse-engineered by SEA's subsea engineers.

## **Communication and Monitoring Systems Experts W-SENSE Join UK Marine Robotics Centre**

Pioneering underwater wireless networking and communications systems developer W-SENSE Ltd. has joined the National Oceanography Centre's (NOC) Marine Robotics Innovation Centre as a strategic partner. W-SENSE was initially established as part of the Sapienza University of Rome, specializing in monitoring and communication systems with pioneering patented solutions in the internet of underwater things (IoUT). The company has been editor of networked scenarios and of the NATO NIAG 190 on JANUS evolution, and it is currently coordinating the EC EASME ArcheoSub project.

## **Remotely Operated Fire-Fighting Vessels Will Offer 'Eye-in-the-Fire' Capabilities**

Robert Allan Ltd. and Kongsberg Maritime are collaborating on the development of a remotely operated fireboat that allows first responders to attack port fires more aggressively. The RALamander fireboat offers in-close firefighting and "eye-in-the-fire" capabilities. The first in the series, the 20-m RALamander 2000, will be equipped with Fi Fi 1 capability with a total pumping capacity of 2,400 m<sup>3</sup>/hr with optional foam. A retractable mast can bring one of the three monitors to a high point of attack for shipboard or dock fires.

## **Two-Year Trial Proves Efficacy of I-Tech's Organic Anti-fouling Coating**

A two-year trial of a hull coating containing the bio-repellent active agent Selektope on a 46,067-dwt chemical and products carrier confirmed the ingredient's hard fouling prevention power.

Selektope is an organic, nonmetal compound that prevents barnacle fouling by temporarily activating the swimming behavior of barnacle cyprid larvae, making it impossible for them to settle on the hull. It has high efficacy at extremely low concentrations (0.1 percent w/w), is ultralow leaching, and offers paint manufacturers the flexibility to boost copper-based paint formulations or replace copper completely.

## Netherlands Workshop Receives DNV GL Approval

AEGIR-Marine's new workshop received approval from DNV GL, making it the first brand-independent service provider in the Netherlands with an approved workshop for repair and maintenance of propulsion systems. Workshop approval includes the quality of maintenance on propulsion systems, workplace routing, workplace safety, hazardous substances handling and risk management. The workshop allows AEGIR-Marine to perform spin tests, running and simulating propeller and thruster speeds in real time.

## Dynamic Underwater Laser Mapping Technique Developed for ROVs

Newton Research Labs Inc. and Sonardyne International Ltd. completed tests to integrate Newton Labs' underwater laser scanners with Sonardyne's acoustically aided inertial navigation system for underwater vehicles, SPRINT-Mapper.

Newton and Sonardyne entered into a formal collaboration in late 2017 to develop and promote dynamic underwater laser mapping, a rapidly emerging survey technique that significantly reduces the time needed to carry out inspections using underwater vehicles, including ROVs and manned submersibles. Now, an underwater vehicle fitted with a Newton underwater laser, is able to capture high-density point clouds of subsea assets and environments while on the move. The milestone paves

the way for greater adoption of mobile laser mapping technology to survey seafloor sites and subsea structures.

## Cornish Company Receives First Grant Issued by Marine Challenge Fund

Marine-i, an EU-funded program to boost the marine technology sector in Cornwall, made its first grant award to Triskel Marine, a technology company that recently moved to the Marine Enterprise Zone in Hayle, Cornwall.

Enterprise Zones are designated areas across England that provide tax breaks and government support for new and expanding firms. The grant, the first from Marine-i's Marine Challenge Fund, has enabled Triskel to build a comprehensive hybrid test rig for a new hybrid energy product, which the company expects to unveil at a launch event in the U.S. in fall 2018.

## Stern Tube Seal Repair in Antwerp Uses Flexible Mobdock Instead of Drydocking

Hydrex diver and technician teams carried out an underwater stern tube seal repair on a tanker berthed in Antwerp. The ship was suffering from an oil leak, making an on-site repair necessary. Using a Hydrex flexible mobdock, the team was able to make the repair on site underwater. The operation started with a thorough underwater inspection of the stern tube seal assembly, which revealed that a rope and a fishing net were entangled around it. Both were removed by divers, and the team then removed and replaced the three damaged seals. **ST**

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# environmental monitoring

## Verifavia Now Offers CSI Verification

Verifavia has expanded its offering to include global verification services for the Clean Shipping Index (CSI).

Formally established in 2011, CSI is an independent rating system of the environmental performance of ships and shipping companies. CSI seeks to deliver market incentives for clean shipping, with a view to encouraging shipping practices that are sustainable and environmentally responsible.

The CSI verification service is an extension of Verifavia's portfolio of services for the shipping sector, which includes EU MRV (monitoring, reporting and verification), IMO DCS (data collection system), and CCWG (Clean Cargo Working Group) verification.

Shipowners whose ships obtain full CSI verification can benefit from lower port fees at participating ports, including the Port of Vancouver and the Port of Prince Rupert. In January 2018, the Swedish Maritime Administration introduced differentiated fairway tax fees for vessels that are more environmentally friendly than their counterparts, solely based on the CSI rating. Vessels with a verified performance of three or more CSI stars will benefit from reduced fairway dues.

## Alaska Data Portal Gets Update

The Alaska Ocean Observing System (AOOS) has updated Ocean Data Explorer, <http://portal.aos.org/alaska-statewide>, a data portal connecting the world to diverse data sets from across Alaska, including the Arctic, Bering Sea and Gulf of Alaska—the state's three largest marine ecosystems.

Packaged in an interactive interface, Ocean Data Explorer organizes and presents data for applications ranging from tracking bird migration to identifying potential assets for future research. The Real-Time Sensor Map provides eyes on live conditions in scientifically and eco-

nomically critical parts of the state. Updates include: data comparison and charting functions; featured data views; advanced charting features, including climatologies and anomalies; station and source level metadata pages; and shareable custom data views.

The updated Ocean Data Explorer is currently in beta testing. Users can submit feedback on the site to help improve the portal features and tools.

## Radium-228 Increase Shows Fast Arctic Change

Scientists have found surprising evidence of rapid climate change in the Arctic: In the middle of the Arctic Ocean near the North Pole, they discovered that the levels of radium-228 have almost doubled over the last decade. This indicates that large-scale changes are happening along the coast—because the source of the radium is the land and shallow continental shelves surrounding the ocean. These coastal changes could also be delivering more nutrients, carbon and other chemicals into the Arctic Ocean and lead to dramatic impacts on Arctic food webs and animal populations.

The research team, led by Woods Hole Oceanographic Institution, suspects that melting sea ice has left more open water near the coast for winds to create waves. The wave action reaches down to the shallow shelves and stirs up sediments, releasing radium that is carried to the surface and into the open ocean. The same mechanism would likely also mobilize and deliver more nutrients, carbon and other chemicals into the Arctic Ocean, fueling the growth of plankton at the bottom of the food chain, which could affect fish and marine mammals and change the Arctic ecosystem.

## Antarctic Survey With Teledyne Sonars

The Teledyne SeaBat T50 and T20 multibeam echosounders are the key component to the Yun Zhou

Tech M80B unmanned surface vessel. Yun Zhou Tech designs and manufacturers a range of USVs, and the M80B was designed for the installation and deployment of the T50 and T20 sonars.

The M80B, fully equipped with a SeaBat T50-P, was recently deployed in Antarctica from the Chinese polar RV *Xue Long* ("Snow Dragon"). The T50 surveyed 5 sq. km in the waters of Antarctica.

## Water Quality Degrades In Caribbean

A team including Smithsonian marine biologists just released 25 years of data on the health of Caribbean coasts from the Caribbean Coastal Marine Productivity Program (CARICOMP). The data revealed that water quality decreased at 42 percent of the monitoring stations across the basin. However, significant increases in water temperature, expected in the case of global warming, were not detected across sites.

"We're seeing important changes in local conditions, like decreases in visibility associated with declining water quality and the increasing presence of people, but we're not picking up global-scale changes, like climate warming," said Iliana Chollett, post-doctoral fellow at the Smithsonian Marine Conservation Program in Fort Pierce, Florida.

The team gathered CARICOMP data from 29 sites in Barbados, Belize, Bermuda, Bonaire, Colombia, Costa Rica, Florida, Jamaica, Mexico, Panama, Puerto Rico, Saba and Venezuela and organized it into a single data set. Despite attempts to locate monitoring sites in places not affected by human activities, the stations are picking up signals of human influence throughout the Caribbean basin.

"One positive implication of this report is people are capable of dealing with local change by regulating pollution and runoff," said Rachel Collin, director of the Bocas del Toro Research Station at the Smithsonian Tropical Research Institute. "If people get their act together very soon, there is still hope of reversing some of these changes." **ST**

## Jensen's First Hybrid Tug to Enter Construction

Jensen Maritime, Crowley Maritime Corp.'s Seattle-based naval architecture and marine engineering firm, was selected to design Baydelta Maritime's new 100-ft., Z-Drive hybrid tugboat. It will use Rolls-Royce hybrid technology and represents the first installation of a hybrid system for Nichols Brothers Boat Builders (NBBB), and it is the first hybrid tug designed by Jensen to enter the construction phase. The tug will feature the same ship assist and tanker escort capabilities of existing *Valor*-class harbor tugs, but with multiple operational modes. The Rolls-Royce hybrid system will allow the vessel to operate direct-diesel, diesel-electric or fully electric. It is scheduled for delivery in the first quarter of 2019.

## LNG-Powered ConRo Ships Will Move Cargo Between US and Puerto Rico

Furuno outfitted the two newest LNG-powered *Commitment*-class ConRo (combination container and roll-on/roll-off) vessels, the *El Coquí* and *Taíno*. The two purpose-built vessels are among the first to be powered by liquefied natural gas. These 219.5-m ships, built by VT Halter Marine in Pascagoula, Mississippi, each have a capacity of 26,500-dwt and are designed to transport containers ranging from 20-ft. standard to 53-ft. high-capacity units, as well as hundreds of cars and other vehicles.

## Ocean Infinity Expands Its AUV Fleet with New Unit Configured for Under-Ice Surveys

Ocean Infinity added a 6,000-m-rated Kongsberg HUGIN AUV system to its existing fleet. This ninth AUV has been configured to conduct under-ice surveys and has Kongsberg's synthetic aperture sonar (HISAS) and a Kongsberg EM 2040 multibeam echosounder installed in an upward-facing modular payload section that is designed to facilitate surveys of the underside of the ice. An upward-looking Doppler velocity log (DVL) is also installed to aid under-ice navigation. Ocean Infinity is scheduled to take delivery of this new HUGIN AUV system December 2018. The system will be immediately put to work on a scientific research project scheduled for the beginning of 2019.

## Oceaneering's Technology for Offshore Wind Wins the Carbon Trust Accelerator Competition

Oceaneering International Services Ltd. was named a winner in the Carbon Trust Offshore Wind Accelerator (OWA) competition, which is geared to find new or adaptable techniques that provide innovative and low-risk subsea inspection solutions for the industry's challenges.

Oceaneering was selected as a winner for its techniques to address the inspection of welds on monopiles and jacket foundations. The company will receive tailored support from the Carbon Trust and OWA partners, including the potential to test the techniques at operational offshore wind farms.

## Phoenix Divers and Hardsuit Pilots Demonstrate Zero-Incident Abandonment Test

Phoenix completed an abandonment campaign in the Gulf of Mexico utilizing its atmospheric diving system (ADS) hardsuit. In phase one of the project, Phoenix cut, plugged and abandoned a 6-in. pipeline and umbilical exiting a J-tube at a depth of 530 ft. Phase two consisted of removing two 6-in. risers and riser clamps, two 3-in. umbilicals, two umbilical I-tubes and all I-tube clamps to a depth of 430 ft.

In total, 20 ADS missions were completed with 61 hours in the water and divers performed 38 dives with 33 hours of total bottom time. The entire project was performed over 18 days using 3,964 man hours without a lost-time incident.

## Torqueedo Now Offers Smart Power Generation Systems

Torqueedo has integrated Sentinel Boat Monitors and WhisperPower smart power generation systems into its electric boat propulsion products. The Sentinel app allows remote monitoring of the vessel's location and on-board systems and provides automatic alerts of any malfunctions and alarms. If the boat strays from its location, the automatic geofencing and GPS tracking function helps locate the boat. When integrated with the Torqueedo system, the boat's electric motor and battery data are displayed in the app, including state of charge, voltage, temperature and remaining range.

## Ship & Shore Environmental to Work with UC Irvine on Air Pollution Capture and Control

Ship & Shore Environmental Inc. (S&SE) joined forces with UC Irvine (UCI) in a program of collaboration, research, professional engagements and exchange of best practices. In addition, S&SE's CEO Anoosheh Oskouian is now a member of UC Irvine's School of Physical Sciences Dean's Leadership Council as well as UCI's executive roundtable, a gateway to mutually beneficial cooperation and knowledge transfer between the business community and the university.

S&SE is a Long Beach, California-based company specializing in air pollution capture and control for industrial applications, including volatile organic compound (VOC) abatement systems.

## Wing Inflatables Acquires Pioneering Life-Saving Inflatable Technology Company

Wing Inflatables Inc. acquired the stock of The Patten Companies located in Lake Worth, Florida, which manufactures inflatable life-saving products used by the U.S. Navy, U.S. Air Force and NASA. Specifically, Patten manufactures high-performance collars for rigid inflatable boats and inflatable watercraft designed for challenging marine environments. The company is a pioneer in the use of polyurethane-coated fabric and thermo-welded air-holding seams. Patten maintains its primary manufacturing facility in Arcata, California, a sales and administration office in Lafayette, California, and a sales and service office in Centreville, Maryland. **ST**

# offshore oil & ocean engineering

## Van Aalst Expands Offshore Offerings

The Van Aalst Group of Dordrecht, Netherlands, became a majority stakeholder in Techano AS, an offshore crane specialist from Norway. This follows the purchase of a 3D crane technology from another Norwegian company in 2016.

With the acquisition, the Van Aalst Group is now one of the very few companies in the world able to deliver a crane and a gangway as a combined package, using the 3D crane function.

The 3D crane can transfer equipment, such as tools, small generators, spare parts and containers, safely to an offshore platform, wind turbine or substation using 3D motion compensation. By eliminating vessel motions, the 3D crane ensures a safe and efficient transfer for service operation vessels and walk-to-work vessels.

With this possibility of offering a

combined crane/gangway package, the Van Aalst Group anticipates the new trend for standby and support vessels.

## McDermott, CB&I Join Onshore-Offshore Forces

McDermott International Inc. and CB&I have agreed to combine in an all-stock transaction to create a fully vertically-integrated onshore-offshore company, with a broad engineering, procurement, construction and installation (EPCI) service offering and technology portfolio.

Upon completion of the transaction, McDermott shareholders will own approximately 53 percent of the combined company on a fully diluted basis, and CB&I shareholders will own approximately 47 percent. The estimated enterprise value of the transaction is approximately \$6 billion.

This move will combine McDer-

mott's established presence in the Middle East and Asia with CB&I's robust operations in the U.S., creating a balanced geographic portfolio with a strong position in high-growth developing regions.

## France Makes Bold Move With Oil, Gas Ban

France has passed legislation to end all oil and gas exploration and production by 2040, the UN Climate Action Programme reported. From now on, no new exploration permits will be granted within French territories.

President Emmanuel Macron's Republic on the Move party voted in favor of the bill with help from other centrist and left-wing parties. France is not a major oil producer, but this ban is a symbolic lead for other nations to make the transition away from exploiting hydrocarbons.

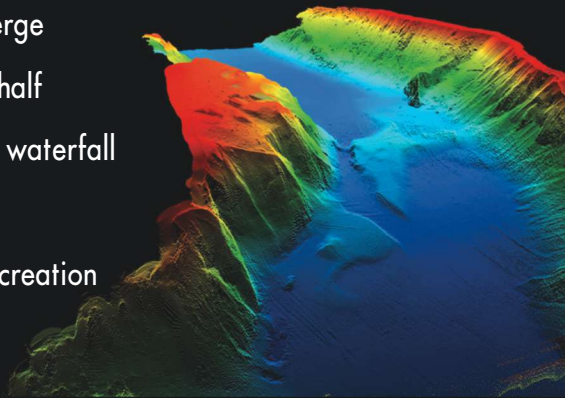
The U.S. leads the world in petroleum production and has been retreating from climate change policy leadership under President Donald Trump. France seeks to lead on



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climate change under Macron. In July, he announced a ban of petrol and diesel cars by 2040.

### **Subsea Laser for Internal Casing Inspection**

Newton Labs and Ashtead Technology have delivered an advanced subsea laser scanning project for Subsea 7 on Chevron's Captain field located in the U.K. North Sea using Newton's underwater laser scanners. The scope of work included an internal casing inspection utilizing Newton's M210UW ultrahigh-resolution short-range underwater laser scanner and a horizontal mapping survey using the longer range Newton M3200UW to capture more than 100 short- and long-range scans. This allowed Ashtead to generate a 3D model of the structure.

### **Shell to Redevelop North Sea Penguins Field**

Royal Dutch Shell plc has made a final investment decision on the redevelopment of the Penguins oil and gas field in the U.K. North Sea. The decision authorizes the construction of a floating production, storage and offloading (FPSO) vessel, the first new manned installation for Shell in the northern North Sea in almost 30 years.

The Penguins field currently processes oil and gas using four existing drill centers tied back to the Brent Charlie platform. The redevelopment of the field, required when Brent Charlie ceases production, will see an additional eight wells drilled, which will be tied back to the new FPSO vessel. Natural gas will be exported through the tie-in of existing subsea facilities and additional pipeline infrastructure.

### **DSM Starts Mooring Work on NCS**

Deep Sea Mooring (DSM), a Vryhof company, has begun work on a contract to provide pre-lay mooring products and services to the Deep-sea Bergen semisubmersible drilling rig on the Norwegian Continental Shelf (NCS). Austrian oil and gas company OMV has deployed the semisubmersible rig to support drilling activities in the region.

The pre-lay mooring equipment and services provided will include chain, fiber ropes, anchors, connectors, buoyancy and handling equipment, as well as mobilization and demobilization services.

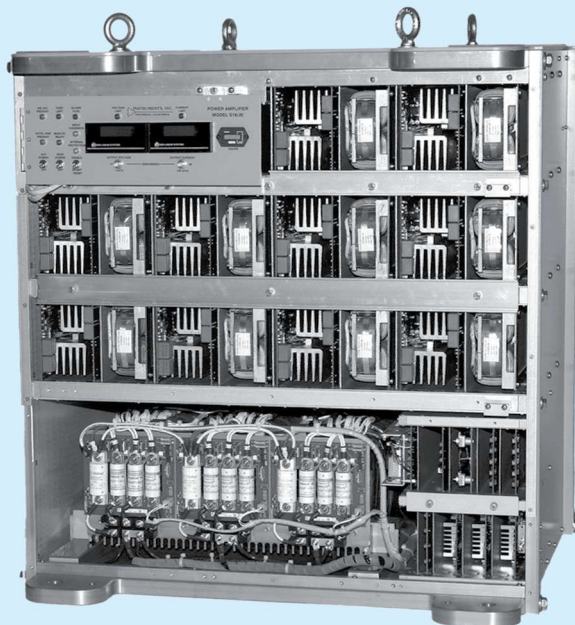
### **Confidence Rising In Oil, Gas Industry**

Senior oil and gas sector professionals expect a step change in the industry's capex, opex and R&D

spending levels in 2018, according to a DNV GL study. Confidence in industry growth has risen globally from 32 percent in 2017 to 63 percent this year. Two-thirds of respondents say their company will maintain or increase spending in 2018. Industry leaders see the need to maintain a tight control over costs to support the leaner, smarter projects and operations that will be necessary to maintain margins. **ST**

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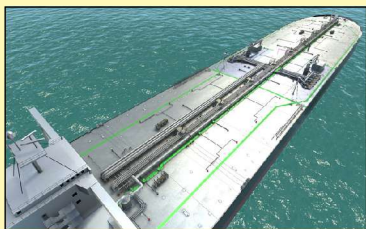
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# productdevelopment

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## Virtual Cargo Simulator



A 3D virtual application for the K-Sim Cargo simulator generates high-fidelity visualizations for operational training on areas of the cargo deck. Students can zoom in and interact with valves, flanges, cargo tank hatches, pressure vacuum valves and crude oil washing machines. Kongsberg Digital.

## Increased CAN Bus Signal Range

CAN bus communication protocol is extended to active flying leads with three configurations for up to 5,000 m, including a fault tolerant CAN bus (ECFL-FT), a high speed CAN bus (ECFL-HS), and an optical extended CAN bus jumper (EO-FL-C). Teledyne Oil & Gas.

## Maritime Black Box

The VR7000S Simplified Voyage Data Recorder is a tamperproof data recording unit for maritime accident investigations. It records

information from all serial, analog or digital sensors, bridge audio and VHF, radar and ECDIS data, AIS, bridge alert management, thrusters and inclinometer. Furuno USA Inc.

## DC Electrical Switches

New models of toggle and push-button switches are available in single- and double-pole and single- and double-throw options. Switches are available with a lighted lever and optional silicone rubber boot for moisture sealing. Hubbell Marine Electrical Products.

## Machine Diagnostics

Using information about speed, horsepower and rigid versus flexible mount, a smart machine checker uses a wireless triaxial sensor to take measurements on the bearing points of a machine, as well as shaft speed, bearing temperature and wireless sensor orientation. Fixtur-laser.

## Navigational iPhone App

The mazu iPhone app now integrates Navionics vector charts for navigation and weather routing. It offers seven-day point forecasts, with wind and wave heights, access to GRIB files, and NEXRAD and

NOAA weather alerts. Navigation includes routes, waypoints, NMEA data, and on-screen tracking. Sky-Mate Inc.

## Artificial Intelligence System

The A-Suite cloud-based operations manager uses algorithms to detect anomalies in the behavior of human operators. It includes a track prediction system and anti-collision support tool, advanced diagnostics for decision support, and uses real-time metocean data, hazards and hydrodynamic performance indicators for optimization. Transas.

## Underwater Tracking Technology



The Micro-Ranger 2 ultra-short baseline acoustic tracking system is built around 6G hardware and Wideband 2 digital acoustic technology. The small, light transceiver can be deployed from a small boat, pontoon or USV. Sonardyne International Ltd.

## Entanglement Prevention

The ARC-1XD acoustic release mechanism is based on vaporization of a nickel-chromium wire by a very high-current electric cur-

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3 m  
5 m  
7 m  
9 m  
11 m  
13 m

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Data courtesy of Statnett Norway

Data Example Innomar SES-2000 standard (8 kHz, range 2–14 m)

SES-2000 compact | standard | SES-2000 towfish

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rent. The wire is strung between two posts constraining a level arm. Upon vaporization, a lever arm is set free and opens by the buoyant force of the instrument package or a buoy released to the surface. Desert Star Systems LLC.

### Optical Ferrule

A 1.25 mm optical ferrule is available for the BIRNS Millennium connector series. It can be used with molded or oil-filled cables in straight or 90° configurations and in high and low voltage, coax, fiber-optic and hybrids of electro-coax, electro-optical and electro-opto-mechanical formats. BIRNS Inc.

### Electric Torque Tool

Australia-based Total Marine Technology has collaborated to release a 24-kilo electric torque tool with built-in drive and torque measurement that is self-calibrating across its full torque range. Saab Seaeye Ltd.

### HD Zoom Camera



The Apex SeaCam incorporates corrector optics with a low-distortion 70° horizontal FOV. It offers several HD formats and high sensitivity to low light with a faceplate illumination of 0.56 lux. HD and 4K UHD configurations have 12x optical zoom. DeepSea Power & Light Inc.

### LED Crane Light

The GAU-HB-1000W-LED-SS-480V universal voltage crane light can be operated on 347-480 V AC without modifications and automatically adjusts input current. The LEDs are paired with a high purity, polished aluminum reflector to produce a focused 10° spot beam. Larson Electronics LLC.

### Lightweight Anchor

The FX-85 anchor weighs 47 lbs.

and offers 21,000 lbs. of holding power in hard sand. With certifications from ABS and DNV GL, it is made from precision-machined aluminum magnesium alloy and can be adjusted to 32° or 45°. Fortress Marine Anchors.

### Waterproof Touch Screen Monitor

This 17-in. sunlight-readable monitor has a five-wire resistive touch screen that can be activated with nearly any object, including a gloved finger or stylus. It has a stainless steel panel-mount enclosure, and operating temperatures range from -22° to 176°F. TRU-Vu Monitors Inc.

### Micro Multibeam Sonar

The Gemini 720im has a 90° horizontal FOV and 50 m range, with an update rate up to 20 Hz. Its small size suits micro ROVs/AUVs and applications with restricted space or weight such as diver helmets and pole mounting in search and recovery. Tritech International Ltd.

### Handheld Data Logger

The Databank Handheld Datalogger uses GPS and the GLONASS satellite system for horizontal position accuracy of 2.5 m. It stores up to 9,999 records and 16 calibrations and uses a GUI interface for configuring Cyclops sensors. Turner Designs Inc.

### Micro Inertial Sensors

The Ellipse 2 Micro Series is available as an IMU (inertial measurement unit) with gyroscopes, accelerometers, magnetometers and a temperature sensor, as an AHRS (attitude and heading reference system) running an extended Kalman filter, or as an INS (inertial navigation system) that connects to a GNSS receiver. SBG Systems S.A.S.

### Recovery Tow Sling

Panther is a lightweight, high-strength, low-stretch tow sling for mining and vehicle recovery with loads from 20-700 MT. It is made of Dyneema SK78 and covered with Dyneema HMPE (high-modulus polyethylene) chafe protection. Samson Rope Technologies Inc. **ST**



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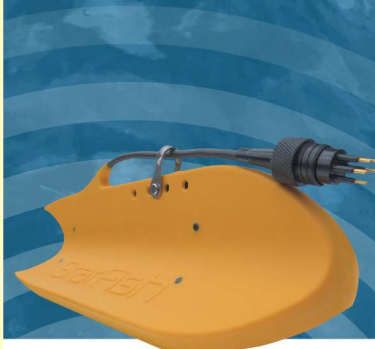
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## Data Comms Tool for Underwater Observatories

COSTOF2 (Communication and Storage Front-end - second generation), a data communication and backup tool, can power and control submarine observation station sensors and retrieve their data in real time. COSTOF2 allows the reliable and synchronized connection of up to 12 sensors, including hydrophones, sonars and HD (4K) video cameras. The latest version of the tool consumes only 1.5 milliwatts on standby mode.

COSTOF2 is now in use at EMSO-Açores observatory at 1,700-m depth. In the future, COSTOF2 will be deployed in other EMSO-DEV observatories. Two units have been produced by RTsys for this purpose at the end of 2017, and three coastal units are under production.

## Cryptocurrency Enters Maritime World

OceanChain Foundation launched a platform using blockchain technology to offer a "one-stop-shop" for maritime trade. The OceanChain platform includes: blockchain-powered currency, Ocash, to simplify settlement of cross-border transactions or transactions in international waters; e-commerce trading to access goods and services, such as fuel; and financial services.

The platform is designed to support transactions across the maritime industry life cycle, from transactions involving fish produce or fisheries services to maritime satellite communications, maritime insurance and supply chain financing, for example.

The new platform is underpinned by a cryptocurrency that can be used to trade services across the OceanChain platform. Ocash will have a total upper limit of 10 billion units in circulation.

## Expedition to Laser Scan Titanic Wreck

OceanGate Inc. and 2G Robotics have formed a strategic alliance to capture laser data of the RMS *Titanic* shipwreck and debris field. 2G Robotics dynamic underwater laser scanner, the ULS-500 PRO, will be installed on OceanGate's Cyclops 2 manned submersible.

The six-week *Titanic* Survey Expedition will depart from St. John's, Newfoundland, Canada, in June with scientists, content experts and mission specialists joining the crew in a series of week-long missions. The 2G Robotics equipment will generate real-time 3D models with millimetric resolution.

Using the laser data, the team will overlay 4K images captured throughout the expedition to create a detailed 3D virtual model of the wreck. This model will serve as an objective baseline to assess the decay of the wreck over time and help to document and preserve its submerged history.

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## Partnership for Digital Fleet Monitoring

BOURBON and Bureau Veritas have partnered to develop and deploy automation and real-time monitoring fleet applications while mitigating cyber risks. The partnership will deliver advanced automation of dynamic positioning (DP) systems to enable: improvement of DP operational safety through real-time advisory tools for bridge operators and remote support for onshore teams; streamlining of onboard organization leading to potential reduction of manning; and a reduction in fuel and DP maintenance costs. A pilot test has been implemented in Trinidad waters.

## High-Res Laser Scan, Drone IMU Combo

iXblue and Newton Labs have conducted demonstrations and tests of advanced integration technology between their systems to supply high-resolution laser scanning coupled with an IMU in ROV/AUV service. The companies first demonstrated the ability of the combination to operate in conjunction with industry standard navigation software. They then also proved the ability of the Newton scanners to work with the full data set from the iXblue Phins IMU to adjust the Newton laser scans for heading, pitch and roll independent of other software.

## Simwave Maritime Center Of Excellence Opens

Simwave B.V. and Kongsberg Digital have successfully completed the site acceptance test for the Simwave Maritime Center of Excellence. The Barendrecht, Rotterdam facility in the Netherlands is now fully operational.

Simwave's training facility covers more than 5,000 m<sup>2</sup> across two floors containing Kongsberg simulators, meeting rooms, offices and welfare facilities. The next step is to develop a hotel facility on the top floor of the building for customers and trainees, enabling training to take place 24/7.

## FDNY Scuba Squad Captain Wins SAR-1

At the DEMA (Diving Equipment & Marketing Association) show in Orlando, Florida, JW Fishers Mfg. held a drawing for a chance to win a SAR-1 underwater metal detector, with law enforcement, military, commercial and recreational diving applications. The winner of the drawing was Capt. Steve Forlenza, Special Operations Command, SCUBA Operations of the F.D.N.Y. Scuba Squad. Forlenza is in charge of coordinating team trainings and marine vessel maintenance diving.

## More Cougar ROVs For Platform Inspection

Bluestream added two new gravity-based Saab Seaeye Cougar XT Compact Zone II ROV systems to its fleet. The Cougar XT Compact was chosen for its regulatory compliance in the central and northern North Sea sectors and ideal size for operating in and around platform structures. Bluestream's Saab Seaeye fleet now totals 22 systems. **ST**

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## Design Contract For Saudi MMSC

Lockheed Martin has awarded Gibbs & Cox a contract to support the functional design of Saudi Arabia's Multi-Mission Surface Combatant (MMSC).

A derivative of the *Freedom*-variant, Lockheed Martin's MMSC was selected to fulfill the Royal Saudi Naval Forces' multi-mission surface combatant requirement. In May 2017, the U.S. Navy and Saudi Arabia signed a letter of offer and acceptance for four MMSCs.

This agreement represents the first sale of a U.S.-built surface combatant to another nation in more than 40 years.

## Propulsion Diesel Engines for San Antonio LPD Ship

Fairbanks Morse has been awarded a contract to build and deliver the main propulsion diesel engines (MPDE) that will power LPD-29, the U.S. Navy's 13th *San Antonio* landing platform dock (LPD) class ship.

Construction of the engines will begin in 2019, and they are scheduled to be delivered in 2020 to Huntington Ingalls Shipbuilding in Pascagoula, Mississippi. Fairbanks Morse will then support installation, testing and sea trials for the vessel.



## International Federation of Hydrographic Societies

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## Echosounders for Canadian Victoria Subs

KNUDSEN Engineering Ltd. has been awarded a two-year contract by the Canadian Department of National Defence for the supply of ruggedized echosounders to replace the dry-end portion of the deep and shallow echosounders currently fitted on board Canada's *Victoria*-class submarine fleet. Additionally, the contract will include installation and training at the Tactical Weapons System Training Facility in Halifax, Nova Scotia. Each deliverable set includes recorders, remote displays, associated switches and ancillary dry-end equipment.

## US Navy Opens Electronics Evaluation Facility in Spain

The U.S. Navy's first permanent Shipboard Electronic Systems Evaluation Facility (SESEF) site in Europe is now operating in Rota, Spain. A Naval Undersea Warfare Center Division Newport tenant activity site at Naval Station Rota, the facility services Commander 6th Fleet forward-deployed naval forces, supporting four guided-missile destroyers currently stationed at Naval Station Rota. The ships require periodicity testing and certification of various onboard tactical electromagnetic systems.

## Diver-Held Sonars For Pacific Special Ops

Sound Metrics completed delivery of four ARIS Defender diver-held high-resolution imaging sonars and associated topside supervisory packages to the Pacific Special Operations Command in Hawaii. The ARIS Defender 3000 systems will be used to provide an accurate identification and classification of previously-mapped suspicious underwater targets. ARIS Defender combines two sonar models in one package and can be tethered or operated autonomously.

## Rugged Tablets for US Navy Shipyards

The U.S. Naval Surface Warfare Center (NSWC) has selected the DT Research DT311 rugged tablets for deployment to U.S. Navy personnel working at various shipyards across the country. The tablets can be used for technical maintenance management, warehouse and fleet inventory control, field testing and training, and other field-office data operations.

## CODA to Develop 3D Head-Up Display for Divers

Coda Octopus Group Inc. received a subcontract award from the Applied Research Laboratory at Penn State as part of a Naval Sea Systems Command (NAVSEA) program. The award is for the development of a prototype real-time 3D head-up display solution for divers (3D HUD system). It will feature real-time 3D sonar imaging hardware and real-time 3D augmented visualization software by Coda Octopus. The 3D HUD System will feed directly into the diver's augmented vision display embedded inside the diving helmet. The prototype is expected to be ready for testing in the second quarter of 2018. **ST**

# contracts

**XSite Modular, Branchburg, New Jersey**, has been awarded the contract to provide a cable landing station in Oahu, Hawaii, which will be part of the Hawaiki submarine cable system, a 15,000-km transpacific cable that will link Australia and New Zealand to the U.S., as well as Hawaii and American Samoa, with options to expand to additional South Pacific islands. Hawaiki Submarine Cable LP.

**Metal Shark Boats, Jeanerette, Louisiana**, delivered a 35-ft. *Defiant* welded aluminum pilothouse patrol vessel with shock-mitigating seating for a crew of four and 300-hp Verado four-stroke outboards for speeds over 45 kt. Puerto Rico Police Department.

**REINPLUS FIWADO Bunker, Rotterdam, Netherlands**, will supply biofuels to inland and coastal vessels throughout Northwest Europe as the demand for alternative shipping fuels increases. The fuels specifically developed for shipping reduce CO<sub>2</sub> and sulphur and are suitable for every type of marine engine without any modifications. GoodFuels Marine.

**Kraken Robotic Systems Inc., St. John's, Canada**, has a contract for more than \$400,000 CAD for its AquaPix Miniature Synthetic Aperture Sonar system with modular system architecture that uses the latest electronics, transducer arrays and real-time signal processing software for the size, weight and power constraints of UUVs. Undisclosed.

**Ocean Infinity Ltd., Houston, Texas**, concluded the initial phase of its construction management and services contract and AUV and survey operations, which combined the latest AUV and USV technology to create a pioneering commercial survey function. SeaTrepid.

**Fugro, Laksevaag, Norway**, will provide rig positioning services for all Statoil-operated rigs on the

Norwegian Continental Shelf and all associated vessels. Positioning systems using navigation satellites (GPS, GLONASS, Beidou and Galileo) will be permanently installed on rigs and vessels for an accuracy of 3 cm. Statoil Petroleum AS. **ST**

# meetings

## APRIL

**April 9-11—MCE Deepwater Development, Milan, Italy.** 281-491-5900, Bo.Howard@questoffshore.com or <http://mcedd.com>.

**April 9-12—MTS Buoy Workshop, Ann Arbor, Michigan.** 508-289-2456, jrjzoli@whoi.edu or <http://mailman.whoi.edu/mailman/listinfo/buoy-workshops>.

**April 18-20—Mari Tech, Victoria, Canada.** 250-797-0711, concierge@mt18.ca or [www.mt18.ca](http://www.mt18.ca).

**April 24-26—Singapore Maritime Technology Conference, Singapore.** +65 6508 2401, register@ibcasia.com.sg or [www.smtcsingapore.com](http://www.smtcsingapore.com).

**April 25-27—European Mediterranean Oil & Gas Summit, Valletta, Malta.** +44 7443 654 777, Mike@EPGSummit.com or [www.euromed-og.com](http://www.euromed-og.com).

**April 30-May 2—Waterpower Week in Washington, Washington, D.C.** 918-831-9160, registration@pennwell.com or [www.waterpowerweek.com/index.html](http://www.waterpowerweek.com/index.html).

**April 30-May 3—AUVSI XPONENTIAL, Denver, Colorado.** [www.xponential.org/xponential2018](http://www.xponential.org/xponential2018).

**April 30-May 3—Offshore Technology Conference, Houston, Texas.** 972-952-9494, meetings@otcnet.org or <http://2018.otcnet.org>.

## MAY

**May 2-3—Nor-Shipping, Oslo, Norway.** +45 40190234, sf@nor-shipping.com or <http://nor-shipping.com>.

**May 15-17—Europort Romania, Constanta, Romania.** +31 10 2933250, info@europort.nl or [www.europort.nl/about-europort/europort-exports/europort-romania](http://www.europort.nl/about-europort/europort-exports/europort-romania).

**May 23-24—Fisheries Management in Estuarine and Coastal Waters, Lancaster, England.** info@ifm.org.uk.

**May 28-31—OCEANS '18 MTS/IEEE Kobe/TechnoOcean2018, Kobe, Japan.** maki@iis.u-tokyo.ac.jp or <http://oceans18mtsieeeekobe.org>.

## JUNE

**June 4—BlueTech Expo, Washington, D.C.** 202-389-9009, rich.lawson@ios-tia.org or [www.bluetechexpo.org](http://www.bluetechexpo.org).

**June 11-13—Global Offshore Brazil Summit, Rio de Janeiro, Brazil.** 281- 491-5900, Exhibits@questoffshore.com or [www.globaloffshore-brazil.com](http://www.globaloffshore-brazil.com).

**June 12-14—International Conference on Ocean Energy, Cherbourg, France.** +331 85 09 68 53, s.pe-seux@bluesign.events or <http://icoe2018normandy.eu>.

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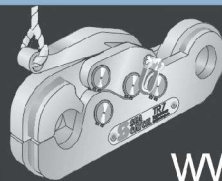


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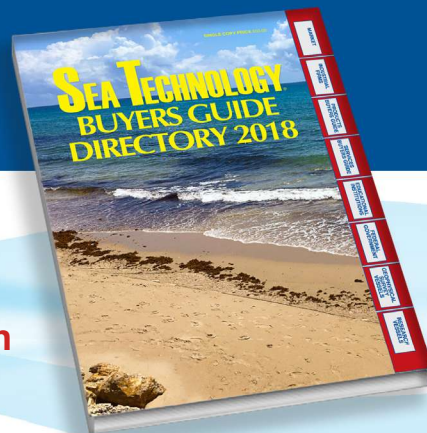
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## We Need More Ocean Data—Steven B. Adler, Andrew Hudson and Dr. David Vousden

*Dr. Steven Adler was the chief data strategist for IBM from 2012 to 2017. His data strategies have yielded new products, services and market strategies.*



*Dr. Andrew Hudson (pictured) heads UNDP's Water & Ocean Governance Programme with a global portfolio of \$200 million. Dr. David Vousden is a professor at Rhodes University, South Africa, with expertise in marine ecosystem management and ocean governance.*

For hundreds of years, vast amounts of wealth have been extracted from the ocean without knowing much about the ecosystems that provide such bounty. To fill this gap—and sustain the ocean and the people that rely on it to feed their families and support their livelihoods—the world needs more ocean data. And we need it now.

The ocean represents most of Earth's surface and living space—but is the least explored part of our planet. Improved monitoring, reporting and analysis of ocean data will enable improved daily understanding of what is happening on the surface, below the waves and on the seafloor, and what is happening chemically, biologically and physically. It will also help to catalog our impact, change our behavior and increase the ocean's sustainable economic potential.

The Ocean Data Alliance, a consortium of private and public entities, represents a first step. We envision a future in which 24/7 ocean observation, data collection, distribution and analysis provide a daily “ocean census” for improved management and decision making in the sustainable use of marine habitats, ecosystems and resources. Leveraging improved ocean data could enable the identification of new ocean uses that create or expand economic sectors and create

new jobs. To accomplish this vision, three things are needed.

The first is coordination; coordination and collaboration among ocean data scientists, maritime industries, governments, United Nations agencies and NGOs on common ocean data protocols and standards for the classification and description of ocean biology, chemistry, physics and geology. Data standards take years to develop, and often the best standards languish with delayed market adoption. In the new world of “The Cloud,” it is possible to leave data at its source, harmonize it with a digital thesaurus, dynamically link the sources, and curate it all for improved quality, accessibility and purpose.

The second is open data. A self-governing commons approach to ocean data can transform every data source into a globally relevant contribution to the sustainable development of ocean resources. That approach would treat every data contributor as a data steward, with reciprocal rights for data curation, attribution, security and revenue recognition from derivative works. With technologies like blockchain, it is possible to reward data collection with royalties generated from derivative works, data analytics and data product development, and thereby create a completely new market for ocean data with tremendous benefits for data producers, consumers and intermediaries alike.

The third is market development. The creation of a new Ocean Data Facility financial mechanism will stimulate market demand for ocean observation technology and data to catalytically increase ocean data capabilities, needs and revenue, and serve as proof of concept. The facility would accelerate needed investments in ocean data collection and stimulate the development of new surface, deep-ocean and seafloor data-gathering and management technologies. It would set up geo-spatial Ocean Data Hubs (ODH) for

participating nations, who would develop local data demand, skill and capacity for collecting, analyzing and using open ocean data. Open ODH could be established to perform similar functions for the high seas, oceanic regions beyond national jurisdiction that account for nearly half of the planet.

All of this would require significant new ocean observation technologies and data, leadership at the international level, and new forums for coordination and collaboration between established and new stakeholders.

We all must do this with an urgency and purpose because our seas are rising, warming and acidifying, fish stocks and coastal habitats are under stress, and, as underscored by the Ocean Sustainable Development Goal 14, we have about 10 to 15 years to get a lot of things right before potential ocean “tipping points” might be reached.

Work is already underway to implement this new vision for ocean data. For example, the Agulhas and Somali Large Marine Ecosystems project supported nine African and Indian Ocean countries in an intensive data-gathering exercise between 2007 and 2014. Supported through the United Nations Development Programme (UNDP) and financed through the Global Environment Facility (GEF), this effort dramatically increased understanding of the biological, physical and chemical functioning of this economically significant ecosystem.

To save our ocean and our planet, innovative new financial mechanisms must be developed for ocean data, and new technologies must harmonize how we use the data without changing the way we work. New ocean governance models can be created to spread opportunity and democratize access to critical information. Done together, we can monitor our ocean and better forecast and plan sustainable development in the future. **ST**

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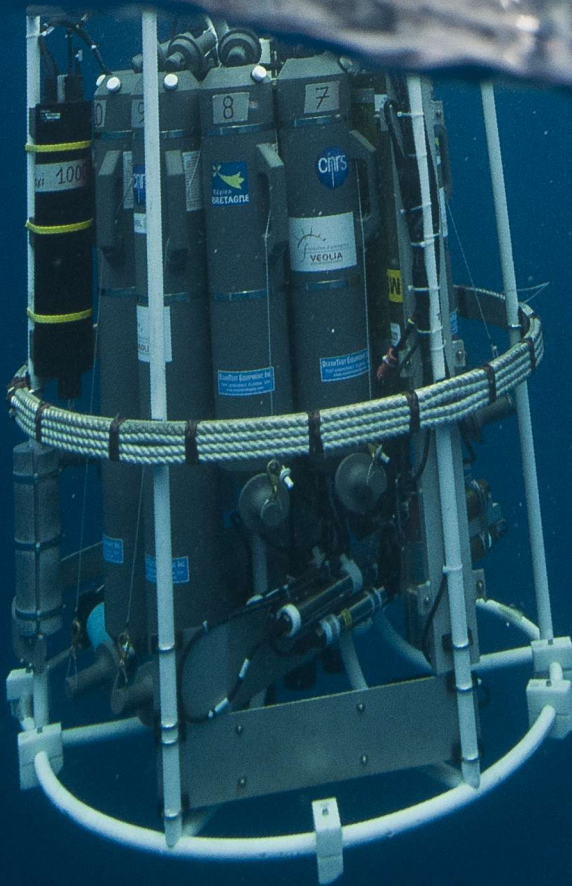
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