



May 2018

ON&T

Ocean News & Technology

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FEATURE STORY

**Improving Survey Efficiency
Through Real-Time Survey
Visualization**

PAGE 10



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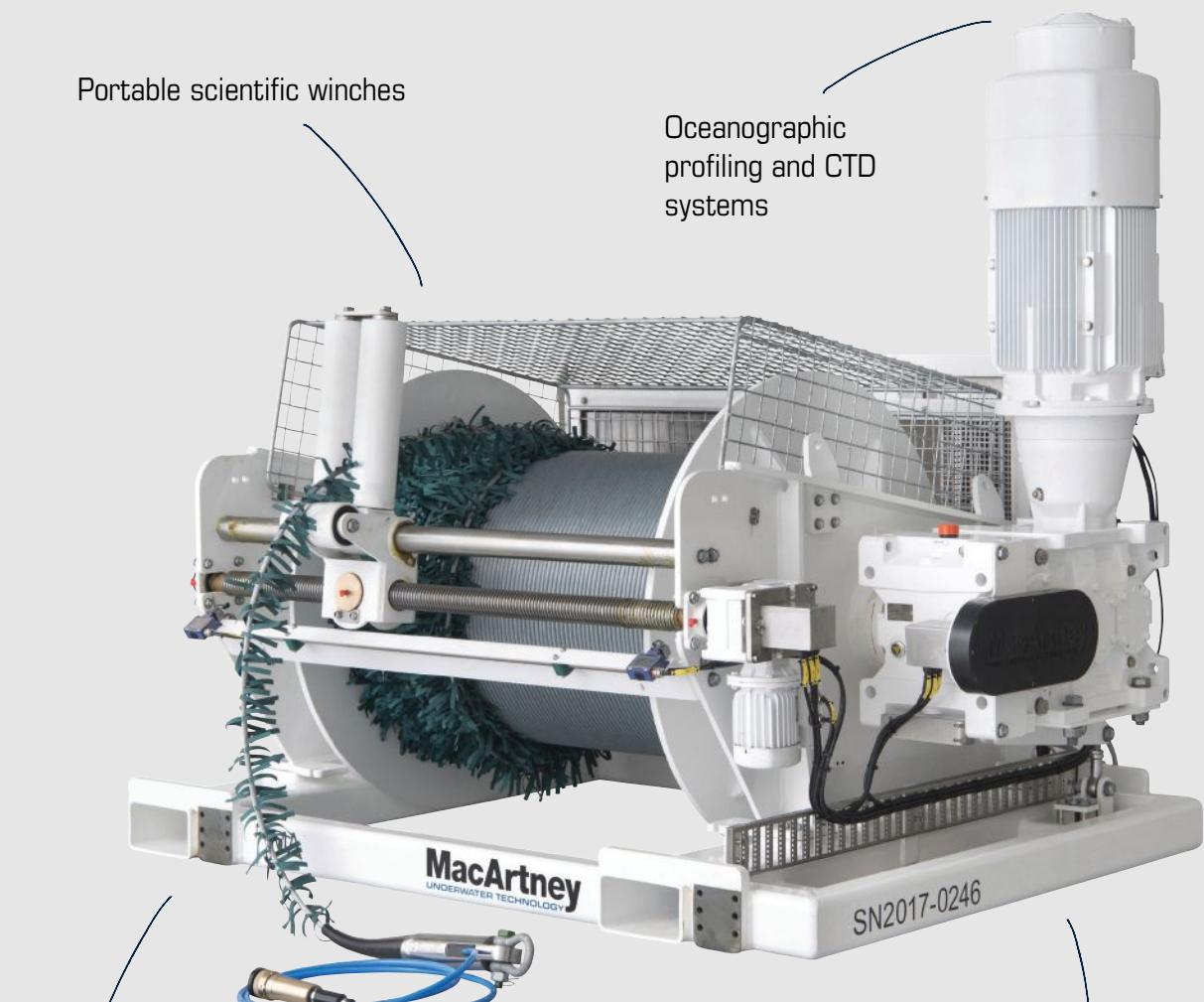
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10



20



DEPARTMENTS

- 14** Ocean Science & Technology
- 22** Offshore Energy
- 32** Subsea Intervention & Survey
- 40** Communication & Subsea Cables
- 44** Defense

FEATURES

- 10** **Improving Survey Efficiency** Through Real-Time Survey Visualization
- 20** **Building A Bathymetric History** Via Farsounders's Local History Mapping™
- 23** **Hawboldt Industries**
- 28** **UKHO:** Smaller Nations Make the Most of Maritime Resources



IN EVERY ISSUE

- 8** Editorial
- 50** Stats & Data
- 54** Events
- 57** Milestones
- 59** Ocean Industry Directory

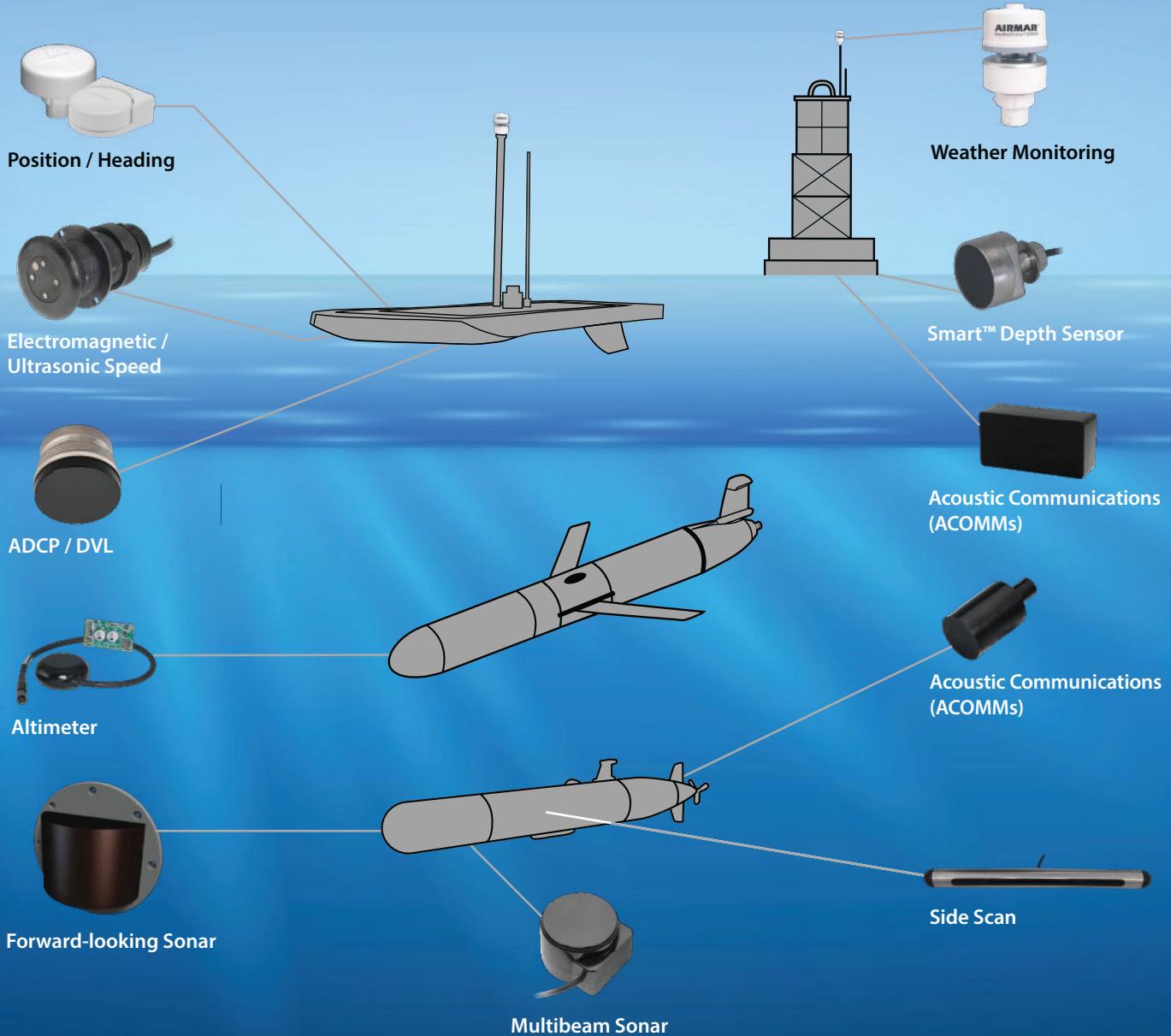
ON THE COVER:

Multibeam dataset of waiting area for ships in the Grand Port Maritime de Dunkerque, France. Image captured by David Jennequin using Teledyne CARIS' Bathy DataBASE software.

Corrections:
Our April 2018 Advisory Board Feature (pgs. 10-14) included referenced L3 Open Water Power as a participant in the UMass Dartmouth Center for Innovation and Entrepreneurship's Technology Venture Center. Instead, they are backed by the MIT Technology Licensing Office.

The Contested Seas article (pgs. 48-49) was edited for length by ON&T staff. The unedited text can be read at www.csis.org/analysis/contested-seas.

Sensor Intelligence from Surface to Seabed



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EDITORIAL

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*Senior Scientist, Government Programs Director
CSA Ocean Sciences Inc.*



Navigating the 'One Federal Decision' Process

Twelve Agencies Adopt Centralized Approach to Environmental Permitting

On April 9, 2018, the White House released a Memorandum of Understanding (MOU) that streamlines the permitting process for major infrastructure projects. Per the "One Federal Decision" (OFD) policy (under Executive Order 13807), the MOU establishes a cooperative relationship between 12 federal agencies to expedite the processing of environmental reviews and authorization decisions under the National Environmental Policy Act (NEPA). The MOU, which went into effect upon signing, centralizes NEPA reviews for an evaluation that results in a single Environmental Impact Statement (EIS) within two years.

Signatories to the MOU include the Departments of the Interior, Agriculture, Commerce, Housing & Urban Development, Transportation, Energy, and Homeland Security; the Army Corps of Engineers; Environmental Protection Agency; Federal Energy Regulatory Commission; Advisory Council on Historic Preservation; and the Federal Permitting Improvement Steering Council. Additional agencies may join in the future.

The stated goal of the MOU is to provide a predictable, timely review and authorization process; eliminate duplication of effort among agencies; improve the efficiency of project delivery; make better-informed decisions and promote good environmental, community, and economic outcomes. Under the MOU, for major infrastructure projects (i.e., those for which multiple authorizations by federal agencies will be required), the signatories will work together to:

- Identify the lead agency that will coordinate with the cooperating and participating agencies
- Develop a single permitting timetable for the necessary environmental review and authorization decisions
- Prepare a single EIS
- Sign a single record of decision (ROD), subject to limited exceptions and
- Issue all necessary authorization decisions within 90 days of issuance of the ROD, subject to limited exceptions.

Offshore infrastructure projects—such as the installation of offshore wind farms, dredging of ports and harbors, and deepwater LNG ports—often require the approval of multiple federal agencies. In the past, this requirement could cause lengthy delays. According to the White House, the average NEPA review has regularly exceeded 1,000 days in recent years. As an example, they cite the environmental review and permitting process for the Herbert C. Bonner Bridge Replacement Project in coastal North Carolina, which took more than 20 years.

Although the OFD framework should allow for a timelier and more coordinated environmental review process, it does not relieve federal agencies of the responsibility to comply with a thorough review of all environmental impacts and a full alternatives analysis. The lead agency will engage with the project sponsors during the pre-application and scoping processes, encourage the sponsor to work closely with the lead agency to address issues as they arise, and provide the lead agency with the data and other information needed for the NEPA analysis.

Given these new guidelines, during the pre-application process, the sponsor of any infrastructure project should help facilitate the identification of the lead agency and be prepared to provide assurances that the reasonable availability of funds for project completion are available—and therefore entitled to the OFD review mandate.

To make the best of these new guidelines and navigate the new pathways successfully, infrastructure sponsors should consider contracting an environmental permitting expert with multidisciplinary experience across all phases of the regulatory process.

To read the full MOU, visit
WWW.WHITHOUSE.GOV/WP-CONTENT/UPLOADES/2018/04/MOU-ONE-FEDERAL-DECISION-M-18-13-PART-2-1.PDF

For more about CSA, visit
WWW.CSAOCEAN.COM/SERVICES/PERMITTING.

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THE FUTURE IS ELECTRIC

IMPROVING SURVEY EFFICIENCY THROUGH REAL-TIME SURVEY VISUALIZATION

Author: Travis Hamilton, Teledyne CARIS Product Manager – CARIS Onboard, HIPS and SIPS

INTRODUCTION

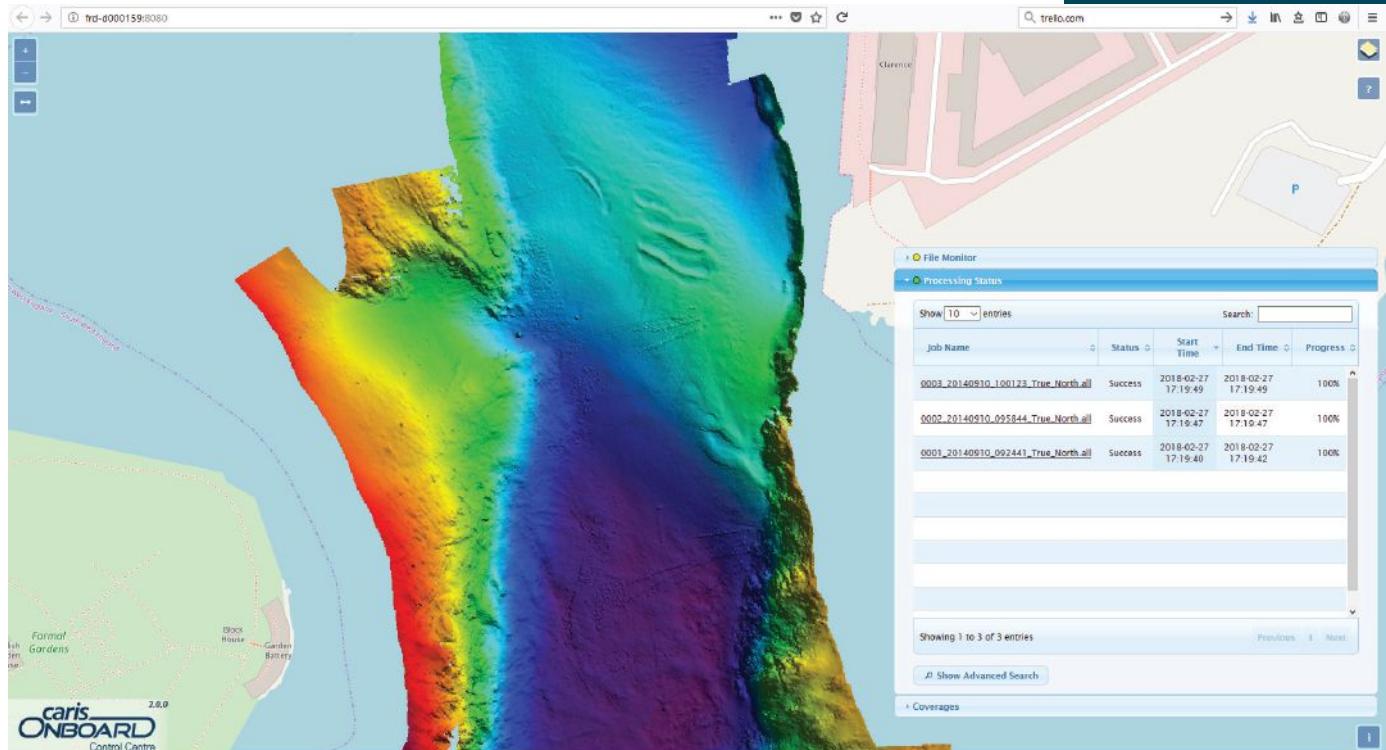
The ocean mapping industry is trending to having fewer people on vessels. This presents many clear benefits such as cutting costs and reducing safety risks, as well as improving quality of life for the surveyors by reducing time offshore and away from home. Since data processors do not have a need to be hands-on with the survey equipment, it makes sense to begin with migrating data processing to shore.

However, this migration-to-shore based data processing is made difficult by communication restrictions between offshore vessels and a shore based office. While transferring all of the raw data from the vessel may be feasible in theory, for most operations it is cost prohibitive. Depending on the bandwidth available and volume of sensor data being logged, the time to transfer the data can easily surpass the time taken to acquire the data, causing processing efforts to quickly fall behind. In a worst case scenario there may be no communications available, so the data would not become available until it can be hand carried to the office.

Considering the importance processed data plays in supporting effective and efficient management of a survey operation, any significant delay between the acquisition and processing of data is immediately detrimental. Such a delay in data processing risks prolonged collection of poor quality data, or create a need of further investigation or re-survey and may require significant transit time to be spent returning to a survey site.

In order to process data automatically on the vessel and to provide information about survey operations in real-time on the shore, high volume raw data must be reduced to information products which are small enough to be easily shared over a low bandwidth connection. Teledyne CARIS recently released CARIS Onboard™ 2.0 with this exact goal in mind. Running on the survey vessel, CARIS Onboard automatically processes raw sonar data, along with positioning, motion, tidal and sound velocity data, and generates a processed surface.

This surface provides information about the survey's quality and coverage. CARIS Onboard further reduces bandwidth requirements by converting the surface into tiled images in Portable Network Graphics (PNG) format, and live streams images into a web map to be opened in any networked device that can connect to the vessel. By providing access to processed products in a web application, CARIS Onboard allows the dataset to be automatically processed on the vessel to a point where low bandwidth information can be



CARIS Onboard 2.0 Control Centre is opened in a web browser. It is focused on a web-map which provides real-time survey visualization, in addition to the tools for controlling data processing.

streamed to shore, providing real-time survey visualization in support of efficiently managing a survey.

SOFTWARE DEMONSTRATION

During the Oceanology International exhibition and conference held in March of 2018 in London, Teledyne CARIS demonstrated using the latest release of CARIS Onboard.

Braveheart Marine's vessel *Patriot* was used for the demonstration. The *Patriot* was equipped with survey equipment from Teledyne Marine, including the T50-R multibeam and the rapidCAST for underway sound velocity profiling. The data was acquired through Teledyne PDS.

CARIS Onboard 2.0 was installed on the *Patriot*, and setup to read the raw data files produced by PDS. Once set to run by the remote data processor, the software automatically processed the raw sonar data according to a pre-defined workflow designed by the data processor. In this case, data was imported to a HIPS project, then georeferenced while applying corrections for water levels and sound velocity variations in the water column, Total Propagated Uncertainty (TPU) calculated, data filters applied, and finally a processed bathymetric surface was calculated from the data.



Braveheart Marine's vessel "Patriot" was used to run the demos during OI18.



Image aboard the Patriot, showing Teledyne PDS controlling the sonar in the top screen, and CARIS Onboard displaying the automatically processed surface on the bottom screen. This demonstrates how the processed data can be used on the vessel to guide the hydrographer without distracting from running the survey equipment.



A low cost laptop was setup at the CARIS booth in the exhibition hall and connected to the vessel, using a standard 3G cellular data modem connected to the laptop, with a second modem on the vessel. For the duration of the three day event, CARIS Onboard automatically processed and live-streamed the data to the web map embedded in CARIS Onboard's new Control Centre. The processed surface was displayed in near real-time at the booth on a large monitor.

Over the course of the three day conference less than 1GB of data was transferred from the vessel. The transfer rates peaked at approximately 1 Mbps, however depending on the location of the vessel, rates were as low as 150Kbps, demonstrating that even with a low bandwidth connection, CARIS Onboard was able to provide real-time survey visualization.

CONCLUSION

The demonstration at Oceanology International successfully showed that by using the commercially available software, CARIS Onboard 2.0, it is now possible to provide remote real-time survey visualization with a low bandwidth connection when operating close to shore. With the data processor positioned on shore, the data can still be processed, and information products made available for supporting the efficient management of survey operations.

ABOUT THE AUTHOR

Travis Hamilton has been with Teledyne CARIS since 2015 and is the Product Manager for CARIS Onboard, and HIPS and SIPS. Prior to this, he spent several years working in research and industry, gaining experience with the operation of, and processing data from AUVs, subsea positioning systems and swath sonar systems.

MYSTERY SOLVED: Oceans' Magnetic Field Linked to Tidal Movement

The magnetic field is arguably one of the most mysterious features of our planet. European Space Agency's Swarm mission is continually yielding more insight into how our protective shield is generated, how it behaves, and how it is changing. Adding yet another string to its bow, Swarm is now tracking changes in the magnetic field produced in the oceans in more detail than ever before.

New results from the trio of Swarm satellites wowed this year's European Geosciences Union meeting in Vienna, Austria. This week-long event draws scientists from all over the world to share discoveries about our planet. A particular highlight of the Swarm presentation is how the mission is tracking one of Earth's more elusive sources of magnetism.

While the magnetic field is created largely by an ocean of superheated,

swirling liquid iron in the planet's outer core, other factors, like magnetized rocks in the crust and the flow of the ocean, also affect the field.

We wouldn't normally think of seawater as being a source of magnetism, but it does make a tiny contribution. When salty ocean water flows through Earth's magnetic field, an electric current is generated, and this, in turn, induces a magnetic signal. However, the field generated by tides is tiny and extremely difficult to measure – but Swarm has done just this in remarkable detail.

Nils Olsen, from the Technical University of Denmark, said, "We have used Swarm to measure the magnetic signals of tides from the ocean surface to the seabed, which gives us a truly global picture of how the ocean flows at all depths – and this is new."

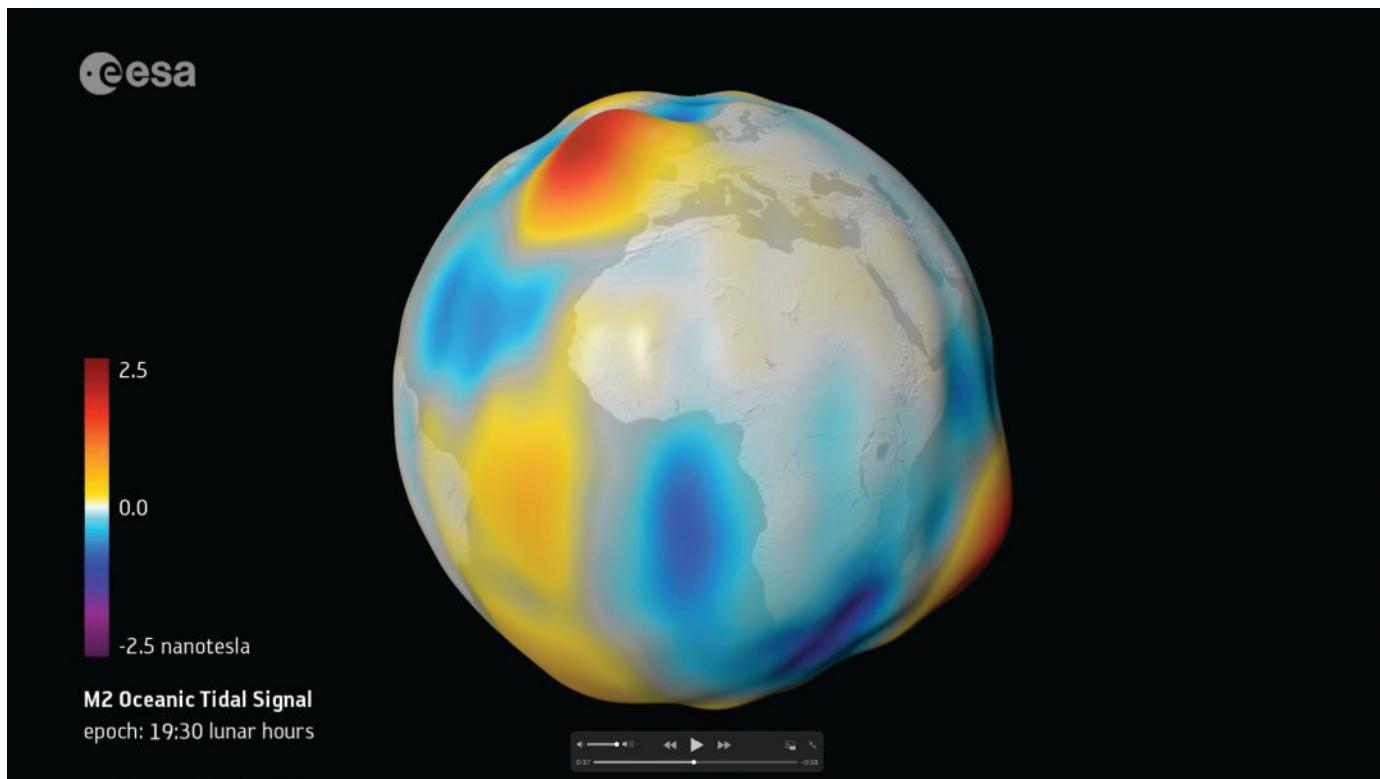
"Since oceans absorb heat from the air, tracking how this heat is being distributed and stored, particularly at depth, is important for understanding our changing climate.

"In addition, because this tidal magnetic signal also induces a weak magnetic response deep under the seabed, these results will be used to learn more about the electrical properties of Earth's lithosphere and upper mantle."

As well as shedding this new light on magnetic tides, Swarm has also yielded a new map of the magnetic field generated by Earth's crust.

[READ MORE HERE:](#)

[HTTP://WWW.ESA.INT/SPACEINVIDEOS/VIDEOS/2018/04/MAGNETIC_LITHOSPHERE_DETAILED](http://www.esa.int/SPACEINVIDEOS/VIDEOS/2018/04/MAGNETIC_LITHOSPHERE_DETAILED)



When salty ocean water flows through Earth's magnetic field, an electric current is generated, and this in turn induces a magnetic signal. However, the field generated by tides is tiny – and extremely difficult to measure, but ESA's Swarm mission has done just this in remarkable detail. Swarm has been used to measure the magnetic signals of tides from the ocean surface to the seabed, which offers a global picture of how the ocean flows at all depths. The magnetic tidal signal measured by Swarm is important for ocean and climate modelling and is used to determine the electrical properties of the Earth's lithosphere and upper mantle.

Silent Marine Robots Allow Researchers to Listen to the Oceans

Robots about the same size as a small human diver—but which can reach depths of 1000 meters and travel the ocean for months—communicate by satellite to build an underwater soundscape of the world's oceans.

Pierre Cauchy, a PhD researcher from at the University of East Anglia's School of Environmental Sciences, has been using one of these autonomous submarines for five years, recording underwater noises in the Mediterranean Sea, and the North Atlantic and Southern oceans. The recordings can be used to measure sea-surface wind speed and monitor storms as well as eavesdropping on marine life.

Mr. Cauchy presented his research at the General Assembly of the European Geosciences Union in Vienna, April 8 to 13. He showed how the robot – called a Seaglider – can measure the wind speed, listen in to the sounds made by fishes and whales, and

pick up human activities, such as marine traffic and seismic surveys.

By recording sounds in remote locations where there are no permanent weather stations, the robots provide valuable information on wind or storm patterns, which can help to finetune climate models.

Mr. Cauchy said: "As an acoustician, it is fascinating to listen in to underwater life such as long-finned pilot whales in the North Atlantic, but also to hear the echoes of what is happening in the skies above."

While pilot whales make whistles, buzzes and clicks, pods of hunting dolphins create high-pitched echolocation clicks, and larger species such as sperm whales make louder, slower clicks. High winds raise the background noise level, seismic surveys' intense pulses are unique and easily identifiable, and marine vessels are clearly identified by low-frequency rumbles.

The Seaglider weighs just over 50kg and is 1.5 meters tall. It is remotely controlled by a pilot and is silent, so records only sound from the ocean without adding its own tones.

For more information, visit
WWW.UEA.AC.UK



Pilot Whales. Photo Credit: UEA

Klüüberbio: Biodegradable Gear Oils for Marine Applications

Klüüber Lubrication, a worldwide manufacturer of specialty lubricants, offers Klüüberbio EG 2-68, 2-100, 2-150, 2-320, a series of biodegradable gear oils based on synthetic ester oil. They contain ≥90% renewable raw materials and comply with the European Ecolabel, as well as the requirements for Environmentally Acceptable Lubricants (EALs) as defined in Appendix A of the EPA 2013 VGP (Vessel General Permit). Notably, Klüüberbio EG 2-320 has been recently added to the portfolio, designed specifically for port cranes, deck equipment, and pod propulsion units.



Klüüberbio EG 2 oils show a high shear stability and form a strong hydrodynamic oil film even when subject to high loads. They have a high scuffing resistance, protecting gear teeth reliably against fretting damage even at high peak loads.

Klüüberbio EG 2 oils are used for the lubrication of ships' gearboxes, particularly for thrusters and rudder propellers. Klüüberbio EG 2 oils protect rolling elements effectively against wear and pitting, complying with the requirements of rolling bearing manufacturers for highly loaded, large rolling bearings in pod drives.

Klüüberbio EG 2 oils can also be used for the lubrication of open running drive and conveyor chains, e.g. in installations and machines in agriculture, forestry and water resources industries as well as for horticultural appliances.

For more information, visit
WWW.KLUEBER.COM/US/EN/

Tara Foundation Benefits from Ocean-Powered Bitcoin Miner



The Tara Expeditions Foundation, with the schooner *Tara*, travels the seas of the globe with scientists on board. For 15 years, *Tara* has been studying and understanding the ocean in front of climate change to better preserve it. Its mission is essential but is often confronted with the difficulty of engaging the general public, the politicians or the investors to finance marine research. The environment represents less than 3% of donations to charities.

The Tara Foundation team has therefore developed - with FF Los Angeles, a creative agency founded by Fred & Farid - a system called "Ocean Miner": a new hydraulic turbine system, installed in Brittany, in the Morbihan region of France, where marine streams and the tides are the strongest.

This turbine was naturally driven by stream action, converting the energy from the ocean into an electrical energy. A computer operating in mining, i.e. the generation of bitcoins, has been wired to this unit. The generation of this crypto-money via mining is a computerized process for accounting trades in the public register of transactions (carried out with what is referred to as the blockchain). Each registered operation generates in return a margin of bitcoin in benefit of the owner of the computer. This digital

currency is then convertible into Euros and can, therefore, immediately be reinvested in ocean research.

The computer and its components were set up in a small house equipped with mirrors, thus downplaying the visual impact of its implementation on the Brittany coast and also protecting them from the weather. After the house was locked and connected to the turbine, the system was autonomous and auto-sufficient, using the power of the ocean to create its own energy.

Equipment Produces Crypto Currency

After a month of running the turbine and of bitcoin generation, the "Ocean Miner" system made it possible for the Tara Foundation to collect nearly 0.0015414 BTC per day, or 200 € per month over the whole implementation phase.

"This system certainly won't cover the needs of the scientific research, it is only a drop in the ocean: a minimal symbolic contribution made to the expeditions led by *Tara*. It is, however, a powerful way of recalling that only the mobilization of everyone together will make it possible to fund the research to study, understand and to better protect the Ocean in the future", explained Romain Troublé, Managing Director of the Tara Expeditions Foundation.

For more information, visit
WWW.TARAEXPEDITIONS.ORG

ScanReach Set to Redefine Safety Standards at Sea

Norwegian start-up technology firm ScanReach has created a system and technology capable of sending and receiving data signals wirelessly through any structure, including steel.

In:Range, a plug and play system capable of locating anyone on a vessel or offshore installation in real time, could save countless lives at sea. Utilizing a combination of advanced radio technology and intelligent software algorithms and protocols, signals sent from bracelets worn by crewmembers are picked up by sensors that simply plug into standard power points. This data is then transmitted to screens on the bridge or, during incidents, to emergency services, land-based facilities or nearby ships. The result is a real-time overview of the exact location of all personnel, negating the need for lengthy (and often dangerous) searches and ensuring that those that need assistance receive it as quickly as possible.

To ensure privacy for those wearing the transmitters, the system's default setting is 'sleep', springing to life in a range of situations, such as when alarms are sounded, the wearer presses a button, or movements are made that show distress. The system is robust, reliable and, despite its advanced nature and artificially intelligent data transmission and capturing capabilities, simple to operate and maintenance free.

In:Range has undergone extensive testing and will have completed rigorous pilot tests on a number of vessels, including North Sea Shipping's North Sea Giant, before its official launch at the end of 2018.

ScanReach has successfully installed In:Range onboard North Sea Giant. North Sea Giant is amongst the largest and most advanced subsea construction vessels ever built.

For more information, visit
WWW.SCANREACH.COM



TCarta Delivers Pre- & Post-Disaster Surface Models for the Caribbean

TCarta has delivered pre- and post-disaster surface models for the Caribbean islands of Antigua and Barbuda for use in Hurricane Irma recovery efforts. The satellite-derived surface models contain seamless datasets of onshore elevation and offshore water depth measurements for each island.

The UK government commissioned the Hurricane Irma disaster mapping for Antigua and Barbuda as part of the Commonwealth Marine Economies Programme. TCarta won a competitive tender.

"By specifying satellite-derived data as the deliverable in its tender, the UK government acknowledged the speed and cost advantages this technology offers compared with traditional ship-borne surveying or airborne LIDAR collection," said TCarta CEO David Critchley.

The governments of Antigua and Barbuda requested accurate data for onshore land elevations and offshore water depths from before and after the storm hit. The datasets will be used in digital change detection analyses to determine how Irma altered the surfaces of the land and seafloor. This will be vital information in repairing onshore drainage systems and updating coastal navigation charts.



For the seafloor dataset, the TCarta team generated Satellite Derived Bathymetry products by extracting accurate water depth measurements from high-resolution multispectral imagery acquired by the DigitalGlobe WorldView satellites. In the clear Caribbean waters around Antigua and Barbuda, bathymetric points were delivered on a 2-meter spacing to deeper than 20 meters.

The TCarta team created digital surface models of the terrain on Antigua and Barbuda, utilizing a technique to derive surface elevations at 0.5-meter point spacing from multiple WorldView images captured over the islands. Vegetation was then removed from surface models to yield bare-Earth elevation models. TCarta delivered the high-quality before-and-after datasets to the UK government which distributed them to scientists on Antigua and Barbuda for damage assessment and planning for the coming hurricane season.

For more information, visit:
WWW.TCARTA.COM

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The Edge of Darkness: WHOI Researchers to Dive into the Twilight Zone

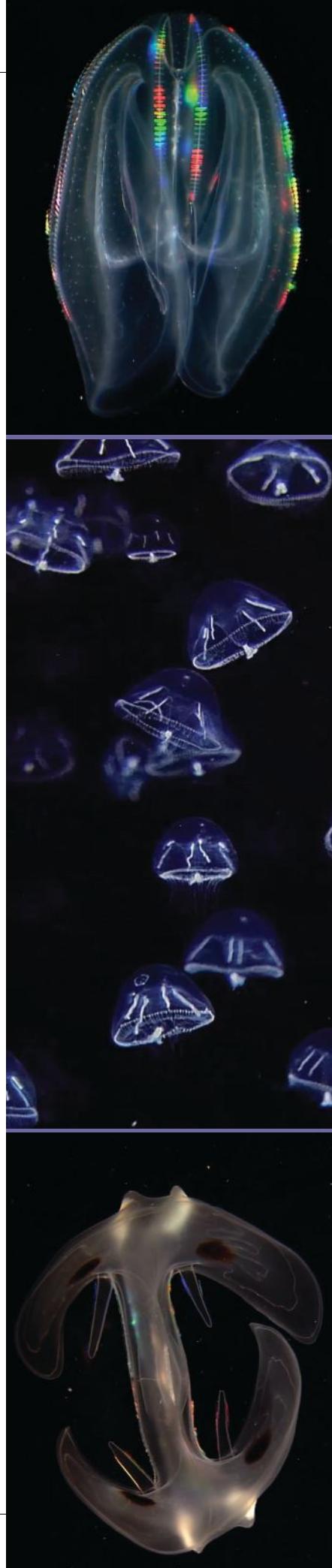
The Woods Hole Oceanographic Institution has received \$35 million private grant to explore one of our planet's hidden frontiers—the ocean twilight zone. The project will combine exacting science, innovative technology, and broad engagement to turn knowledge into actions that improve understanding of our planet and how to live sustainably on it.

At 200 to 1000 meters below the ocean's surface, sunlight is barely a glimmer, yet flashes of bioluminescence give us a clue that these waters teem with life. In fact, the twilight zone is believed to be home to more than one million new species, and up to 90 percent of the world's total fish biomass. The world's largest animal migration takes place here every day. Yet, the region has been largely unexplored.

Most life forms in the twilight zone are tiny—a few inches or less—but some, such as gelatinous siphonophores, can form chains that extend as much as 130 feet, making them among the biggest animals on Earth. But even the smallest twilight zone inhabitants can be powerful through sheer number. A tiny but fierce-looking fish called a bristlemouth is the most abundant vertebrate on Earth. And the combined biomass of all twilight zone fish may be more than in the rest of the ocean combined.

This biological abundance makes the twilight zone an attractive target for commercial fishing operations. However, much of the twilight zone lies beyond national boundaries, in the "high seas" where relatively few laws or regulations apply.

Heidi Sosik told a TED Conference audience in Vancouver, British Columbia that the goal is not to ban fishing, but to answer vital scientific questions about



how to manage it sustainably before large-scale before large-scale fisheries have an "irreversible global scale impacts on marine life and food webs."

"How amazing would it be to take a different path this time," Sosik said. "The Twilight Zone is indeed a global commons. We need to first understand it before we can be responsible stewards and hope to fish it sustainably."

Project Scientist Heidi Sosik will apply three decades of oceanographic research experience in the lab and at sea to shape the direction of this project. She will be joined by famed Ocean Systems Engineer Andy Bowen and WHOI Director Mark Abbott, who will guide WHOI's continued commitment to twilight zone study, and will manage a team of hardware and software developers to assess technology trends and emerging science needs.

With this mission, WHOI aims to form a new body of knowledge that will promote responsible stewardship of the ocean and shed new light on our planet. They will do this by continuing their groundbreaking work developing new generations of smart robots and other tools necessary to explore the twilight zone. Scientists, engineers and technicians at WHOI will begin by deploying autonomous underwater vehicles and sensors in the Atlantic Ocean, offshore from the recently created Northeast US Shelf Long-Term Ecological Research (LTER) site. This will set the stage to opening the twilight zone to comprehensive study, laying the groundwork for a network of hardware, software, and data throughout the ocean worldwide.

Funding for this project comes from The Audacious Project, housed at TED, which invites change-makers to submit their best, boldest ideas for tackling the world's biggest challenges.

Learn more at

[HTTPS://AUDACIOUSPROJECT.ORG/IDEAS/2018/WOODS-HOLE-OCEANOGRAPHIC-INSTITUTION/](https://audaciousproject.org/ideas/2018/woods-hole-oceanographic-institution/)

New Underwater Geolocation Technique Takes Cues from Nature

Marine animals such as mantis shrimp and squid have inspired a new mode of underwater navigation that allows for greater accuracy. Univ. of Queensland Queensland Brain Institute (QBI) scientists are part of a group of researchers who developed the technique using imaging equipment sensitive to polarizing light. The researchers built polarization sensors able to determine the sun's position based on patterns of light underwater.

Dr. Samuel Powell said the discovery took inspiration from marine animals including mantis shrimp and cephalopods, which use polarization to communicate. People cannot perceive polarized light without the help of special lenses, which are often found in sunglasses. The new method would enable more accurate and cost-effective long-distance navigation.

"Most modern navigation techniques don't work underwater. Satellite-based GPS, for example, only works to a depth of about 20 cm," Dr. Powell said. "Underwater, visibility is also limited, so relatively old technology such as lighthouses don't work, because the farthest distance you can see is around 100 m. Currently, submarines use GPS systems at the surface, and when they descend they rely on dead reckoning to calculate their position. The error in this case is unbounded—that is, the longer without GPS, the more erroneous your calculation can be. Using polarization sensors, our method would allow for real-time geolocalization underwater with more accurate long-distance results, without the need to resurface periodically."

The technique could enable navigation at depths up to 200 m.

The research was done in collaboration with colleagues at Washington Univ., and Viktor Gruev at the Univ. of Illinois at Urbana-Champaign. The study, "Bioinspired polarization vision enables underwater geolocalization," is published in *Science Advances* 04 Apr 2018.



The mantis shrimp has inspired a new method of underwater navigation.



Dr. Samuel Powell is part of the team that has developed a new underwater navigation technique.

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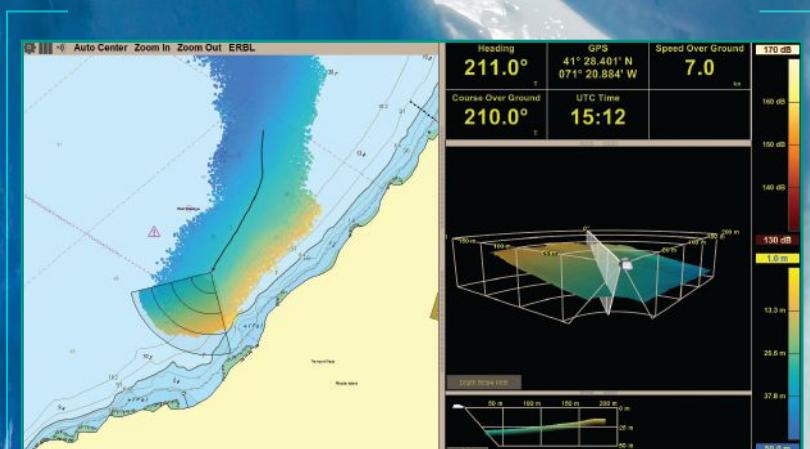
Building A Bathymetric HISTORY

via FarSounder's Local History Mapping™

By Cassie Stetkiewicz, FarSounder, Inc.

Until 2017, FarSounder's 3D Forward Looking Sonar (FLS) products operated purely as real-time navigation and obstacle avoidance sonars. The user-friendly interface conveniently overlaid the real-time sonar imagery on top of a standard nautical charts including S-57 and S-63 charts. However, since the early days of development, they have always believed that storing the sonar data and building a bathymetric history would be a valuable capability. Some years ago, they started developing the first Forward Looking Multibeam (FLMB) proof-of-concept and are excited to share this innovative creation with its users.

Recently, FarSounder, the world leader in 3D FLS systems, added a software feature that 'paints' a bathymetric map. FarSounder's cutting-edge sonar provides real-time imagery of what's beneath of the waters ahead and this revolutionary



Local History Mapping (LHM) capability allows the FLS navigator to 'paint' an intuitive 3D image of the bottom contour and potential obstructions ahead of their vessel in real-time

feature builds and saves a map of what you have sailed past. This appropriately named Local History Mapping™ (LHM) application is an included standard feature with their navigation systems.

To know where you're going, it is important to understand where you've been. That is the simple concept behind LHM. The map that is created as the ship sails is updated with every ping and is displayed on top of your chart. This allows users to quickly see what lies ahead, while also seeing what they've recently passed over. Due to the unique performance characteristics of FarSounder's forward-looking sonar systems,

LHM is based on a bathymetric survey engine that was developed in-house from the ground up. The Company has also invested heavily in a database infrastructure associated with the storage and integration of large survey datasets. These investments will accelerate the release of additional bathymetric mapping capabilities in the future.

The Farsounder FLS has a wide horizontal field-of-view ahead of the vessel, a single pass of the sonar with LHM can survey a much wider swath of the seafloor than with a standard echosounder. In addition, the large coverage zone from a single ping results in a huge overlapping area from one ping to the next. This means that users don't have to worry about missing any obstacles between pings. This is extremely helpful in unknown or even uncharted waters.

WHAT CAN OPERATORS DO WITH THE LHM CAPABILITIES OF THEIR 3D FLS SONAR?

Currently, operators reap the benefits of this software allowing for not only for detecting hazards, but seeing and saving unforeseen shallow bottoms and obstacles jetting up from the seafloor. The implication of this work is that as the global fleet of vessels utilizing 3D

FLS continues to expand, the potential for bathymetric surveys without adding additional survey specific hardware will increase dramatically.

LHM's real-time data can be used by a vessel to perform a small survey covering the expected extent of the area over which the vessel is expected to swing. Displaying the survey as an overlay on

top of an electronic nautical chart, makes it easy for the bridge crew to visualize the vessel's current position. Operators would be able to orient the vessel relative to any features or obstructions found with the survey. It would assist even when an obstruction is not within the current field-of-view of the sonar's real-time display.

Hurricanes or other natural disasters often result in waterways become littered with debris from broken and lost vessels and equipment, as well as other obstacles. In addition, bathymetric changes are typical and unable to be seen or predicted. It is quite a challenge for Coast Guard and other rescue ships to maneuver within these regions, particularly in shallow, littoral areas. LHM will allow 'first-responders' and workboats to save a 3D map of the seafloor. Updated with every ping and displayed as an overlay on top of the system's nautical chart display, vessel operators will be able to quickly see what lies ahead; and future software releases will allow operators to save a map of what they've recently passed over.

LHM also has benefits in seismic survey applications, which has piqued the interest of operators of seismic survey vessels, because it would be useful when operating from the mothership or from an Unmanned Surface Vehicle (USV). Obstacles in the sea are ever changing due to both man-made and natural occurrences, but this application would allow operators to safely engage in a search for obstacles in the water like fishing equipment and other deep



A cruise equipped with FarSounder FLS technology navigates Milford Sound in the southwest of New Zealand's South Island. By reducing the likelihood of collisions and underwater security threats, FarSounder sonar systems help prevent costly damages to property, the environment, and marine and human lives alike.

floating debris. This is often a problem during seismic surveys where equipment is towed in varying depths. The concern here is in protecting the tow-fish, since an accidental collision, allision or grounding could halt seismic surveys and cost significant lost time and damage equipment.

The initial LHM release persists for one hour of the vessel's bathymetric history. However, additional software updates are planned which will extend the system's LHM capabilities. It is clear that there are a number of valuable applications to which real-time 3D FLS is a great match and that today's products can meet those needs. It is also clear that using 3D FLS in a forward looking multibeam mode can unlock even greater value to the mariner without the need to install additional 2D multibeam equipment.

FAROUNDER'S FUTURE PLANS

With the ocean floor constantly changing (particularly with the shifting climate of the polar regions), there will always be a need for LHM capabilities. Based on customer feedback and the product roadmap, FarSounder plans a continual evolution of real-time system performance via software upgrades to its existing products. However, more excitingly, FarSounder foresees large advancements in the use of historical bathymetric data generated by 3D FLS. Specifically, FarSounder's software development plans include improvements to their LHM capabilities which include: storing a longer duration of historic data, enabling the saving and recalling of surveyed routes similar to the saving and recalling of waypoints associated with ECDIS route planning, and the sharing of surveyed routes among a fleet.

Diamond Offshore Launches Sim-Stack™ the First Cybernetic BOP Service

Diamond Offshore Drilling, Inc. has announced the launch of its Sim-Stack service, the offshore drilling industry's first cybernetic BOP service enabling Diamond Offshore to continuously and accurately assess BOP status. When issues arise, the Sim-Stack service immediately determines a proper course of action while providing a third-party Statement of Fact to the operator, BSEE, and other regulatory bodies.

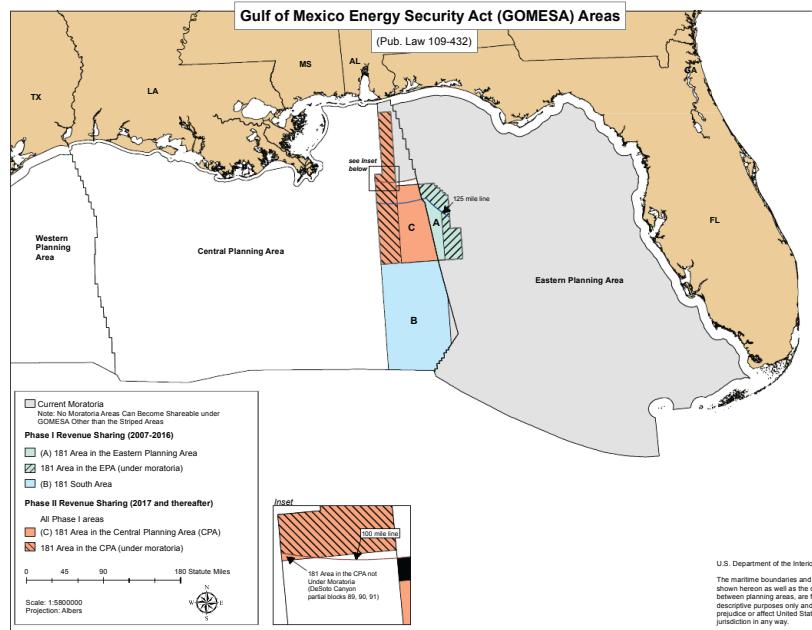
Acting as the "virtual twin" of a BOP system on a drilling vessel, Sim-Stack replicates the BOP hydraulically and electrically to assess its overall health and regulatory compliance. When component failures are identified, Sim-Stack provides critical feedback without human bias in a systematic method to make informed subsea stack decisions.

"The majority of non-productive time for an offshore drilling rig relates to subsea equipment certification, repair and maintenance," said Marc Edwards, President and CEO of Diamond Offshore. "We have been driving innovation and thought leadership into the industry so as to reduce costs. Our Sim-Stack service is our latest advancement to reduce BOP downtime, resulting in operational efficiency gains for our clients."

Moreover, Sim-Stack serves as a robust training tool for offshore personnel to learn and further develop subsea BOP expertise in a safe and dynamic environment, similar to simulated flight training in the aviation industry.

In conjunction with BOP Risk Mitigation Services LLC, Diamond Offshore developed and implemented this new service across all eight BOP systems on its four dynamically positioned drillships working in the Gulf of Mexico. In the coming months, the Company plans to expand this service to additional rigs in its global fleet.

For more information, visit
WWW.DIAMONDOFFSHORE.COM



Florida Voters to Decide Offshore Drilling Ban

On 16 April 2018, the Florida Constitution Revision Commission (CRC) voted to approve eight revisions to be placed on the 2018 General Election ballot for voter consideration. Among the revisions was P 6004 which would "prohibit the drilling for exploration and extraction of oil and natural gas in specified coastal waters."

Proposed constitutional revisions on the ballot must secure at least 60 percent voter approval to become law. According to the CRC, a formal report will be submitted to the Florida Secretary of State as soon as possible.

CRC Chairman Carlos Beruff, said his team had traveled across the state to speak directly with citizens about the changes they want to see in the Florida Constitution.

"From protecting our state and territorial waters from oil drilling to strengthening our ethics laws, I commend my fellow Commissioners for their hard work and leadership representing the people of Florida. We are grateful to the thousands of Floridians who participated in this historic process and look forward to letting voters have the final say in November," said Beruff.

On 4 January 2018, U.S. Secretary of the Interior Ryan Zinke announced BOEM's Draft Proposed Program (DPP) for development of the nation's oil and gas resources in the outer continental shelf (OCS), including opening up lease sales in the eastern Gulf Mexico for the first time since 1988. On 9 January, after meeting with Governor Rick Scott, Zinke announced that Florida is "off the table" for new offshore oil drilling.

The full text of each approved ballot revision is available on FLCRC.GOV.



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As of early 2018, Hawboldt has now celebrated a milestone of selling over 50 cranes, ranging from 2 ton to 100 ton capacity, in fixed boom, telescopic, and knuckle boom designs.

During 2018 we will deliver a total of 19 cranes to Shell Deer Park in Houston as part of a major dock upgrade, to be used primarily for handling fuel hoses during loading and unloading operations at the refinery. These 20 ton, double telescopic cranes incorporate an explosion proof design, wireless operator controls, remote load monitoring, hydraulic power units, and maintenance platforms. Other typical applications for our cranes include workboat industries, offshore construction, ocean science, and defense.

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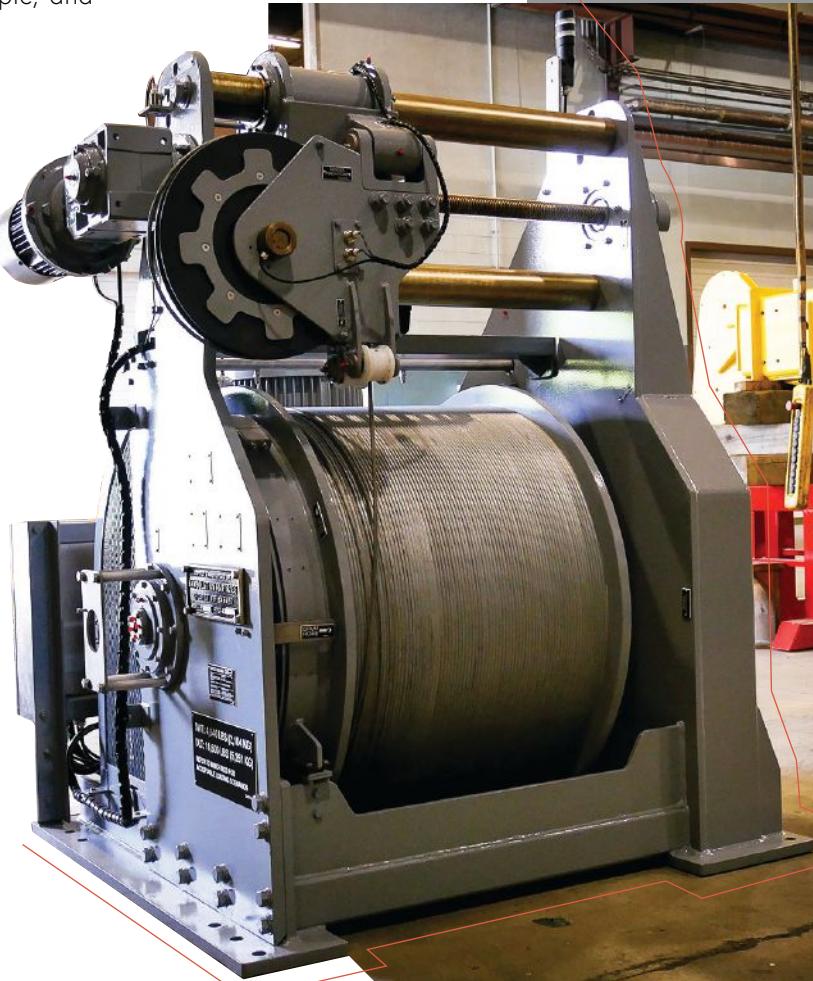
Beyond cranes, Hawboldt has recently seen successful market adoption of our line of Active Heave Compensated winches. Our new multi-drive winch design is focused on being the lightest, strongest, and smartest on the market. We have incorporated a number of industry leading features to provide high performance at low cost, with simple operations and a high level of redundancy. Applications include offshore ROV launch and recovery, ocean science, offshore cranes, and more.

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Siemens' BlueVault™ Energy Storage Solutions for Offshore Operations

A clean, reliable power supply is critical for offshore oil and gas assets. Siemens is now applying its extensive electrification experience in the marine industry to offshore oil and gas, with a focus on reducing emissions and risk in particularly unforgiving operational environments. The company's advanced lithium-ion battery-based solution, known as BlueVault™, is suited for both all-electric and hybrid energy-storage applications. BlueVault energy storage solutions are designed to help ensure continuity of power and to minimize carbon dioxide emissions, with an end goal of a low-emissions platform. The battery is designed to maximize life, performance and safety.

Since 2013, Siemens has been supplying the marine industry with an innovative Diesel-Electric Propulsion system, BlueDrive PlusC, designed to reduce greenhouse gas emissions, fuel consumption and maintenance costs when compared to traditional diesel-electric propulsion systems.

The company already has a track record of developing cost- and emission-reducing solutions for marine applications. In 2015, Siemens jointly developed the world's first electric car ferry, Ampere, with Fjellstrand shipyard and ship-owner, Norled. Today, the Ampere ferry's zero-emission propulsion solution has no direct or indirect emissions, because the batteries are recharged using hydroelectric power. The all-electric ferry weighs approximately half that of a regular car ferry due to the aluminum hull and uses only 150 kWh of renewable energy per crossing which eliminates emissions and reduces fuel costs by 60 percent.

Pursuant to its research and development efforts and experience with harsh offshore operating environments, the company will open a fully robotized and digitalized plant in Norway that

will develop and manufacture energy storage technologies for both marine and offshore oil and gas applications. The same battery storage solutions for marine and offshore environments are also applicable to offshore wind farms. In the longer term, Siemens hopes to leverage its expertise to develop a low-emissions offshore platform.

"Energy storage solutions provide a means to establish a stable, reliable electrical network by buffering intermittency and providing clean, dispatchable power," said Terje Krogh, CEO of Siemens Offshore Solutions. "The Ampere ferry, which is entirely emission-free, serves as an example of how an energy storage system could also be successfully applied in an oil and gas environment."

Siemens has already signed several contracts for its new energy storage system and expects to deliver the first one this summer.

For more information, visit
WWW.SIEMENS.COM

Flintstone Technology Sets Sights on Floating Wind



Flintstone Technology Ltd. is diversifying its mooring operations to help drive down costs for the offshore floating wind industry. The company's Subsea Mooring Connector (SMC) has been used in a number of oil and gas projects. It provides a simple connection to an anchor on the seabed, and is self-aligning and fully scalable. With a proven track record of solving complex mooring problems since 2012, Flintstone has risen to become a leading name in the sector.

The Dundee-headquartered firm has delivered cost savings for their clients as well as mitigating risk during operations. The company believes the SMC system will help make the industry more cost competitive. It is a low cost, easy to install solution and stands the test of time.

According to Scottish Enterprise, Europe is forecast to build around 25GW of offshore wind by the end of the decade, worth an estimated £60 billion in capital and operational expenditure over the next five years.

In November, Flintstone secured a deal for its mooring connectors, in collaboration with parent company MacGregor. The project with Bangladesh-based company, Summit LNG Terminal Co. will see its system utilized on Summit's floating storage and regasification unit (FSRU).

Flintstone's Subsea Mooring Connector has been designed for connecting to anchor points on the seabed using a self-aligning male and female forging with simple load pin. The male, connected to the mooring line, is lowered by crane into the female which is mounted onto the seabed pile or suction anchor. A simple load pin is inserted through the female and male and the connector can then be lifted away by the mooring line.

For more information, visit WWW.FLINT-TECH.COM

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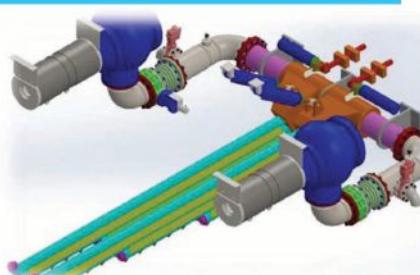
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Roxtec UK marine and offshore director John Kayes

ROXTEC SUPPLIES SCOTLAND'S LARGEST OFFSHORE WINDFARM

International manufacturer Roxtec has supplied a package of fireproof and watertight seals to secure high voltage cables on substations within the Beatrice Offshore Windfarm Limited (BOWL), Scotland's largest offshore wind farm.

The £2.6billion energy project is located in the Outer Moray Firth, around 13km from the Caithness coast. Once fully operational the 84-turbine operation is expected to generate up to 588MW, powering 450,000 homes. Onshore construction began in Moray in May 2016 and offshore construction began in April 2017. Beatrice will be energized in phases and will be fully operational in 2019.

Roxtec has built a strong reputation in the renewables market having worked with Siemens Transmission and Distribution Ltd, which supplied and installed two offshore substations for the first 630MW phase of London Array, two at Gwynt Y Mor and 1 at Dudgeon offshore windfarms.

Roxtec's cable seals can be used within a broad variety of applications including generator systems, switch rooms, converters, towers, the nacelle, transition pieces, control cabinets, power converter cabinets, davit cranes, onshore grid substations and offshore converter stations.



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MONTH IN REVIEW

CEO of DNV GL Energy Group: Plunging Costs Will Lead to Huge Uptake for Offshore Wind

In an interview with SubCable World, Ditlev Engel, CEO of DNV GL's Energy business area, said "We have to distinguish between the growth of electricity generation and the growth of energy overall. And in the growth of electrification we see the uptake of renewables growing very, very fast. It will happen in three main areas: solar, onshore wind, offshore wind." Read the entire interview at www.subcableworld.com/newsfeed/power-cables/ceo-of-dnv-gl-energy-group-plunging-costs-will-lead-to-huge-uptake-for-offshore-wind/

Balmoral Expands into the Offshore Renewables Market

Balmoral Offshore Engineering has acquired Norwegian manufacturer, Seaproof Solutions, to accelerate its expansion into the offshore renewables market. The move is seen by both companies as a strategic development built on the strengths of the constituent parts. Seaproof holds a market leading position for elastomer products in the offshore renewables sector while Balmoral enjoys a reputation for materials innovation and product development. <https://www.oceannews.com/news/energy/balmoral-expands-into-the-offshore-renewables-market>

Bennett to Lead Energy Department's Oil & Natural Gas Office

The Department of Energy's Office of Fossil Energy (FE) has announced the appointment of Shawn Bennett as Deputy Assistant Secretary (DAS) for Oil and Natural Gas. Previously, Mr. Bennett served as the Executive Vice President for the Ohio Oil and Gas Association (OOGA) and the Director of Strategic Communications for FTI Consulting. <https://www.oceannews.com/news/energy/bennett-to-lead-energy-department-s-oil-and-natural-gas-office>

Marine Renewables Energy Conference Brings Experts to Normandy

The International Conference on Ocean Energy (ICOE 2018) will gather stakeholders involved in Marine Renewable Energies in Cherbourg, Normandy, France from 12-14 June 2018. Over 3500 stakeholders of the MRE market (offshore wind, tidal energy, wave power, and ocean thermal energy markets), representing 25 countries, will attend the event, which combines scientific contents and business opportunities. <https://www.oceannews.com/news/energy/marine-renewables-energy-conference-brings-experts-to-normandy>



Driving the pile free hanging from crane

CAPE Holland's Vibro Lifting Tool Drives 6.5m Monopile

CAPE Holland recently achieved another milestone with its Vibro Lifting Tool (VLT) on the Maasvlakte 2 in Rotterdam. A large 6.5m diameter monopile was successfully upended and driven to target penetration. Free hanging from the Matador 3 of Bonn and Mees the VLT only needed a net driving time of 15 mins to get the 330t weighing monopile to a penetration depth of 24m. Without any other tool, gripper or installation frame the pile ended up at 0.05° verticality which was well within the set tolerance. For this project, CAPE Holland used a TANDEM configuration of the CV-320 VLT-U with a total of 640 kgm. The VLT proved an ideal tool to drive the test pile of Fistuca to sufficient depth to place the 700t weighing Blue Piling Hammer on top ready for the inshore testing program. For more information, visit www.capec-holland.com.

For more information, visit WWW.CAPE-HOLLAND.COM

UKHO

HELPING SMALLER NATIONS MAKE THE MOST OF MARITIME RESOURCES

By Ian Davies, International Hydrographic Programme Manager at the UK Hydrographic Office

We live on a blue planet. The surface of the Earth is 71% water and yet, as our reliance on the seas continues to grow, there is still much to understand about the marine environment and the benefits marine resources can offer.

The sustainable use of these marine resources to support economic growth,

improve livelihoods and jobs, and manage ocean ecosystem health is fast becoming known as the 'Blue Economy'. Depending on the particular circumstances, infrastructure and natural environment of each nation, the potential for blue growth varies.

For developed nations, like the UK, the foundations of a rewarding Blue Economy

are already in place. Many British Overseas Territories and Commonwealth nations are also surrounded by considerable natural maritime resources that offer huge potential for economic growth. However, due to their remoteness, small populations and land masses, some are often vulnerable to environmental and economic challenges. Many are also unable to invest in the



UKHO surveyor collecting data in Vanuatu. Photo credit: UK Hydrographic Office



hydrographic surveying and scientific research that could help them make use of their maritime resources.

As the UK's hydrographic office and a leading marine geospatial information agency, the UK Hydrographic Office (UKHO) helps many of these nations to support safe navigation in their waters under its obligations as Primary Charting Authority for 71 nations. Working collaboratively, the UKHO is also using its technology and expertise

to help them unlock the potential of their blue economies through a number of international hydrographic programmes.

OVERSEAS TERRITORIES SEABED MAPPING PROGRAMME

The sea plays a significant role in the daily lives of those living in small islands - from dependence on fisheries for food security to their exposure to marine climate change. Up-to-date and accurate seabed mapping is key to

unlocking a diverse range of benefits, from sustainable aquaculture activities to safety at sea.

Through the Overseas Territories Seabed Mapping Programme, the UKHO is undertaking hydrographic surveying in British Overseas Territories such as Anguilla, the British Virgin Islands, the Cayman Islands, St Helena and Montserrat. Funded by the UK Government's Conflict, Stability and Security Fund (CSSF) and coordinated by

the Foreign and Commonwealth Office (FCO), the programme exists to enable safe navigation through surveying and developing hydrographic capability which, in turn, can bring significant economic benefits.

Data collected under this programme will be used to produce up-to-date navigational charts, which will improve access for trade and cruise tourism on the islands. For example, in the Cayman Islands, bathymetric information (of seafloor features and depths) will be used to update chart coverage in the waters off Grand Cayman and Cayman Brac. This will support navigation and allow larger ships to call at the main port of the islands.

In terms of port expansion, a greater understanding of the seabed can also inform sustainable development. This has an obvious economic benefit for the islands – both in terms of local job creation and in increasing capacity to tap into global trade flows.

HYDROGRAPHY IN ADVERSITY

Marine geospatial information captured under the Overseas Territories Seabed Mapping Programme has the potential to be used for a wide range of applications. Up-to-date, accurate data of the seabed not only enables safer navigation and better management of marine resources, but allows for greater resilience against forces of nature, by informing disaster response management and planning. This was a specific challenge faced by the survey team in the British Virgin Islands in the wake of the hurricane season, last year.

While surveying in the British Virgin Islands for the Overseas Territories Seabed Mapping Programme in 2017, Hurricane Irma made landfall on the islands, sustaining winds of 185mph and causing wide devastation. In this midst of this crisis, the team had to use their contacts and skills to help the situation the best they could, despite their equipment being disabled and their boat destroyed.

Once confirmed that their colleagues had safely ridden out the storm, data scientists from the UKHO's head office in Taunton, Somerset, set about collecting the best information on the region that satellites could provide, using radar satellites to penetrate the clouds and identify shapes



on the ground in low resolution. The UKHO usually uses this data to pick out coastlines, oil platforms and wind turbines against the ocean, as it shows strong outlines between water and solid objects. In this situation, the radar was used to give clear and accurate maps of flooding in hurricane-hit islands including the Turks and Caicos Islands, Montserrat, Antigua, Barbuda and Anguilla. From this, the UKHO created emergency flood maps for all these countries and sent them to government authorities and humanitarian mapping charity Map Action.

In the British Virgin Islands, the survey team were provided with a boat and access to a single-beam echo sounder and a GPS system. Although this wasn't capable of carrying out the high-quality data collection normally undertaken by the UKHO, it did enable the team to complete an improvised survey of the main Road Town harbour. This involved the skipper steering as straight a line as possible, while time, latitude, longitude and depth was recorded manually from the GPS and echo sounder, using pen and paper.

Transcribing the hand-recorded data into spreadsheets, these were then sent to Taunton, where the UKHO was able to deliver special-purpose printed chartlets to the Disaster Emergency Committee within less than 24 hours. These emergency charts enabled relief teams to establish sea routes along which it was safe to load and unload fresh water, medical supplies and food rations to people in need of aid. This was vital as the airport had been badly damaged and needed to be cleared by Royal Marines and Army engineers. Digital versions were also supplied to the Royal Navy,



Satellite image of Road Harbour, British Virgin Islands after Hurricane Irma. Photo credit: UK Hydrographic Office

the Royal Fleet Auxiliary and RFA Mounts Bay.

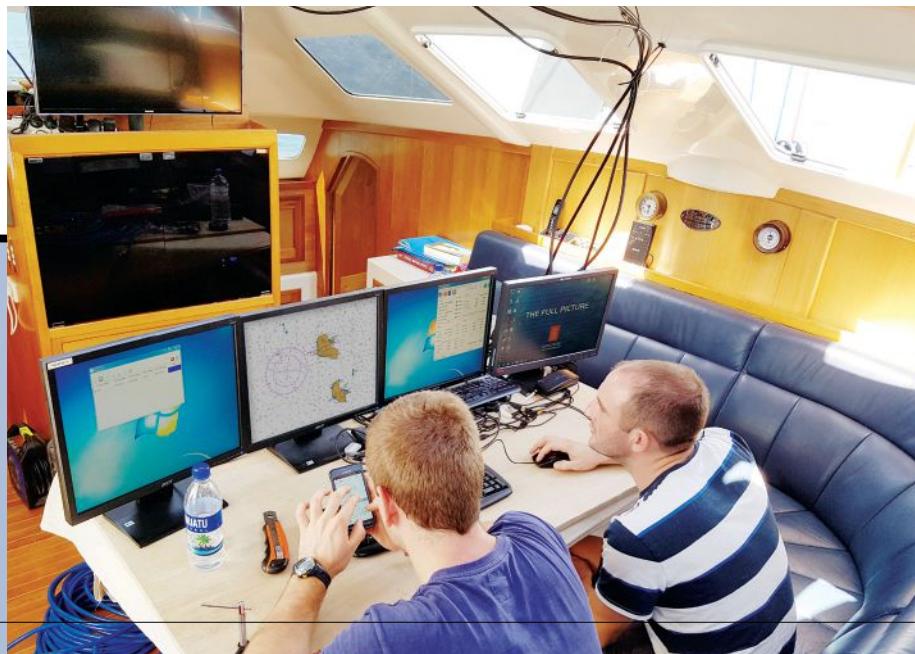
The UKHO has since returned to the islands to complete the activities originally planned, surveying additional priority hurricane-hit areas with multibeam sonar equipment which will further aid disaster recovery.

COMMONWEALTH MARINE ECONOMIES PROGRAMME

In addition to the Overseas Territories Seabed Mapping Programme, the UKHO also plays a leading role in the FCO's Commonwealth Marine Economies (CME) Programme, in partnership with the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the

National Oceanography Centre (NOC). The CME Programme aims to unlock over £2bn return for the economies of 17 Commonwealth Small Island Developing States through a range of Blue Economy developmental work - from hydrographic and geodetic surveying, to providing training and capacity building. Within the first two years of the project, the UKHO has undertaken surveying in the likes of St Vincent and the Grenadines, Grenada, Guyana, Vanuatu, Jamaica, Tonga, Belize and Tuvalu to support safe and efficient navigation.

This was particularly beneficial for Vanuatu, where cruise tourism is a major driver of economic growth - accounting for around 40% of national GDP and



UKHO surveyors on catamaran in Vanuatu. Photo credit: UK Hydrographic Office

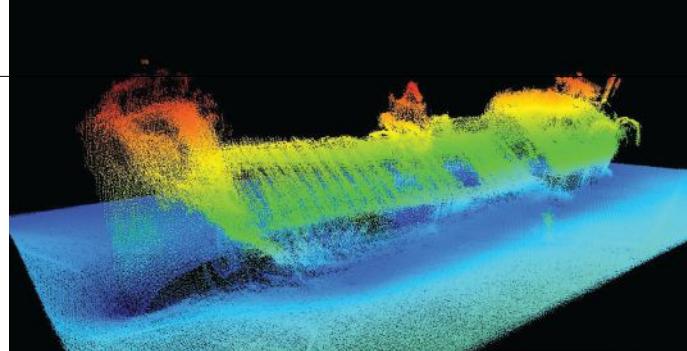
generating over 29,000 employment opportunities. Work was completed last year to capture full seafloor coverage and tidal data in Port Resolution on the island of Tanna – home to the Mt Yasur Volcano, a popular tourist destination. After being processed and validated by teams at its head office, the UKHO used this information to update chart coverage of the area, helping larger ships (and larger cruise ships in particular) to safely visit the island.

After further discussion with the Vanuatuan authorities, the team later returned to complete a second bathymetric survey, this time in the North West of Tanna. This area was identified as a potential site for cruise ships to anchor closer to the main population centres of the island, enabling further development of the island's economy. The work achieved by the CME Programme and local partners will not only enable the economic benefits of tourism, but also maintain a healthy and sustainable marine environment while doing so.

Working alongside partners Cefas and NOC, survey data collected under the CME Programme has the potential to be used for even wider applications, to sustainably manage and preserve marine environments while developing economies and livelihoods.

This was the case for St Vincent and the Grenadines, a Caribbean Small Island Developing State with a marine area of over 90 times its land area. After the UKHO completed seabed mapping work to update chart coverage of the island chain, this data went on to form the basis for a series of habitat maps, produced by Cefas and the NOC. The organisations used the survey data, along with the latest image analysis methods, to produce custom maps, created to describe biological communities present in the area and inform marine conservation.

This information will help protect the unique and rich environments found around the islands and inform future marine planning, supporting healthy fisheries, biodiversity, tourist experiences and more. The work will also enable better managed moorings, which, combined with safe navigation, can reduce the impact of human activity on the environment, such as anchor damage to coral.



Bathymetric data of an uncharted wreck, discovered in St Vincent and the Grenadines. Photo credit: UK Hydrographic Office

needs across nations in the Caribbean and Pacific to ensure a lasting legacy of self-sufficiency.

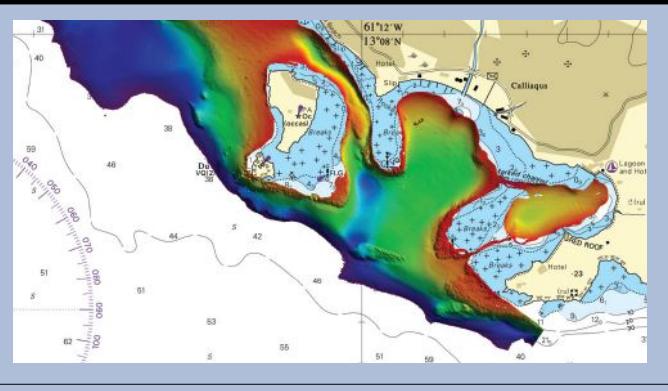
THE FUTURE OF HYDROGRAPHY

Recent years have seen a significant acceleration in the adoption of new technology and the use of big data across industries; in order to develop its capability as a marine geospatial information agency, the UKHO is continuing to invest in data science and software development. Today, it employs over 120 software engineers, solutions architects and data scientists (alongside hydrographers, cartographers and navigation specialists) and is working in innovative ways to further its data handling capability and expertise.

Beyond the flood maps developed to support disaster relief in the British Virgin Islands, the UKHO is using satellite technology for a variety of applications, including automated offshore object detection. Using synthetic-aperture radar, combined with machine learning, data scientists at the UKHO have developed the ability to process open-source satellite imagery to detect marine objects. It is hoped this will improve understanding of offshore infrastructure (such as oil rigs and wind turbines) to reduce the risk of collision and automate the data capture process.

Looking forward, the UKHO is also working alongside other leading geospatial bodies in the UK to form part of the 'Geospatial Commission', which was announced by the Chancellor last year. Together with the Ordnance Survey, HM Land Registry, British Geological Survey (BGS), Valuation Office Agency (VOA) and Coal Authority, the commission aims to maximise the value of all UK location-based data to drive economic growth in the UK. It is predicted that this could unlock up to £11 billion of extra value for the economy every year.

Whether in the UK or overseas, marine geospatial information is the keystone to the sustainable use of our oceans. Whether used for supporting maritime navigation, disaster management and economic growth, or emerging new sectors like marine energy, the availability of accurate location-based information will remain essential. And, as our marine environments continue to change and the global Blue Economy develops, the UKHO will continue to work collaboratively to support our future use of the seas, helping to deliver safer and more sustainable marine economies in developed and developing nations alike.



Survey data of Calliaqua Bay, St Vincent, overlaid onto chart coverage. Photo credit: UK Hydrographic Office

OCEANGATE AND IXBLUE in First Manned Submersible Expedition of the Titanic

OceanGate, Inc., a provider of manned submersible services, and iXblue, a global company that provides innovative solutions for navigation, positioning and underwater imaging, are combining forces to conduct the first manned submersible expedition to the wreck of the RMS Titanic since 2005. iXblue's Phins 6000 inertial navigation system and Posidonia USBL positioning system will both be used for the accurate and reliable navigation and positioning of OceanGate's Titan, the newest addition to the company's fleet of deep sea manned submersibles and the first privately-owned manned submersible capable of reaching Titanic depths.

The exploration team will conduct annual surveys of the wreck in collaboration with scientific and imaging experts from multiple organizations as part of an ongoing long-term study to document the current condition of the Titanic maritime heritage site.

iXblue's unique strap-down Fiber-Optic Gyroscope (FOG) technology, Phins 6000 subsea Inertial Navigation System (INS) provides accurate position, heading, attitude, speed and depth information as the manned submersible captures laser data and the first ever 4K images of the RMS Titanic shipwreck and debris fields. Its high-accuracy inertial measurement

unit is coupled with an embedded digital signal processor that runs an advanced Kalman filter for optimum positioning of the subsea vehicle.

The six-week expedition will depart from St. John's, Newfoundland in June 2018 with scientists, content experts, and mission specialists joining the crew in a series of week-long missions. The expedition crew size for each mission is about 30 people, including nine mission specialists, submersible pilots, operations crew and content experts. Qualified individuals will join the crew as mission specialists to support the mission by helping to underwrite the expedition and by actively assisting the team aboard the submersible and the ship in roles such as communications, navigation, sonar operation, photography, and dive planning.

The Titanic Survey Expedition will conduct an annual scientific and technological survey of the wreck with a mission to:

- Create a detailed 3D model of the shipwreck and portions of the debris field using the latest multi-beam sonar, laser scanning and photogrammetric technology.
- Supplement the work done on previous scientific expeditions to

capture data and images for the continued scientific study of the site.

- Document the condition of the wreck with high-definition photographs and video.
- Document the flora and fauna inhabiting the wreck site for comparison with data collected on prior scientific expeditions to better assess changes in the habitat and maritime heritage site.

Increased positioning precision of Titan on the shipwreck site will be provided by Posidonia, iXblue's long range and high accuracy USBL system that is operated from the surface ship and will be calibrated thanks to a Phins surface INS. Designed to track subsea vehicles to depths of 6,000 meters at ranges reaching over 10,000 meters, Posidonia uses advanced acoustic modulation, as well as digital signal processing technology and operates in the low frequency band for deep sea tracking operations. To communicate with Posidonia during each dive, Titan is equipped with iXblue's MT8 compact low-frequency transponder.

For more information, visit
WWW.OCEANGATE.COM
WWW.IXBLUE.COM



Illustration copyright Andrea Gatti. Inspired by Ken Marschall





Fugro Activities Update

Ultra-Deepwater Surveys for Deep Sea Mining

Fugro is commencing its first project supporting deep sea polymetallic nodule mining under a contract awarded by seafloor mineral exploration company Nauru Ocean Resources Inc. (NORI), a subsidiary of DeepGreen Metals Inc.

In the deep waters of the eastern Pacific Ocean, its specialist marine geoscience team will perform detailed site characterization surveys. The project, which began on 19 April 2018, will advance NORI's polymetallic nodule project. Polymetallic nodules are potato-sized concretions enriched in nickel, copper and cobalt. These nodules also contain metals and non-metals important to 'green-tech' enterprises, such as electric vehicles and wind energy production.

The site characterisation surveys will involve acquisition of high-resolution imagery and geophysical data, and sampling of minerals from the seafloor. Fugro will also measure geotechnical properties, catalogue the mineral resource and help NORI to determine optimal mining areas. The data acquisition and sampling will take place in water depths of up to 4,500 meters over a 400-square-kilometer area between the Clarion and Clipperton fracture zones. The field work will be accomplished using the company's Echo Surveyor VII autonomous underwater vehicle (AUV) and specialized seafloor sampling equipment.

Seep Hunting Offshore Brazil

Working for multi-client geoscience data company, TGS, Fugro continues the hunt for hydrocarbon seeps, this time offshore Brazil. Two modern, purpose-built vessels – Fugro Brasilis and Fugro Searcher – have been deployed to acquire high-resolution multibeam echosounder and sub-bottom profiler data in the Campos and Santos Basins. The survey is designed to mirror TGS's successful 2016-2017 Gigante and Otos projects in the Gulf of Mexico in which Fugro provided similar services. Covering an area of approximately 200,000 square kilometres, Fugro will use these data to identify and recommend the most prospective locations to target for geochemical sampling. Project deliverables will be used by energy companies to help optimise and refine their exploration and development activities in this prolific region.

Novel Hurricane Modelling at OTC 2018

Fugro made its mark on the Offshore Technology Conference (OTC) this year with 14 presentations in the technical program. Involving 32 of its global experts, Fugro took part in six conference sessions throughout the show as presenter or collaborator, and for one session, provided the chairperson. The collaborators come from Fugro's worldwide locations including USA, Mexico and UK. Also present in the main exhibition hall, the company displayed its services for marine asset integrity and marine site characterisation on booth 1604.

One of the Fugro-authored papers - 'A Novel Approach to Generating a Hurricane Database for the Gulf of Mexico Based on Numerical Weather Prediction Models' - won the 2018 Arthur Lubinski OTC Best Paper Award, by the American Society of Mechanical Engineers (ASME) Petroleum Division. The paper has, as a backdrop, the scarce availability of public metocean data in the south of the Gulf of Mexico. It describes how an accurate hurricane modelling approach has been used to generate a valuable new source of data to assist development in the region.

Juan Liria, Principal Metocean Modeller in Fugro's Metocean Modelling and Analysis Department (who presented the award-winning paper) explains, "In situ measurements during hurricanes are scarce, and if they are available, they rarely cover a large enough number of events to enable the derivation of statistically robust and reliable design criteria."

Fugro has developed the capability to model the complex atmospheric conditions during hurricanes (and similar events, known collectively as tropical revolving storms). "We can accurately reproduce the tracks and intensities of historical storms, together with important related elements such as convection, gravity, waves, storm surge and convective precipitation, among others," Liria added.

For more information, visit
WWW.FUGRO.COM



Underwater Acoustics & Drones

UNDERWATER ACOUSTICS & DRONES

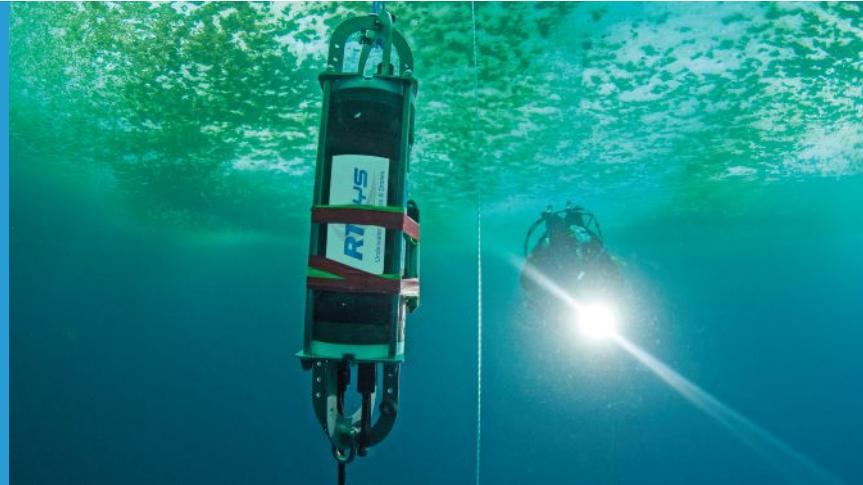
TECHNOLOGY

RTsys specializes in underwater acoustics & drones. The company relies on its cutting-edge technology SDA electronic boards. All the devices are powered by SDA-14 or SDA-416 allowing synchronous acquisition systems. The board enables the equipment to do sonar signal processing and handle underwater acoustic communications. Its electronics and embedded software make real-time systems possible.

PRODUCTS

RTsys designs and manufactures underwater acoustic recorders and buoys whether for post-processing treatment or real-time monitoring missions. Devices can be operated manually or automatically depending on the mission requirements. Mission can be programmed easily from a computer (frequency choice, recording channel, size of the files recorded, duty cycles, sampling frequency...) and deployed by a single man. The equipment can directly compute data to display in real-time noise levels, for example onto the operator's computer allowing him to comply with the noise emission regulation set. Post data analysis is easy to do as the recorder can be connected to a computer via an Ethernet connector. Data extraction is then easy to proceed through the intuitive web-interface.

The company also designs and makes underwater autonomous vehicles both for civilian and military applications. RTsys takes advantage of its expertise in acoustic to integrate underwater communication in its drones. It allows them to operate in swarm for different kind of missions (surveillance, survey, pipeline, inspection, mine warfare...). The AUVs are modular and allow the integration of numerous payloads. The COMET 300 AUV can be provided with a module enabling him to dock in a station (avoiding all the launch and recovery process usually handheld by a crew and a vessel saving costs for the operators. The SEMA AUV is used by the navy to train its



crew for anti-submarine warfare by simulating the acoustic signature of a submarine. Its speed and the fact that the drone is recoverable make it a great asset for navies.

RTsys provides underwater sonar solutions. Combining its knowledge in underwater communication and navigation, the company developed the SONADIVE handheld sonar for divers designed for EOD missions and mines clearance. The sonar is well appreciated by navy users thanks to the SONADIVE's special features: large screen, easy programming mission, user-friendly human machine interface, long-term autonomy, interoperability...

Based on this great experience, the company also develops sonar solutions for surface ship improvement and sonar calibration to offer its customers a great improvement in sonars accuracy, and making them easier to use (electronic converted from analog to digital) for operators. RTsys also provides a solution for the best possible characterization and calibration of underwater acoustic systems (hull-mounted sonars, dipping sonars, towed sonars, buoys...).

ADDED-VALUE

RTsys provides with its equipment a full range of software and dedicated solutions. The devices are provided with pre-programming software

allowing users to prepare the mission before deployment. It is also possible to realize in-situ test to quickly assess the good functioning of the device. Moreover, the users can program the frequency range they need to monitor and extract Excel tables from the entered values. A dedicated website named Resonance can be provided with the devices to monitor in real-time different sensors on a station (acoustics, oxygen, temperature, turbidity, pressure, video camera...). This solution allows operators to access data at anytime from anywhere around the world.

SUPPORT

The RTsys team is always available to support customers either from over the phone to in the field missions. The company works with universities and institutes, industries and government organizations. Visit their website and subscribe their Twitter and LinkedIn pages as well as YouTube channel. RTsys can make your work easier saving time and operational costs. They provide the solution you need to succeed in your mission!



For more information, visit: WWW.RTSYS.EU

NSF Eyes New Approach for the Provision of Marine Seismic Capabilities to Research Community

The National Science Foundation (NSF) Division of Ocean Sciences' (OCE) has decided to divest from ownership of R/V *Marcus G. Langseth*, a 235-foot specialized seismic research vessel that has long supported the marine seismic community's need for long-term, sustainable access to seismic data collection capability. NSF anticipates the end of field commitments to be no later than mid-2020, at which time NSF will implement the divestment of the *Langseth*.

As a result, the Marine Geology and Geophysics (MGG) program will immediately begin to work with the community and the UNOLS Marine Seismic Research Oversight Committee (MSROC) to identify decadal-scale solution(s) for the provision of marine seismic capabilities. In the meantime, NSF will continue to accept proposals that include large tuned-source, long-offset data acquisition, but access to these capabilities will need to be coordinated by Principal Investigators as part of their proposals, through industry



providers or international/institutional partners. Should a sustainable new approach not be in place by the end of R/V *Langseth* operations, this practice will continue until a new approach can be identified and implemented.

Finally, through the time-frame of this overall transition, NSF will continue its programmatic support of other seismic acquisition capabilities (e.g., portable 2-Dimensional multichannel seismic [MCS], ocean-bottom seismometers, CHIRP systems, P-cable, etc.) Such capabilities could be provided by other Academic Research Fleet vessels (UNOLS), international or commercial partners, or other means as identified by potential Principal Investigators, MSROC, and NSF. The full, official release of be read at <https://nsf.gov/pubs/2018/nsf18061/nsf18061.jsp>.



BARRACUDA

The Barracuda is a new breed of ROV, designed to work in high current. Small, Streamlined, Extremely Powerful and loaded with Advanced Capabilities.

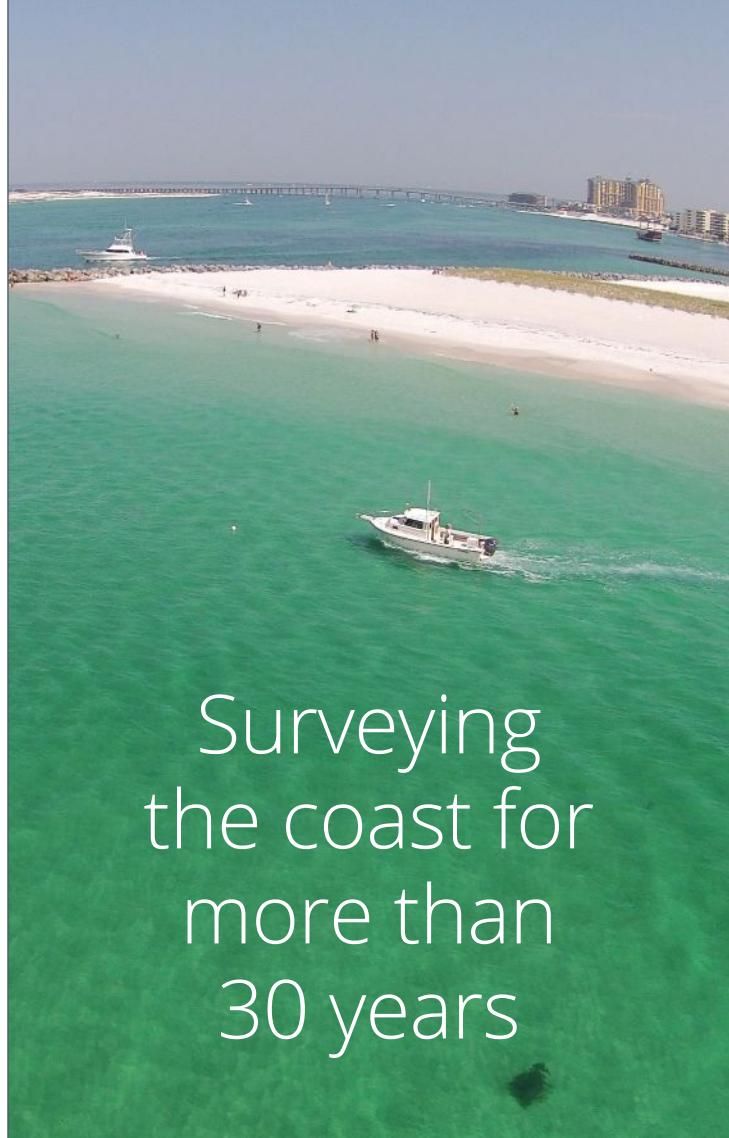
- Lightweight, easy to deploy.
- High Thrust.
- Integrated Total Navigation System (TNS) Including GPS, DNS,(LBL also available).
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SOIL MACHINE DYNAMICS SIGNS CONTRACT FOR ITS ATOM ROV

Subsea equipment design and manufacturer Soil Machine Dynamics Ltd (SMD), announces a contract to supply its Atom Mk1 1000m 100hp Work Class Remotely Operated Vehicle (ROV) system to Chinese power specialist, China Southern Power Extra High Voltage Power Transmission Company (EHV, CSG), a subsidiary of the state-owned China Southern Power Grid (CSG).

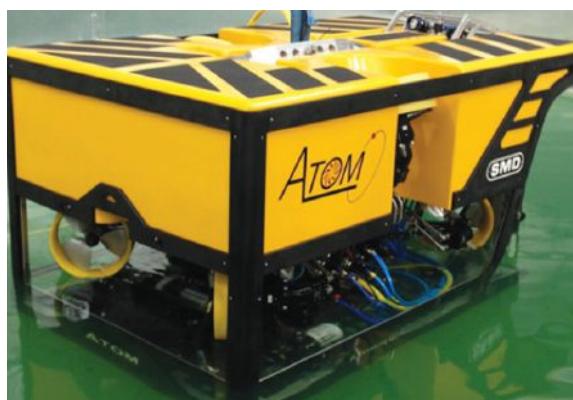
The ROV will be used for inspection of the 31km physical power cable connections in the Qiongzhou Strait between Hainan Island and mainland China. The Qiongzhou strait often experiences high currents so it was essential that CSG chose a compact and powerful ROV to cope with the harsh conditions.

The Atom system is SMD's lightest work class ROV suitable for offshore power applications, survey and light construction duties, and can be mobilized on vessels with limited deck space. For this contract, SMD will integrate a TSS350 cable tracking system and other survey tools to perform cable inspection.

Scheduled for delivery at the end of 2018, the ROV will be equipped with SMD's proven and reliable range of Curvetech® components, DVECSII control system and 20ft control cabin which will be mobilized on board CSG's new cable installation vessel. As part of the contract, SMD Services is also providing bespoke training courses to ensure CSG's operational team are prepared with the necessary operating skills.

SMD Services will utilize CRRC SMD Shanghai's facilities to support mobilization of the ROV on board CSG's new vessel. They will also lead on the sea trials ensuring the ROV operates at maximum capacity with support from the SMD Services offshore team, who will be on hand to provide assistance for any on deck ROV support.

For more information, visit
WWW.SMD.CO.UK



Atom Mk1 1000m 100hp Work Class Remotely Operated Vehicle (ROV) system. Photo credit: SMD

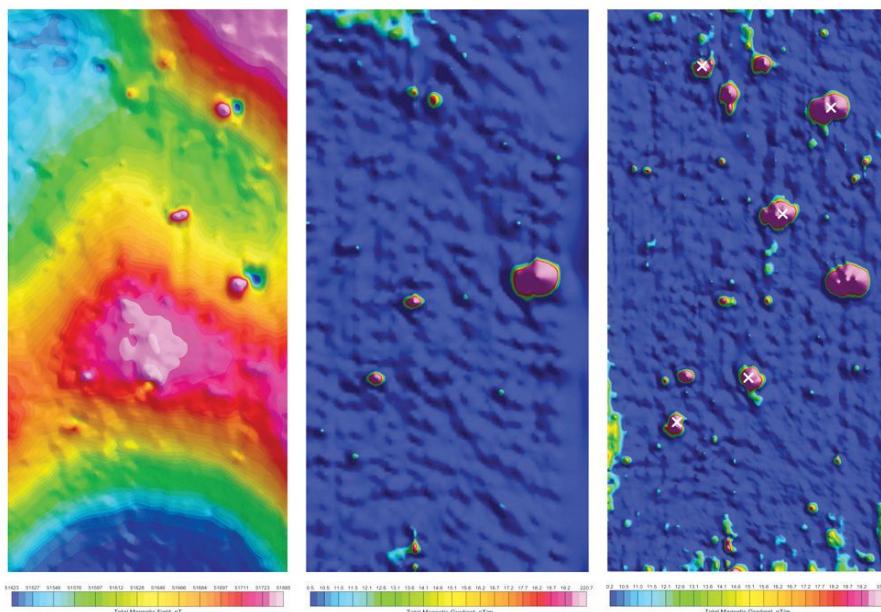


Figure 1 (images from left to right): Total field, pre-seeded, and post-seeded

MARINE MAGNETICS' EXPLORER Magnetometer Integrated with the Gavia AUV

Teledyne Gavia, manufacturer of the Gavia Autonomous Underwater Vehicle (AUV), announces the integration of Marine Magnetics' Explorer AUV magnetometer, a high accuracy omnidirectional sensor, which is towed behind the vehicle allowing it to operate outside the AUV's magnetic signature. The Explorer's exceptional accuracy and sensitivity, small size, low noise, and minimal power requirements make it a highly valuable tool that is ideally suited for use with AUVs.

Dynamic and static testing of the Gavia AUV was conducted at Marine Magnetics' facility in Canada and near Teledyne Gavia's manufacturing facility in Kopavogur, Iceland to validate that the Explorer could measure variations in the magnetic field, rather than the influence of the Gavia moving through the water column. The trial ensured that the data was accurate and free of heading error that might obscure small targets. The testing produced the data set in figure 1, which is smooth and free from stripping, a by-product of heading error. The pre and post-seeded surveys, completed on separate days, matched

up perfectly. The data illustrates the accuracy of both the Explorer magnetometer and the 3D positioning capabilities of the Gavia AUV, allowing the combined Gavia AUV Explorer Mag to locate all of the seeded targets.

Equipping the Gavia AUV with the Marine Magnetics Explorer enables the Gavia AUV to combine high accuracy magnetic signature mapping along with Side Scan or Bathymetric survey data, Sub Bottom Profiler data, and still images, providing multiple detection levels of Unexploded Ordnance (UXO), pipelines, buried objects, or shipwrecks.

For more information, visit
WWW.TELEDYNEMARINE.COM/GAVIA



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HOUSTON MECHATRONICS Unveils Shape-shifting Aquanaut

Houston Mechatronics has announced their new subsea robot, Aquanaut, a multipurpose subsea robot that employs a patented shape-shifting transformation from an Autonomous Underwater Vehicle (AUV) to a Remotely Operated Vehicle (ROV), removing the need for vessels and tethers. The vehicle enables both the efficient collection of data over long distances as well as manipulation of subsea objects at a significantly lower cost than today's technology.

"We firmly believe that this technology is a revolution in subsea robotics. Aquanaut, and our tightly coupled over-the-horizon software Commander, enables Houston Mechatronics to deliver more feature rich, safer subsea services to commercial and defense customers that demand it," said Houston Mechatronics CEO Matthew Ondler. "Our team developed some of the most advanced robots that NASA ever produced and has been developing advanced subsea robotics technology for confidential customers for years. Aquanaut represents the pinnacle of our company's expertise and experience and

we are beyond excited to introduce this vehicle to customers."

Nic Radford, CTO of Houston Mechatronics, remarked that, "We saw a great opportunity to fundamentally change the commercial and defense subsea markets with Aquanaut. Aquanaut was designed to operate over-the-horizon with onshore operator supervision. We have removed the need for onsite vessels (and people) from subsea work while still maintaining the operator's situational awareness and the ability to modify missions, which our customers demand. Our capability can truly transform industries. For the warfighter, this means increasing the standoff distance therefore resulting in safer conditions. For commercial customers, this means that we can provide more capability than they have today for much less cost."

For more information, visit
WWW.HOUSTONMECHATRONICS.COM

UKHO Purchases NORBIT iWBMS Multibeam Survey Capability

NORBIT announced its appointment by the UK Hydrographic Office (UKHO) as the single framework supplier until August 2020 for survey equipment and associated engineering support to enable British Overseas Territories and other Commonwealth Small Island Developing States (SIDS) to develop their own hydrographic survey capability to meet IHO standards.

NORBIT iWBMS equipment installations will be conducted in cooperation with local government authorities who will provide suitable vessels and facilities, ultimately enabling the growth in knowledge and

capability of local hydrographic services.

NORBIT will provide through the UKHO, storage, shipping, installation and support of multibeam echo sounder and survey systems on a country by country basis worldwide.

With fully integrated multibeam survey systems, NORBIT will ensure high data quality and ease of operation for NORBIT trained local agencies in often challenging environmental and economic conditions.

For more information, visit
WWW.NORBIT.COM/SUBSEA

Nexan to Supply Umbilicals and Accessories for BP's Mad Dog 2 Project

According to the IEA's World Energy Outlook 2017, the United States is expected to account for up to 80 percent of the increase in global oil supply to 2025. This growth is driving the development of new fields far offshore in ever greater water depths. One of the leading oil and gas producers in the Gulf of Mexico, BP, has selected Nexans to supply umbilicals for the second stage development of the Mad Dog offshore field.

The Mad Dog 2 project is a deep-water oil and gas production development located in the Southern Green Canyon area of Gulf of Mexico, approximately 200 miles south of New Orleans, Louisiana. BP discovered the Mad Dog Field in 1998 and it is still one of the largest discoveries in region.

Within an existing five-year frame agreement, BP has ordered Nexans' static and dynamic umbilicals and accessories that will be deployed in water depths from approximately 1,280 m to 2,160 m (4,200 ft to 7,100 ft) to connect the field to the Floating Production Unit (FPU). The scope of work includes three different umbilical designs integrating hydraulic, data and fiber optic services.

The electrical and fiber optic elements will be manufactured at Nexans Norway plant in Rognan, Norway and the umbilicals will be developed, manufactured and tested at Nexans Norway specialized plant in Halden, Norway.

For more information, visit
WWW.NEXANS.COM



McDermott to Self-Perform Diving Scope for SAPREF and BP

McDermott International, Inc. will self-perform air and saturation diving on two key projects in the Americas, Europe and Africa region. McDermott was awarded a contract to remove and replace a single 24 inch subsea hose string to a single buoy mooring and pipeline end manifold for Southern Africa's largest crude oil refinery operated by SAPREF, located about 1.5 miles off the coast of Durban, South Africa.

McDermott conducted a scheduled critical saturation and air diving campaign in early May 2018 from the multi-purpose vessel, *Amazon*, which functions as a diving support vessel for the project. The project marks an operational return to Africa for McDermott.

McDermott's global diving team will also support the pipeline installation and pre-commissioning work for the BP Trinidad & Tobago, LLC (BP TT) Angelin project, located 25 miles off the east coast of Trinidad and Tobago. McDermott has an engineering, procurement, construction, installation and commissioning (EPCIC) contract from BP TT for the Angelin gas field.

McDermott will use a mix of McDermott divers and local Trinidadian divers to perform the diving activities. The divers will work off the diving support vessel (DSV) *Da Vinci*, contracted by McDermott on bare boat charter from Boskalis. McDermott diving operations include: free flooding the pipeline; barrier testing; metrology and 26-inch spool tie-in at the new platform and at the Serette facility; pre-commissioning support for pigging, hydrotesting and dewatering of the pipeline and free span rectification. The dive

team will use the DSV with support from local Trinidadians for the planned month-long campaign. McDermott's *DLV 2000* will install the platform and pipeline, which is due to arrive in Trinidad in the third quarter of this year and expected to be installed in the fourth quarter.

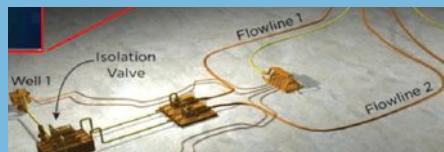
McDermott's diving function provides a variety of in-house underwater services in support of (EPCIC) projects such as pipe and cable lay, demolition and installation of spool pieces, risers, platforms and other structures. These operations are performed from McDermott's derrick barges, subsea construction vessels and DSV's.

Catering to both shallow and deepwater operations, McDermott maintains 12 mixed gas packages (MGP's), 5 saturation diving spreads and a large inventory of portable equipment. The MGP's are used for depths of up to 100 feet while the diving spreads can be used in depths of up to 984 feet.



For more information, visit
WWW.MCDERMOTT.COM

MONTH IN REVIEW



Anomaly Detection App Introduced by Clarus Subsea Integrity

Clarus Subsea Integrity has introduced the iCUE Digital Anomaly Detection App, which provides rapid, accurate detection of anomalies by reviewing inspection video footage of subsea assets. <https://www.oceannews.com/news/subsea-intervention-survey/clarus-subsea-integrity-s-icue-digital-anomaly-detection-app>



DeepOcean Acquires Delta SubSea

Delta SubSea is an agile and cost-effective provider of Inspection Maintenance and Repair (IMR) and light construction services with a focus on the US Gulf of Mexico (GOM) and US based customers with international operations such as West Africa, Trinidad & Tobago and Guyana. <https://www.oceannews.com/news/subsea-intervention-survey/depocean-acquires-delta-subsea>



i-Tech Services and Leidos Partner to Drive Digitalization Subsea

i-Tech Services, a Subsea 7 company, and Leidos have announced a five-year digitalization partnership agreement. <https://www.oceannews.com/news/subsea-intervention-survey/i-tech-services-and-leidos-partner-to-drive-digitalization-subsea>

Osbit Secures Major DeepOcean Subsea Plough Upgrade

Osbit Ltd, an offshore engineering and technology company, has secured a project with DeepOcean to deliver a significant upgrade to a subsea plough, enhancing its capabilities for the installation of a new gas pipeline. DeepOcean's Advanced Multi-Pass Plough (AMP500) will be deployed to the Baltic Sea for the construction of the 1,200km Nord Stream 2 Pipeline, which will transport natural gas from Russia to the European Union.

<https://www.oceannews.com/news/subsea-intervention-survey/osbit-secures-major-depocean-subsea-plough-upgrade>



The ICPC Addresses Three Future Challenges for Subsea Cables

The International Cable Protection Committee (ICPC) celebrated its 60th anniversary Plenary meeting by highlighting the three themes it is addressing to ensure that subsea cables continue to provide reliable long-term socioeconomic benefits to global communities.

This year's ICPC Plenary—held in Cape Town, South Africa and sponsored by Mertech Marine—was attended by 128 delegates and invited guests from all over the world, including many from Africa. Spanning three days of insightful presentations and lively debates, industry experts shared experiences, trends, challenges, and innovative solutions to the following key issues facing subsea telecommunication and power cables.

- Cable security:** Considering that subsea cables are often described as critical infrastructure, the ICPC kicked-off new activities focused on the end-to-end security of cable systems and the continuity of the benefits they provide. The ICPC and its Members have an extensive evidence-led understanding of the potential threats to cables and are leveraging this knowledge on policies and procedures for protecting these strategic assets.

- Sharing the seabed in harmony with others:** While the cable industry has flourished under the current freedoms to lay and maintain cables enshrined in international law, the ICPC recognizes that there are other organizations which have legitimate interests in how our oceans are protected and managed. The ICPC continues to seek fact-based dialogue and cooperation between these actors to avoid potential conflicts of interest, by:

- Promoting wider understanding of cables' neutral-to-benign impact on delicate marine ecosystems – for example within the United Nations as it considers new international legislation on Biodiversity Beyond National Jurisdiction; and

- Engaging with commercial interests such as deep seabed mining – coordinated by the International Seabed Authority (ISA) – to emphasize the benefits of marine spatial planning which pays due regard to the concerns of all.

- Protecting cables from accidental damage:** This has been a central part of the ICPC's work since its creation 60 years ago. The organization continues to collate, analyze, and share information on man-made and natural events, which affect subsea cables. Moreover, the ICPC is continuing its outreach to bodies such as the International Hydrographic Organization, to proactively ensure that maritime charts provide ships' masters with the necessary information to avoid accidental contact with subsea cables. The ICPC is also supporting studies to better understand natural processes such as subsea earthquakes, landslides and climate-driven events, which will allow future cables to be laid in areas of ever-lower risk.

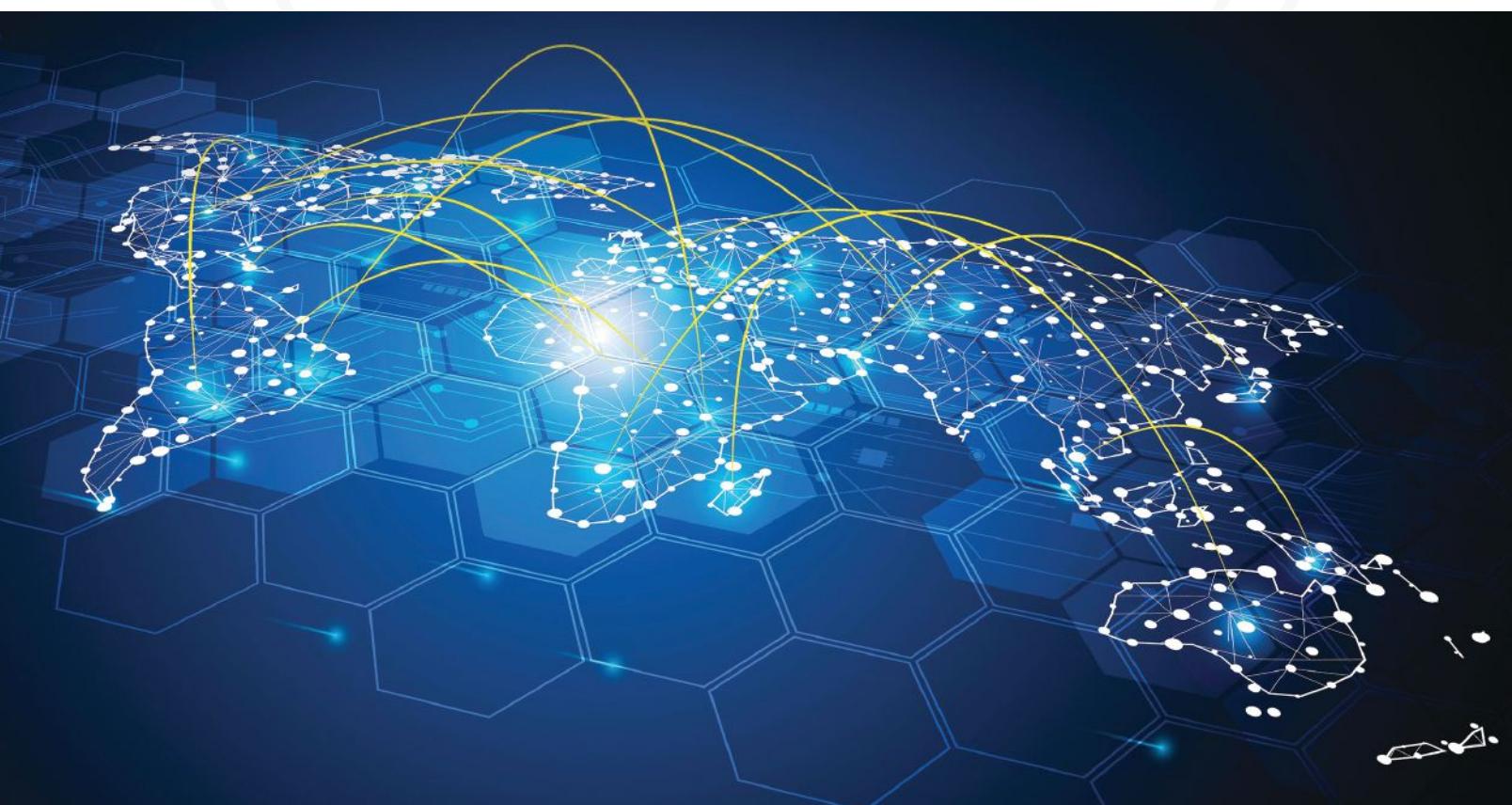
In the ICPC's Diamond Jubilee year, its Members also reflected on the history of the organization, from its formation in 1958 as the Cable Damage Committee, to the present day, where it represents a membership of more than 170 companies, including governments and academic institutions. "We have evolved over the decades from a focus on damage control towards proactive means to minimize cable faults," said the ICPC Chairman, Graham Evans. "Now we're continuing to adapt ourselves to new commercial, environmental, and legislative challenges, as part of our work to ensure the connectivity of communities and states."

For more information, visit
WWW.ISCPC.ORG

MAREA cable running out to ocean. MAREA is a 4,000-mile-long cable between North America and Spain that can transmit eight times the volume of the U.S. Library of Congress, in a single second. Photo courtesy of RUN Studios.



SubCableWorld



Analyzing the cable industry.

VARD TO BUILD PRYSMIAN CABLE LAYER VESSEL



Italian subsea cables specialist Prysmian has selected Vard, a Fincantieri shipbuilding company, for the design and construction of its new cable laying vessel.

The contract value, including owner supplied special equipment, amounts to approximately € 170 million (approximately NOK 1.6 billion).

The specialized vessel for advanced subsea operations, is intended to be the most capable cable layer in its market, featuring deep water installation capabilities for depths of more than

2,000 meters and high cable loading capacity in large cable rotating platforms.

The cable layer is developed to perform complex installation operations, supported by a variety of burial systems, including heavy duty ploughs, and seakeeping systems, coupled with a reduced environmental footprint.

With a length of 172 meters, and a beam of 34 meters, the vessel will be able to accommodate a crew of 120 persons.

The cable layer is designed by Vard Design in Ålesund, Norway. The start of construction phase is foreseen by end 2018.

The vessel is scheduled for delivery from Vard Brattvaag in Norway, in 4Q 2020. The hull will be built at Vard Tulcea in Romania. Several of the group's specialized subsidiaries are also involved

in the project through deliveries of equipment and solutions.

Mr. Giuseppe Coronella, Chairman of Vard Holdings Limited, commented: "We are proud to have been chosen by Prysmian to contribute to their development plans bringing to life this advanced vessel which will unquestionably make the difference in the deep water cable laying market."

Mr. Massimo Battaini, Prysmian Group SVP Business Energy Project, commented: "This new strategic asset will consolidate Prysmian Group's leadership in the submarine cable industry, by bolstering turnkey approach, under which we deliver end-to-end EPCI projects, from engineering, manufacturing and installation to full monitoring and diagnostic services."

For more information, visit
WWW.PRYSMIANGROUP.COM

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For more information, visit us at www.oceanspecialists.com.



XKL Systems to Enhance London to Cape Town Subsea Network

The Tertiary Education and Research Network of South Africa (TENET) has purchased XKL DarkStar transponder and mux/demux systems from XKL LLC, providing a protected connection between two of their strategic data center locations in London. The interconnection is a critical component of a subsea cable network linking London to Cape Town.



The transponder systems grow to 36x10G in a 1RU package; establish the connection between multi-tenant data centers, which connect to subsea fiber managed by the West African Cable System (WACS). The inclusion of an amplified mux/demux with optical switch protection, was driven by TENET's desire to easily scale its transport capacity as demand increases as well as provide optical path protection between locations in the event of a fiber break.

TENET operates multiple peering and transit links across Europe and Africa, as well as UbuntuNet gateways under contract to the UbuntuNet Alliance. The provider also offers direct connections to GÉANT, the European research and education network. With several initiatives driving network utilization, the company intends on increasing its capacity over time and sought a network solution that intelligently accommodates growth. XKL's mux/demux offering allows TENET to simply add new optical transport systems as needed without service disruption. This pay-as-you-grow approach is facilitated through the unified design of XKL's suite of products. Network architects have gravitated toward that flexibility when planning their networks. For more information, visit www.xkl.com.

Hydro Group CEO Among Scotland's Entrepreneur of the Year Finalists

Douglas Whyte, chief executive of Aberdeen-based Hydro Group is one of twenty-three business leaders to compete for the title of Scotland's Entrepreneur of the Year award. The overall winner will be announced in June at Gleneagles. Winners from Scotland and the English regions will progress to the UK finals.

Doug Whyte said "It is a huge honor to be shortlisted for this business accolade, and I am humbled to have been recognized by some of the most influential business leaders today."

He added, "Hydro Group has experienced rapid growth over three decades of business, which wouldn't have been possible without my dedicated team. I've been lucky to work with some of the most fantastic and enthusiastic individuals throughout my career and whilst it's satisfying to look back at my time in the industry, it's much more interesting to look forward and consider that now is the time to support the development of new technologies and innovations."

Mr. Whyte was specifically cited for sustained excellence in his award

recognition. Founded in 1982, Hydro Group is at the forefront in the development and innovation of subsea product technologies. Whyte has grown the company into two design and manufacture businesses – Hydro Bond Engineering and Hydro Cable Systems – supported by two subsidiaries, Singapore-based Hydro Group Asia and US-based Hydro Group Systems.

For more information, visit
WWW.INSIDER.CO.UK/NEWS/SCOTLANDS-EY-ENTREPRENEUR-YEAR-2018-12372460



ALGERIA to be Connected to Two New Subsea Cables in 2018

Algeria's Minister of Post, Telecommunications, Technologies and Digital Technologies Houda Imane Feraoun, announced 17 April that her nation would be connected before the end of 2018 to two new subsea fiber optic cables. The first will link Oran and Algiers to Spain and the second Annaba to several cities in America and Asia

The two new cables, the Alger-Oran-Valencia (Orval) and Annaba-USA, have been driven by the increased connectivity due to the growing number of subscribers and internet users in the count, she explained. The connectivity link with the United States will be the

second of its kind to house the Algerian coastal city of Annaba. Indeed, the city already hosts the submarine cable Sea-Me-We 4 which connects Algeria to France via the city of Marseille. It is one of the main telecom infrastructures in the country. Its rupture on October 22, 2015 paralyzed a large part of the transmissions on part of Algeria for several days, causing a financial loss of 600 million dinars (\$ 5,220,000) to Algeria Telecom.

Minister Feraoun recalled that at the beginning of the millennium Internet did not exist in Algeria, while today, the nation has 3,166,000 subscribers with Internet access. She also celebrated the improving mobile coverage for the nation.

"Investment in this area is underway and we hope to receive these two lines in a timely manner," reassured the minister.

Sunken WWII Cruiser Located by Paul Allen's Expedition Crew

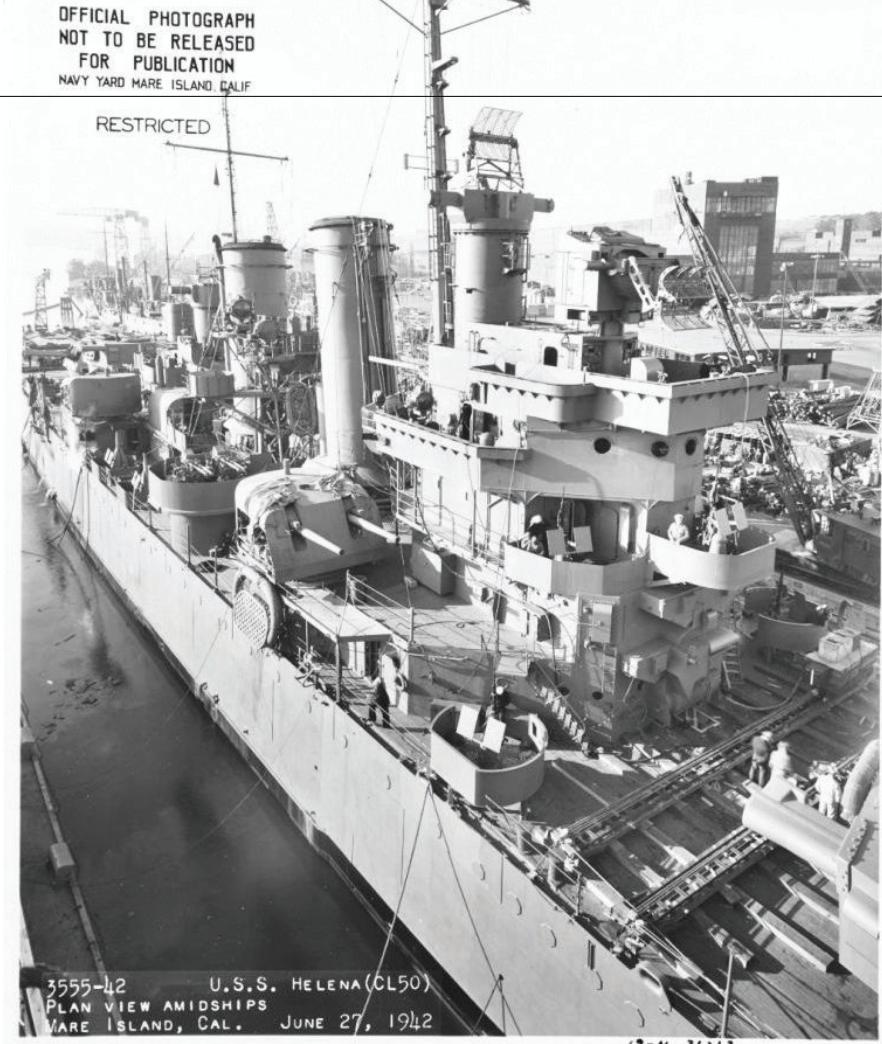
By Dave Werner, Pacific Fleet Public Affairs and The Editors

Few ships can claim a history like that of USS *Helena* (CL 50). Her distinguished and storied World War II service began at Pearl Harbor and ended in a heroic and determined rescue seemingly too dramatic to be true. Late in March 2018, the *Helena* was discovered by Paul Allen's expedition crew aboard R/V *Petrel*.

Sunk on July 6, 1943 by three Japanese torpedoes during the Battle of Kula Gulf, the St. Louis-class cruiser was found 860 meters below the surface, resting on the floor of the New Georgia Sound off the coast of the Solomon Islands.

"We do these missions as testament to the brave souls who served on these ships," said Robert Kraft, director of subsea operations for Allen. "Each ship has a story that touches families and friends of those who perished or survived. It's gratifying to hear those stories each time we announce a new discovery."

Helena's history closes with the almost incredible story of what happened to her crew in the hours and days that followed. As various rescue efforts got underway over the course of 10 days, amazing stories of sailor toughness unfolded



View of USS *Helena*'s starboard side amidships, taken at the Mare Island Navy Yard, California, 27 June 1942. Photograph from the Bureau of Ships Collection in the U.S. National Archives.

in which 732 of the 900 crew survived the sinking and were ultimately rescued. When her bow rose into the air after the sinking, many of them clustered around it, only to be fired on. Two American destroyers, the *USS Nicholas* (DD 449) and *USS Radford* (DD 446) were dispatched to rescue the surviving crew.

As the sun rose, the enemy remained within striking distance, and the two American vessels suspended rescue operations to pursue the Japanese. The survivors were amassed into two groups.

The first group of about 275 survivors was aided by volunteers and small boats left on scene by the two destroyers. *Helena*'s commanding officer, Capt. Cecil, who survived the sinking, organized a small flotilla of three motor whaleboats each towing a life raft, carrying 88 men each, to a small island about 7 miles. This group was rescued the next morning by *USS Owin* (DD 433) and *USS Woodworth* (DD 460).

The second group, numbering nearly 200, clung to the slowly sinking bow



of *Helena*. When things were looking bleak, a Navy Liberator dropped lifejackets and four rubber lifeboats. The wounded were placed aboard the lifeboats, while the able-bodied surrounded the boats and did their best to propel themselves toward a nearby island.

Wind and current, however, carried them away from the island, and ever further into enemy waters. American search planes who eventually arrived could not locate the drifting flotilla, and some of the wounded began to perish under the harsh circumstances. Another night passed, and in the morning the island of Vella Lavella was within reach. Survivors landed safely on the island. Two coast watchers and local natives cared for the survivors as best they could, and radioed news of them to Guadalcanal. The remaining 165 Sailors took to the jungle to evade Japanese patrols. Finally, Nicholas and Radford, augmented by *USS Jenkins* (DD 447) and *USS O'Bannon* (DD 450) set off July 15, 1943 to sail further up the slot than had been attempted before. On the night of July 16, the rescue team brought out the 165 *Helena* men, along with 16 Chinese who had been in hiding on the island.

Helena started with a crew of 900 men. All but 168 had survived the sinking and eventual rescue. Read stories told by the survivors on a site created by a former crewman of the *USS Helena* (CA-75) at <http://www.usshelena.org/celozzi.html>.



Wet and oil-covered survivors of *USS Helena* go over papers after their rescue from the waters of the Central Solomons, 6 July 1943. Official U.S. Navy Photograph

For a video of this discovery, visit
[HTTPS://WWW.YOUTUBE.COM/
WATCH?V=HAB4EBLXIAE](https://www.youtube.com/watch?v=HAB4EBLXIAE)



Cellula Robotics Awarded Defense Contract for Long-Range AUV Fuel Cells



Cellula Robotics Ltd. (Cellula) has been awarded a contract under Canada's All Domain Situational Awareness (ADSA) Science & Technology (S&T) Program to develop and perform a laboratory demonstration of an innovative fuel cell designed for use on a long range autonomous underwater vehicle (AUV). The demonstration will include operating in a simulated deep-water environment, supplying several hundred kilowatt hours of energy.

The fuel cell system will incorporate a novel hydrogen peroxide oxygen delivery system developed for this project by Protonex Technology Corporation, a subsidiary of Ballard Power Systems. By using hydrogen peroxide as the reactant, both the energy density and specific energy of the fuel cell system are greatly improved for subsea applications compared to conventional systems. It has the potential to dramatically reduce the cost of ocean exploration, observation, and mapping by allowing users to run month-long underwater autonomous missions, eliminating or reducing the necessity and cost of surface launch/retrieval vessels or manned submarines.

FOR MORE INFORMATION, VISIT
WWW.CELLULA.COM



Royal New Zealand Navy Adds FarSounder Sonar

FarSounder's flagship forward-looking sonar, the FarSounder-1000, is the latest cutting-edge gear slated to equip the Royal New Zealand Navy's (RNZN) future fleet replenishment tanker, *HMNZS Aotearoa* (A12). The company's longest range sonar will provide real-time 3D data as the tanker navigates the seas, giving the vessel's crew an elevated level of safety and security.

HMNZS Aotearoa is a Maritime Sustainment Capability (MSC) Vessel that is bound for use by the New Zealand Defense Force under the maritime arm, the RNZN. This new naval tanker will be replacing *HMNZS Endeavour*, a veteran ship in the RNZN scheduled for decommissioning in the near future. With construction underway in South Korea's Hyundai Heavy Industries Shipyard, this naval tanker will be the largest vessel in the RNZN fleet and be equipped with ice-strengthened and winterized steel for a full range of New Zealand Defense Force operations in Antarctica. This state-of-the-art technology along with

a FarSounder-1000 aboard, the *HMNZS Aotearoa* is the perfect ship to take over these duties of the aging *HMNZS Endeavour*.

Additionally, the tanker will be suitable for a number of missions, from logistics support to maritime protection, to humanitarian aid and disaster relief. FarSounder's innovative sonar will be used on the 24,000-metric ton vessel as it carries out operations in disaster zones with dangerous debris and changing seafloors and in the always challenging Antarctic environment.

FarSounder's South Korean dealer, Oceantech Co., is the facilitator for this project responsible for delivering the FarSounder-1000 for installation. The vessel's expected delivery date to its home port in New Plymouth is January 2020, with operations set to commence March 2021.

FOR MORE INFORMATION, VISIT
WWW.FAROUNDER.COM

BAE Systems to Upgrade Its Maritime Integration & Support Center

BAE Systems has announced a £10 million investment program to upgrade its Maritime Integration & Support Center (MISC) in Portsmouth - a specialist facility providing vital support for Royal Navy warships while researching future combat systems and technologies.

Located on Portsdown Hill and shaped like a Type 45 destroyer, the MISC facility accurately replicates real-life ship conditions using the same combat system technology found across the Royal Navy's surface fleet - including systems used to track threats, co-ordinate weapons and manage on-deck aircraft movements. The facility enables highly skilled engineers to develop and test key elements of combat systems before they are installed on ships and, once in service, provide them with through-life support.

Supporting the development of future combat systems, BAE Systems' £10 million investment program will research new technologies such as artificial intelligence, information and electronic warfare, unmanned vehicles and new weapons.

The MISC will benefit from new facilities including a state of the art visualization suite able to display live tactical data from any Royal Navy warship anywhere in the world, further enhancing warship support. The pioneering technology will provide BAE Systems' Naval Combat Systems Integration Support Services engineers with all the information they need to keep ships battle ready and support them in their deployments.

For more info, visit
WWW.BAESYSTEMS.COM/EN



USCG Commissions Fast Response Cutter, Names it after WWII Hero

The U.S. Coast Guard (USCG) commissioned a new Fast Response Cutter (FRC), the *Richard Snyder*, during a ceremony in Atlantic Beach on 20 April 2018.

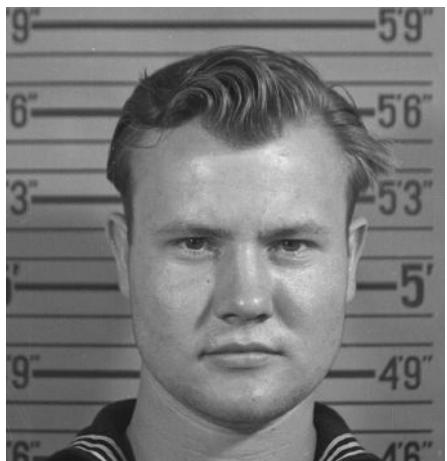
The cutter is named after Richard Snyder, a World War II hero known for his brave actions in battle defending troops coming to shore on the Island of Biak at the western edge of Papua New Guinea. Snyder was awarded the Silver Star and was entitled to six bronze stars on his campaign ribbons, which included the Asiatic-Pacific Theater Medal, the Philippine Liberation Medal and the Good Conduct Medal.

FRCs feature advanced command, control, communications, computers, intelligence, surveillance, and

reconnaissance equipment that allow their crews to more effectively conduct the Coast Guard's statutory missions. They are considered the mainstays of the coastal patrol fleet and have been a key part of coastal defense efforts since 1830.

Today's *Sentinel*-class FRCs perform drug and migrant interdiction; ports, waterways and coastal security; fishery patrols; search and rescue; national defense; and much more. Twenty-seven FRCs are already in service, with six stationed in Miami Beach, Florida; six in Key West, Florida; six in San Juan, Puerto Rico; two in Ketchikan, Alaska; two in Cape May, New Jersey; two in Pascagoula, Mississippi; two in Honolulu and this latest one in Atlantic Beach, North Carolina. Future FRC homeports

include; San Pedro, California; Galveston, Texas; Apra Harbor, Guam; and Astoria, Oregon.



The service record photo of Richard Thomas Snyder. U.S. Coast Guard photo.



SENSORS FOR:
Ocean, Harbors
Intracoastal
Lakes, Ponds
Wave Tanks

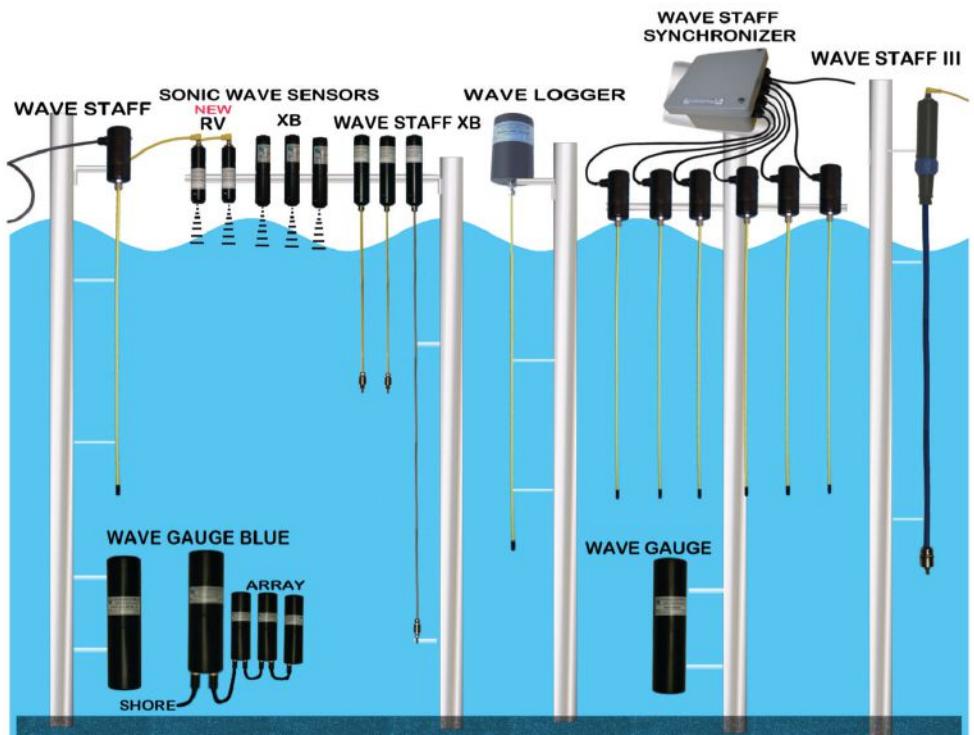
MEASURE:
Waves
Tides
Levels

DATA VIA:
Cable
Logger
Wireless

WE SUPPLY:
Tech Support
Software
Accessories
Custom Work

Ocean Sensor Systems

For Details Visit Us on the web or call 954-796-6583 USA
WWW.OCEANSENSORSYSTEMS.COM



MONTH IN REVIEW

ECA Group Awarded New Orders in the field of Naval Robotics

ECA Group has been awarded three export orders in its Robotics division, all of them concern naval domain. Two of these orders cover the supply of mine counter underwater robots and systems for robotization of ships enabling their transformation into surface drones (USV – Unmanned Surface Vehicles). The third order involves the supply of power conversion systems to be replaced on existing sub-marine equipment. These orders represent a cumulative amount of over €12 million. Deliveries will be spread over the next 24 months.

<https://www.oceannews.com/news/defense/eca-group-awarded-new-orders-in-the-field-of-naval-robotics>

Belgian Navy Renews SeeByte's SeeTrack Licenses for AUV Fleet

The renewal includes an upgrade to the latest version of SeeTrack V4, and comprises of operational support and SeeByte's Automatic Target Recognition (ATR) suite.

<https://www.oceannews.com/news/defense/belgian-navy-renews-seabyte-seetrack-licenses-for-aув-fleet>

Royal Saudi Navy Frigates to be Powered by Fairbanks Morse Engines

Fairbanks Morse has been awarded a contract to deliver eight FM | Colt-Pielstick diesel engines to power four frigates for the Royal Saudi Navy. The company also won a multi-year \$17.3 million contract to provide services to the U.S. Navy's Military Sealift Command (MSC).

<https://www.oceannews.com/news/defense/royal-saudi-navy-frigates-to-be-powered-fairbanks-morse-engines>

MVI Awarded IDIQ Multiple Award Contract from NAVFAC EXWC

Marine Ventures International Inc. (MVI) has been awarded an indefinite-delivery/indefinite-quantity, multiple award contract for capital improvements ocean facilities projects located within the Naval Facilities Engineering Command and Expeditionary Warfare Center (NAVFAC EXWC). The maximum combined dollar value including the base period and one option for all contracts under the award is \$245,000,000.

<https://www.oceannews.com/news/defense/mvi-awarded-idiq-multiple-award-contract-from-navfac-exwc>

Coast Guard Commandant Talks Icebreakers, Readiness

The recapitalization of the nation's polar icebreaker fleet is a matter of vital national interest, Coast Guard Commandant Adm. Paul F. Zukunft told reporters in Washington, D.C. on 11 April 2018.

"This is the highest priority for us right now," Adm. Zukunft said at a Defense Writers Group event. "It's the one area where we don't have redundancy in our national inventory when it comes to icebreakers."

The Arctic region has seen many changes since the Coast Guard released its Arctic Strategy in 2013, he said, such as receding sea ice and as increased human activity, which includes a larger Russian footprint in the region.

The Coast Guard recently put out its request for proposal for the advance procurement and detail design for the new heavy polar icebreaker, Adm. Zukunft said, noting he believes the program of record will eventually include six icebreakers.

The 2019 budget authorizes \$750 million for an icebreaker, the admiral said. Further, the National Defense

Authorization Act stipulates that the Defense Department fund an icebreaker.

The Coast Guard, which is a part of the Department of Homeland Security, currently has two operational icebreakers, the USCGC *Polar Star* and the USCGC *Healy*. The icebreakers enable the U.S. to maintain defense readiness in the Arctic and Antarctic regions, enforce treaties and other laws, and provide support to facilitate the movement of goods and personnel, as Adm. Zukunft outlined.

The comments echoed statements Adm. Zukunft made in February 2018 at West 2018, an AFCEA-sponsored naval conference and exposition held in San Diego. At that time, he not only said that the Coast Guard clearly needs to build new icebreakers, but he warned that the sealift fleet is so old that there are few mariners left who can operate the steamships. However, Adm. Zukunft also said that defense services must strive to build strength using alternative methods instead of ruing shortcomings. "The more we bemoan our readiness, the more an enemy is incentivized," he said.



Coast Guard Cutter Polar Star sits on blocks while the cutter undergoes depot-level maintenance in a dry dock facility in Vallejo, Calif., in preparation for the cutter's future polar-region patrol, April 16, 2018. The current polar icebreaking fleet provides the minimum capacity to meet the nation's most critical icebreaking needs but does not facilitate year-round access to the Polar regions or self-rescue. USCG faces challenges with repairing components on the Polar Star, commissioned more than 40-years ago, due to the inability to locate and replace the aging and obsolete parts. U.S. Coast Guard photo by Petty Officer 1st Class Matthew S. Masaschi.

IT'S WHAT'S ON THE INSIDE THAT COUNTS



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OIL AND GAS REACT DIFFERENTLY TO FEAR

BY G. ALLEN BROOKS | Author, *Musings From the Oil Patch* | www.energymusings.com

The never-ending winter of 2017-2018 continues delivering abominable weather to parts of the nation. The National Weather Service has begun naming winter storms, in keeping with its naming of tropical storms. We now know that Xanto delivered record April snowfalls to the upper Midwest and Great Lakes states. In fact, the 15.8 inches of snow that were dumped on Minneapolis/St. Paul, Minnesota, April 13-16, set a new record for that month. It also ranks as the 12th heaviest snowstorm in the history of those cities. This winter is depleting natural gas storage facilities at a record rate, creating fear among gas users about there will be adequate supplies for next winter. Their solace comes from growing gas production.

Fear reigns in the crude oil market, too, but not in the same way as in the gas market. Rather, it is economic and geopolitical concerns that have people concerned about oil supplies. An emerging global trade war, initiated by the U.S., and involving our leading trading partners, has people worried about an abrupt ending of the synchronized global growth cycle. These fears are amplified by geopolitical concerns, following the U.S. strike against Syria for its use of chemical weapons against its citizens. Either or both of these events could upend the global oil supply/demand balance.

Despite a growing list of global worries, it doesn't seem that commodity markets are concerned. Why?

Crude oil is the commodity that most likely should reflect those concerns. Oil is critical to a functioning world economy. WTI has bounced up and down recently in response to the news and speculation about Syria. Those ups and downs reflect traders' convictions that actions

could either heighten or lessen the risk of a Middle East oil disturbance.

WTI price movements since the start of 2016 tell an interesting story. Prices are reflecting a healthier oil market, as opposed to geopolitical fears. The chart shows daily WTI futures prices versus monthly domestic oil production. Oil output fell slightly during the first nine months of 2016. Since then, output has risen steadily, recently reaching all-time highs. The U.S. oil output climb has been accompanied by rising prices. In other words, oil traders are unconcerned about too much oil entering the market. They are more worried about a lack of future supply.

The concurrent rise in oil prices and domestic oil output speaks to the tightening global supply/demand balance helped by the OPEC/non-OPEC production cut agreement. Rumors about the continuation of the agreement have surfaced, but the key parties involved have indicated their satisfaction with it and see no reason to abandon it. The talk now is whether Saudi Arabia will extend the agreement in order to drive oil prices to \$80 a barrel or higher, in order to support the initial public offering of Saudi Aramco, next year.

The dashed red lines on the chart demonstrate an improving oil market. The line from spring 2016 to the fall of 2017 reflects an extended period when oil traded in the high \$40s-a-barrel range. That period helped establish that the market downturn had ended and gave industry participants time to sort out their business models, repair their balance sheets and make necessary cost adjustments to re-establish profitability in a low-price environment. The shorter 2018 dashed red line reflects the new plateau around which oil prices are likely to fluctuate in the future. A low- to mid-

\$60s-a-barrel price should be sufficient to stimulate more drilling and production, while not cutting off demand growth. This price level strikes us as critical for a healthy recovery, and one that can survive increased oil price volatility in response to the latest economic and geopolitical news. The underlying fundamentals are solidifying and will support a continuing oil industry recovery.

Given the rate at which natural gas storage volumes have been drawn down this winter, and the ongoing winter weather, one would expect fear to be driving natural gas prices. That doesn't appear to be the case. As the chart of production and Henry Hub gas futures prices demonstrates, even though natural gas storage volumes are 21 percent below the latest five-year average, it has yet to spark a price response.

Forecasts call for a second weekly gas storage draw in April, traditionally the start of the storage injection season. While the first week or so in the injection season often sees withdrawals, the projected 29 billion cubic feet to be removed from storage is one of the largest late-season draws. It is possible April will see a third weekly storage withdrawal before gas injections begin.

Although total gas in storage is down, and lower than at any point since the winter of 2008-2009, storage volumes are nearly 500 Bcf above the modern low mark established at the end of the 2013-2014 winter. The concern for the natural gas market should be shifting to focus on what price will be necessary to rebuild storage to meet not only this summer's need to handle the air conditioning load from a hot summer but to ensure sufficient supplies for next winter's demand. However, as the chart shows, since the price spike in December 2016, gas prices have trended steadily lower,

interrupted only by the January 2018 spike in response to a polar vortex Arctic cold spell. In other words, gas traders believe there is, and will continue to be sufficient gas supplies to meet increased demand.

That confidence is reflected by the growth in weekly dry gas production volumes, which has been confirmed by the official monthly production data from the government. In fact, there has been an inverse relationship between

gas output growth and gas prices. Is it possible this relationship might end anytime soon?

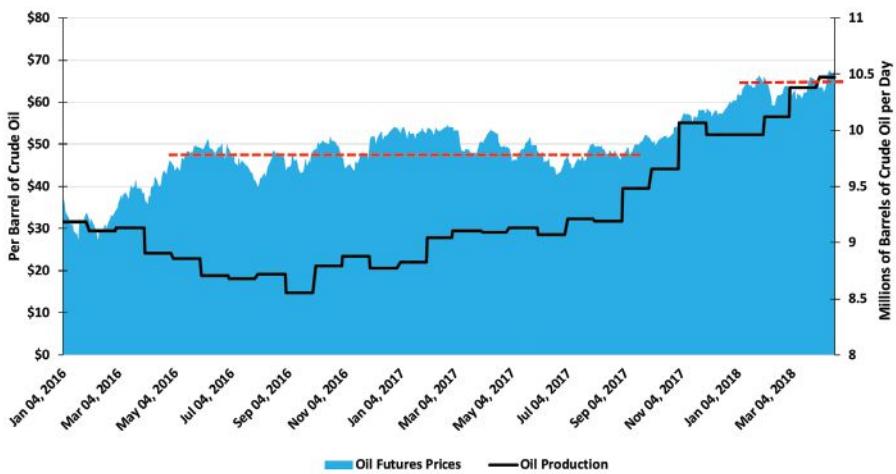
We note that the Energy Information Administration's monthly Short-Term Energy Outlook projects dry gas production to grow through the end of 2018. What may be a problem is that the EIA's April forecast projects dry gas production to fall by roughly 0.5 Bcf/d, or about 0.5 percent, in 2019. Will the market need to see production actually

fall before gas prices rally? If so, we may be waiting until year-end for that to occur.

Fear is a strong motivator. It is known to cause superhuman responses. Commodity markets usually don't need such stimulus, only a recognition of changing fundamentals. At the moment, there are few signs of impending changes sufficient to move these markets.

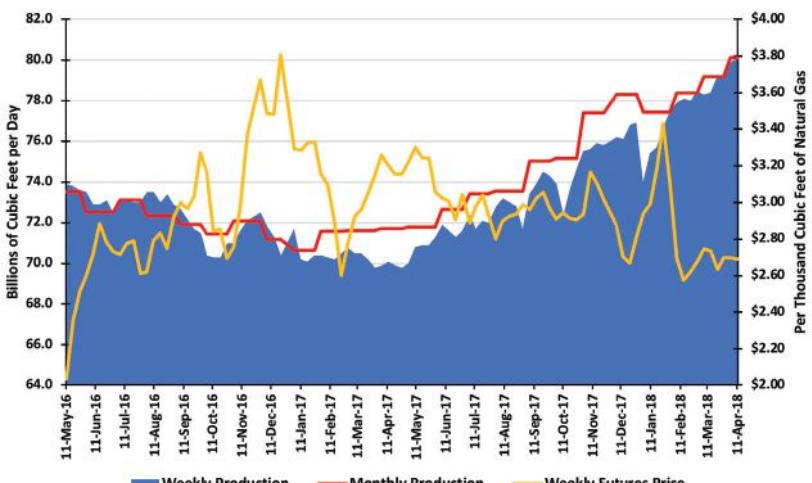
1.

CRUDE OIL FUTURES PRICES 2016-2018



2.

NATURAL GAS WEEKLY vs. MONTHLY PRODUCTION AND HH FUTURES PRICES

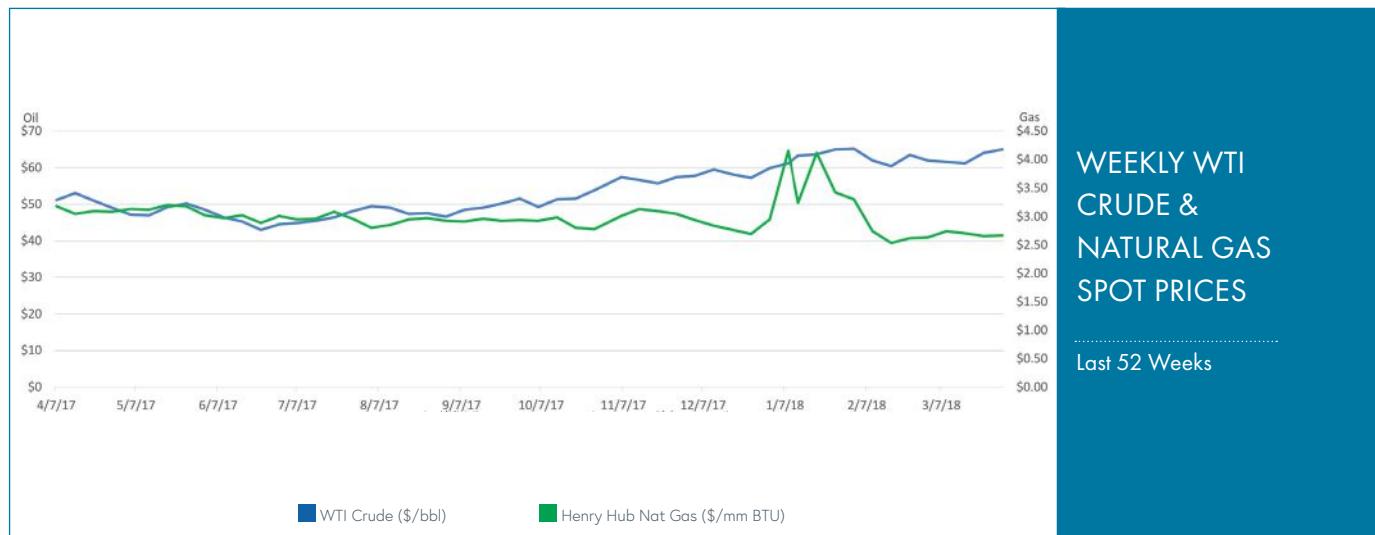


CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF APRIL 10, 2018

Oil prices regained some momentum in late March, moving back above \$64 per barrel by the end of the month. While still below the price levels seen during the coldest part of the winter, oil prices have gradually trended upward thus far in 2018.

Henry Hub natural gas spot prices continued to stabilize by the end of March following a roller-coaster ride during January when bitterly cold weather in the Northeastern United States drove prices above \$4 per million Btu. By the end of March, prices were back down to \$2.67 per million Btu, continuing the gradual trend downward that has been seen for the past year.



WEEKLY WTI
CRUDE &
NATURAL GAS
SPOT PRICES

Last 52 Weeks

\$64.97

\$61.28 previous month



TRENDING UP



Cushing, OK
WTI Spot Price

\$2.67

\$2.71 previous month



Henry Hub
Spot Price



TRENDING DOWN

KEY EQUITY Indexes

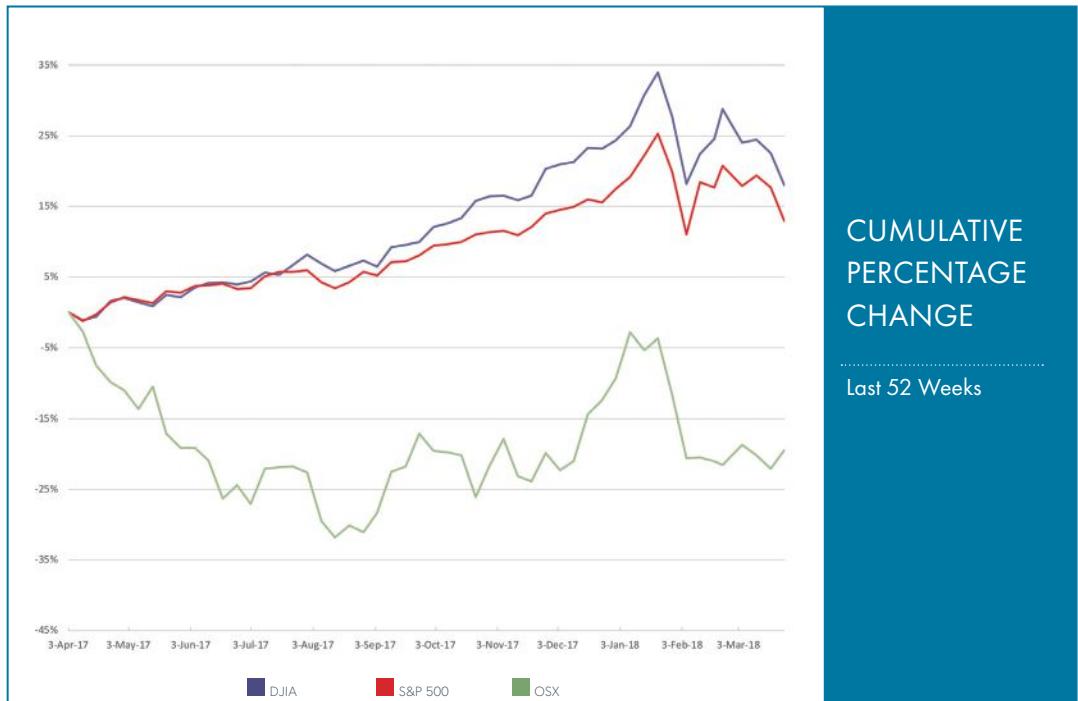
PRICES IN US DOLLARS AS OF APRIL 10, 2018

U.S. EQUITY MARKETS

continued to fluctuate wildly in 2018.

U.S. equity markets have been in decline since reaching a record high of over 26,000 points in late January. By early April, the **Dow Jones Industrial Average** was down to around 23,600. Losses have been attributed to fears of a trade war between the United States and China. The Dow also experienced strong rallies during March and early April, but overall is trending downward. Similarly, the **S&P 500** was down to below 2,600 points after record highs of over 2,800 points in January. The **OSX** also struggled, falling to just above the 130-point mark in early April after topping 160 points in January.

SELECTED EQUITY INDEXES



23,644.19

-118.55 from previous month



TRENDING DOWN

DJIA

2,581.88

-37.47 from previous month



TRENDING DOWN

S&P 500

132.13

-3.33 from previous month



TRENDING DOWN

OSX

ICCE

Baltimore, MD
July 30-August 3
icce2018.com

Int'l Cable Connectivity Symposium

Providence, RI
October 14-17
www.iwcs.org/

AWEA Offshore Windpower

Washington, DC
October 16-17
www.awea.org/events/event.aspx?eventid=50111&navItemNumber=8237

Clean Pacific

Portland, OR
June 19-21, 2018
2018.cleanpacific.org

Ocean Renewable Energy

Portland, OR
September 18-19
oregonwave.org/2018-conference

OilComm & FleetCom

Houston, TX
October 3-4
2018.oilcomm.com

MTS Dynamic Positioning

Houston, TX
October 9-10
dynamic-positioning.com

UDT

Glasgow, UK
June 26-28
www.udt-global.com/welcome-to-udt-2018

CORE

Glasgow, UK
August 26-28
www.offshore-renewables.co.uk

Ocean Energy Europe

Edinburgh, UK
October 30-31
www.oceanenergy-europe.eu/event/oee-2018/

ENGenius

Aerdeen, UK
September 4-6
engeniousglobal.com

Offshore Energy

Amsterdam, The Netherlands
October 22-24
www.offshore-energy.biz

ITST

Lisbon, Portugal
October 15-17
www.itst2018.org

WindTech Summit

Porto, Portugal
October 28-29
windtech.global/

ICOE

Normandy, France
June 12-14
www.icoe-conference.com

OMAE

Madrid, Spain
June 17-22
www.asme.org/events/omae

Tug, Salvage & OSV

Marseille, France
June 25-29
www.tugandsosv.com/its2018-home

UTC

Bergen, Norway
June 12-14
www.utc.no

Offshore Northern Seas

Stavanger, Norway
August 27-30
www.ons.no/2018

Deep Sea Mining Summit

London, UK
May 23-24
www.deepsea-mining-summit.com/

Naval Survey & Ocean Intelligence

London, UK
June 19-21
navsurveyandoceanintel.ipc.co.uk/

Baltic Clean Technology

Szczecin, Poland
October 17-18
www.baltic-clean-technology.com/

Offshore Wind Operations & Maintenance Forum

Prague, Czech Republic
June 28-29
www.offshore-wind-operations-maintenance.com/

SMM

Hamburg, Germany
September 4-7
www.smm-hamburg.com/en

WindEnergy Hamburg

Hamburg, Germany
September 25-28
www.windenergyhamburg.com/en

WindEurope

Hamburg, Germany
September 25-28
www.windeurope.org/summit2018

RemTech Expo

Ferrara, Italy
September 19-21
www.remtechexpo.com/index.php/en/

OTO'18

Kobe, Japan
May 28-31
www.oceans18mtsieekobe.org

AWTEC

Taipei, Taiwan
September 9-13
www.awtec2018.com

Submarine Networks World

Singapore
September 24-26
www.terrapinn.com/conference/submarine-networks-world/index.stm

2018 EDITORIAL CALENDAR

CALENDAR

JANUARY

EDITORIAL: Underwater Navigation; Manned Submersibles; Deepwater Pipeline/Repair/Maintenance
FOCUS: Multibeam and Side Scan Sonar; Oil Spill Prevention and Clean-Up Services

FEBRUARY

EDITORIAL: Oceanology; Maritime Security
FOCUS: Buoys and Monitoring Instrumentation; Diver Detection Systems; Training & Safety

MARCH

EDITORIAL: Offshore Technology; Subsea Fiber Optic Networks
FOCUS: Connectors, Cables & Umbilicals; Environmental Monitoring/Testing Services

APRIL

EDITORIAL: Meteorology; Ocean Mapping & Survey; Decommissioning & Abandonment
FOCUS: Subsea Tools & Manipulators; Data Acquisition Products; Seismic Imaging

MAY

EDITORIAL: Ocean and Coastal Engineering, Infrastructure, and Construction; Bathymetric Mapping
FOCUS: Cranes, Winches & Control Systems; Water Dredges and Airlifts

JUNE

EDITORIAL: UW Imaging and Processing; UW Archaeology
FOCUS: UW Imaging and Processing; Tracking and Positioning Systems; Magnetometers

JULY

BUYER'S GUIDE

AUGUST

EDITORIAL: ROV and AUV Technology
FOCUS: Cameras, Lights and Imaging Sonars; Vehicle Sensor Suites

SEPTEMBER

EDITORIAL: Offshore Wind Installation and Maintenance; Offshore Supply & Emergency Vehicles
FOCUS: Offshore Support; Turbines; Offshore Wind Inspection Services

OCTOBER

EDITORIAL: Offshore Communications; Subsea Telecom; Subsea Inspection, Monitoring, Repair & Maintenance
FOCUS: Marine Communications; Cable Installation Services

NOVEMBER/DECEMBER

EDITORIAL: Year in Review; Commercial Diving and Salvage; Ocean Observing Systems; Ocean Science & Exploration
FOCUS: Acoustic Modems, Releases and Transponders; Diving Equipment and Services; Salvage; Buoyancy Materials

SHOW DISTRIBUTION

JANUARY

GoM Oil Spill & Ecosystem - February 5-8
Underwater Intervention - February 6-8
Subsea Expo - February 7-9
Decomm & Abandonment Summit - February 20-21

FEBRUARY

Oceanology International - March 13-15
Asia Pacific Maritime - March 14-16 *
CUC-E - March 25-27 *

MARCH

Int'l Offshore Wind Forum - April 3-6
OTC - April 30 - May 3

APRIL

TBD

MAY

ICOE - June 12-14
Clean Pacific - June 19-21

JUNE

UDT - June 26-28 ^

JULY

TBD

AUGUST

SMM - September 4-7 ^*
Submarine Networks World - September 24-26 *
MTS Dynamic Positioning - October 9-10 ^
OCEANS '18 - October 22-25 ^

SEPTEMBER

Wind Energy Hamburg - September 25-28 ^
AWEA Offshore Wind - October 16-17 ^
Offshore Energy - October 22-24 ^
Ocean Energy Europe - October 30-31 ^
Pacific Marine Expo - TBD

OCTOBER

Clean Gulf - November 13-15 ^
Offshore Well Intervention - TBD

NOVEMBER/DECEMBER

TBD

* Digital Distribution

^ Pending

MILESTONES



Leaders & Innovators Drive Change for Ocean Conservation Issues at Inaugural Rising Tide Summit

The inaugural Rising Tide Summit – with support from the XPRIZE Ocean Initiative and AltaSea at the Port of Los Angeles – was held on March 28 and 29 at Brouwerji West in San Pedro, CA. The conference convened business leaders, thinkers and innovators to discuss and unite on issues and solutions surrounding ocean conservation. Attendees heard from those on the frontline of the issues that our oceans are facing but also from businesses and innovators who are working toward effective solutions. For more information about the Rising Tide Summit, visit <https://risingtidesummit.net>. Join the conversation #RisingTideSummit.



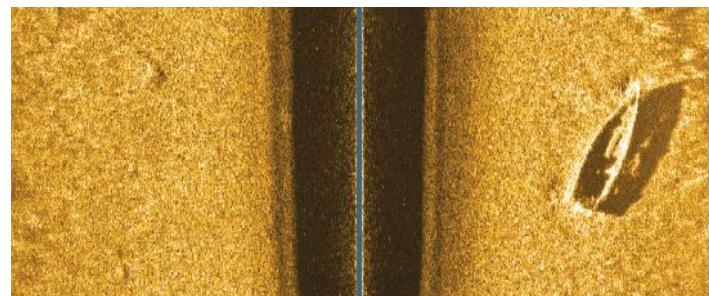
RockSalt Subsea Dive into Energy Central

Energy Central has welcomed its newest tenant, as a family owned subsea dive firm returns home to Blyth, UK. RockSalt Subsea provides commercial diving services for the offshore energy and ports facilities across the world. The company, which was established in Aberdeen by Blyth-based entrepreneur Tony French and his family, is opening a new project office at Arch's Blyth Workspace as part of Energy Central.

RockSalt Subsea has expanded into Blyth to capitalize on the offshore energy and subsea cluster closer to his original home. The company has over 50 years' experience in the commercial diving industry and has undertaken project work scopes for clients, including fully integrated health and safety processes across the UK. For more information, visit: <http://www.rocksaltsubsea.com>.



Thermal Paper Image of Boat on Lake Floor 1992



Computer Interface Image of Boat on Lake Floor 2017

JW Fisher's Celebrates 50 Years of Innovation and Service

In 1968, Jack W. Fisher began developing underwater search equipment, setting the stage for JW Fishers to become the most trusted name in underwater search equipment. The JW Fishers story began when Jack Fisher, an avid diver, required an underwater metal detector for use on a salvage project. He discovered that there was no such device available, and over the next several years built his own; the Mark 1. Jack's detector quickly gained popularity and, after marketing the product, customer demands for new and more powerful models developed quickly. As a result, the company expanded the product line from diver-held detectors to boat-towed metal detectors (Mark 7) and magnetometers (Proton 1).

In the early 1980's, exploration of our oceans was reaching new heights and underwater video options became a necessity. The DV-1 dropped camera system was introduced to maintain industry leadership. In 1987, the award-winning Pulse 8X hand held underwater metal detector hit the open market with large success. It became the "workhorse" of the metal detector world and was rated #1 by U.S. Homeland Security in 2014. JW Fishers' first ROV, the SeaOtter, was introduced in 1989. This 85-pound remote operated vehicle had four motors, a color camera, and a depth rating of 500 feet.

Over the next two decades, JW Fishers brand and technologies advanced rapidly. In 1994, the company moved from its original location, a facility hand-built by Jack and the original JWF team, to a newer and larger building more suited for the company's expanding family and product line. In 1994, a larger ROV, the SeaLion, was introduced with a 1,000' depth rating. This beast weighed-in at 125 pounds with six motors and a variable speed, reversible propulsion system. Ultimately, both ROVs received a redesign to become smaller and more powerful in the mid 2000's. In 1993, JW Fishers' first side scan sonar system was introduced, allowing operators to "paint the bottom" of the ocean floor on thermal imaging paper. Acoustic pingers were also added as a way to mark the location of underwater sites and oceanographic instruments. Cable and pipe trackers followed suit in addition to scanning sonar systems and JW Fishers' sub bottom profiler. The JWF brand was again expanded in 1999 when the first iteration of the www.jwfishers.com website was launched.

Recently, Fishers introduced the SAR-1 search and recovery metal detector; JW Fishers' first wireless, "snareless" metal detector specially designed for use by public safety dive teams, law enforcement agencies, and military units that need to locate metal objects in poor water visibility. The SAR-1 alerts the operator to the presence of metal through vibration along with a high intensity LED display.

JW Fishers' decades of innovative momentum has continued into 2018 with the debut of the newest boat towed detector; the Proton-5. This fifth-generation magnetometer boasts new backlit LCD screens, auto-tuning, and a modular design for easy storage.

JW Fishers will be celebrating the milestone year with a tribute on www.jwfishers.com.

MILESTONES



Paul Braiden, BiSN Operations Manager

BiSN Reinforces Global Growth Plans with Key Appointment

BiSN, a global leader in innovative metal-to-metal downhole sealing solutions, has underlined its strategic plans for global growth with the appointment of Paul Braiden as operations manager. Paul brings more than 20 years of experience to the award-winning company and will be responsible for managing worldwide field operations for BiSN. For more information, visit www.bisn.com.



President of Petrobras Pedro Parente said: "Our partnership is based on common values and business principles that guide both companies."

BP and Petrobras Form Strategic Alliance

BP and state-owned Brazilian oil company Petrobras have announced that they have signed a memorandum of understanding to form a strategic alliance to jointly explore potential business opportunities both in Brazil and beyond. The memorandum of understanding will see the companies explore cooperation in areas including upstream, downstream, trading and across low carbon initiatives. The alliance is also expected to include the transfer of technology, as well as joint training and research. For more information, visit www.petrobras.com.

UDT
Undersea Defence Technology

26–28 June 2018
SEC, Glasgow

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 Website: www.appliedacoustics.com
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Manufacturer of fully integrated USBL acoustic tracking systems, both portable and vessel based, high quality multi-system compatible beacons for acoustic positioning and release, and seismic sub-bottom profiling systems for coastal, offshore or geohazard surveys. All products are supported by a network of overseas representatives providing a first class service on a global scale.

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 Contact: Glenn Pollock



Experts in rugged marine sensor systems utilized in geophysical surveys, anti-submarine warfare, marine mammal monitoring and downhole applications. Products include data acquisition systems, hydrophones, array cables, pressure vessels and peripherals related to marine systems.

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 Website: www.oceansonics.com



Ocean Sonics designs and manufactures the icListen, a compact self-contained easy to deploy digital hydrophone. As the world leader in gathering ocean sound, Ocean Sonics combines very high signal performance with innovative ease of use, to give customers the best digital hydrophone technology available. It's a compact, all-in-one instrument capable of processing data while collecting in real-time.

Creating Acoustic Arrays is now simple. Connect two or more icListen hydrophones together and they self-synchronize, operating as one. Ocean Sonics offers a wide range of geometries, including vertical, horizontal, autonomous, very small geometrical arrays, or spread out over many kilometres.

RTSYS
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 Website: www.rtsys.eu



- Acoustic Monitoring: EASDA14, Embedded Multichannel Passive Acoustic Recorders
- WiFi remote Buoy: BASDA14, Multi-sensor & Rechargeable Acoustic Buoy accessible in Real-time
- Sediment Characterization: INSEA, Acoustic Velocimeter for Sediment Characterization

We provide advanced embedded acoustic products in the environmental research, surveying and monitoring areas. With Synchronized Multichannel Acquisition and accepting a broad range of Acoustic Transducers and Hydrophones from 3Hz to more than 1MHz, our solutions allow the user a new range of applications.

ADCP/DVL

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Nortek excels in the development and manufacture of acoustic Doppler instrumentation. Doppler Velocity Logs (DVLs) are used for subsea navigation. Acoustic Doppler Current Profilers (ADCPs) are used to understand physical processes in the ocean, rivers, lakes and laboratories. We pride ourselves on being innovative in product development and production processes. Nortek provides solutions to engineers and scientists by offering real-time data collection and support from our responsive technical team.

ROWE TECHNOLOGIES, INC.

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 Website: www.rowetechinc.com
 Contact: Chris Arends, Global Sales Director



Rowe Technologies designs and manufactures state-of-the-art Acoustic Doppler Current Profilers (ADCPs) and Doppler Velocity Logs (DVLs), applicable to an array of current measuring and navigational deployments for world-wide use, in oceans, lakes, and rivers. Rowe Technologies 7,100 ft² facility is headquartered in San Diego California and was founded in 2009 by Dan and Steve Rowe, the sons of Fran Rowe who is the originator of the Acoustic Doppler Current Profiler (ADCP) and co-founder of Teledyne RDI. Rowe Technologies highly experienced, innovative staff has over 250+ years of Doppler system development experience and is on the preponderance of ADCP patents.

BUOYS

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 E-mail: emily@metocean.com
 Website: www.metocean.com
 Contact: Emily MacPherson

MetOcean Telematics designs and manufactures drifting buoys, environmental platforms, and the world renowned NOVATECH locator beacon product line. In addition to providing complete end-to-end telematics services, and one of the few manufacturers in the world to achieve ISO 9001 certification. MetOcean Telematics' drifting buoy family consists of environmental and weather monitoring, oil spill response, and search and rescue drifters: NOVA profiling float, Iridium SVP (iSVP), iSPHERE, Argosphere, SLDB, and iSLDB.

BUOYANCY PRODUCTS

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 E-mail: sales@deepwb.com
 Website: www.DeepWaterBuoyancy.com
 Contact: Dan Cote, Sales Manager

DeepWater Buoyancy creates subsea buoyancy products for leading companies in the oceanographic, seismic, survey, military and offshore oil & gas markets. Thousands of customers have relied on our products for over thirty-five years, from the ocean surface to depths exceeding six thousand meters.



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Nautilus Marine Service provides the finest VITROVEX® glass housings that are capable of operating in the most extreme regions of the Earth. VITROVEX® glass enclosures offer the dual advantage of buoyancy and pressure proof housings - a perfect combination for small and autonomous underwater instrumentation packages.

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 Contact: Richard Fryburg

Since 1977 Subsalve USA has been America's #1 manufacturer of standard and custom flotation devices and we are the innovators in buoyancy and engineered inflatables. Our products include: Professional, Commercial, Standard, Shallow Water, Enclosed Flotation Bags, Cable & Pipeline Floats, Water Load Test Bags, Rapid Recovery & Mark V/ORCA EOD Systems.

CABLES

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Contact: Marco Cano



Cortland has more than 30 years of manufacturing experience supplying custom-designed electro-optical-mechanical cables. We provide solutions that meet the challenges posed by harsh environments, hydrostatic pressures, and high mechanical stresses.

We manufacture custom EOM cables assemblies for various subsea applications which include CTDs, hydrophones, magnetometer, tow cables, ocean bottom, ROV cables, and other custom application. Our global presence and industry-leading design engineers, manufacturing facilities, and management teams, work together to implement integrated solutions with unsurpassed reliability that support the needs of customers worldwide. Visit us online at cortlandcompany.com

FALMAT CABLE

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Contact: Shawn Amirehsani



For over 50 years, Falmat Cable has been a key supplier and a solution provider to many global OEMs and end users supporting a wide range of marine applications. We design and manufacture high performance cables for use in harsh and demanding environments. Our rugged Xtreme cables are known and preferred worldwide for superior reliability and durability in commercial and military projects. We offer XtremeMarine cables with precision coaxial components for use with SD/HD video requirements, wet rated submersible pump cables, miniature fiber optic cables, a comprehensive range of highly engineered ROV Tethers plus our well recognized Xtreme Ethernet cables. Falmat is a Certified ISO9001/AS9100 organization. Visit our web site: www.falmat.com.

SOUTH BAY CABLE CORP

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Website: www.southbaycable.com
Contact: Gary Brown, Sales Manager



Since 1957, South Bay Cable Corp has designed and manufactured specialized electrical, electro-mechanical and electro-optical-mechanical cables for use in demanding marine environments. Cables are designed to meet customer requirements and include tether and umbilical cables for ROVs, tow cables, video inspection, faired cables and a host of other customer specific applications.

CONNECTORS

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Contact: Eric Birns



BIRNS, Inc. has been serving the subsea industry since 1954, and is an ISO 9001:2008 certified global leader in the design and manufacturing of high performance connectors, custom cable assemblies and lighting systems. With a NAVSEA PRO-020 certified molding facility, the company leads the industry with sophisticated connector lines, including exceptional 6km-rated electrical, electromechanical, coaxial, electro-coax, optical, electro-optical and electro-opto-mechanical hybrid options. BIRNS provides the industry's highest volume of cost-effective hydrostatic and helium pressure testing, and has a wide range of ABS Product Design Assessment (PDA) certified fiber optic and electrical penetrators. BIRNS also delivers brilliant LED and tungsten-halogen marine, chamber, security and commercial diving lights trusted in the world's most extreme environments.

BIRNS AQUAMATE LLC

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E-mail: sales@birnsaquamate.com
Website: www.birnsaquamate.com
Contact: Eli Bar-Hai



Birns Aquamate design and manufacture underwater electrical connectors, cable assemblies, and cable terminations. The company produces a wide range of standard industry connectors such as the 5500 Series, SC, MC, LP, FAWL/FAWM, Rubber Molded, etc. BIRNS Aquamate is the only underwater connector producer that guarantees compatibility with other manufacturers. Birns also specializes in fast turn-around for custom design of special connector solutions. Stocking dealers in the UK, South Africa and Holland as well as dealers in Canada, Germany, Belgium, Norway, China, and Brazil.

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The SEACON Group are world leaders in underwater connector technology and provide an extensive and diverse range of electrical, optical and hybrid connector assemblies, submersible switches and cable system solutions for many applications within the Oceanographic, Defense, Oil and Gas and Environmental markets. With locations in California and Texas, USA, Mexico, Brazil, the United Kingdom and Norway and a worldwide network of agencies and representatives, SEACON is able to supply very quick solutions to any requirements across the globe.

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Website: www.teledynemarine.com



Teledyne Marine Interconnect Solutions integrates the resources of ODI, DGO, Impulse, and Cable Solutions into a single organization that supplies innovative, high-performance solutions for harsh environment interconnect. Solutions for these harsh environments include wet-mate, splash-mate and dry-mate connectors, pressure boundary penetrators, cable assemblies, cable terminations, and custom-engineered encapsulation and molding. TMIS contains a broad portfolio of field-proven, time-tested electrical, optical, and hybrid interconnect capabilities optimized for applications where performance and reliability are imperative. Products are available as stand-alone items, or as complex solutions that integrate technologies into advanced, value-added systems.

DESIGN & ENGINEERING

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Website: www.hydroleduc.com



Hydro Leduc is a specialist in the design and manufacture of hydraulic piston pumps, hydraulic motors, hydro pneumatic accumulators, and customized hydraulic components satisfying customer needs with reliable products from a reliable source. As the leader in micro hydraulics, it is feasible to obtain several tons of force from a minimal power source within a restricted space envelope. The techniques of micro hydraulics allow simple solutions to problems that are often beyond the limits of traditional mechanical options. Hydro Leduc's expertise is at your service in varied applications such as oil service tools, oceanographic instrumentation, aeronautics, and any extreme working condition of temperature, pressure, medium, and environment.

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Okeanus is the premier rental provider for oceanographic and marine scientific research equipment utilized in nearshore and offshore projects around the world. Focused on providing industry-leading customer service, Okeanus offers advanced, high-quality technology coupled with knowledgeable and experienced staff that can deliver dedicated support regardless of a project's location.



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Ocean Specialists, Inc. (OSI) is a developer of undersea cable projects and technology with global project capabilities. OSI works with clients during all project phases of subsea network development, from planning and design to procurement and implementation. Our customers, primarily representing Oil and Gas, Telecommunications and Ocean Observing, recognize the value of fiber optic networks to their field and services solutions, and look to OSI to deliver the skills and experience that developing these networks require.

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KONGSBERG

Kongsberg Seatex is a leading international marine electronics manufacturer specializing in the development and production of precision positioning and motion sensing systems. Our commitment is to provide quality products and solutions for safe navigation and operations at sea in the commercial offshore, maritime, hydrographics and defence industries.

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ATL specializes in the design/manufacture of custom bladder-type fluid containment systems, including tanks, inflatables, pillows and bellows for surface and subsea. ATL's flexible fluid containers boast unparalleled chemical tolerance, abrasion resistance, and remarkable durability - used with methanol, diesel fuel, gases, ethyleneglycol, hydraulic fluids and chemical cleaning cocktails. Expedited deliveries are also available.

MARINE ENVIRONMENTAL CONSULTING SERVICES

CSA OCEAN SCIENCES INC.

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Contact: Gordon Stevens



CSA Ocean Sciences Inc. (CSA) is a marine environmental consulting firm specializing in multidisciplinary projects concerning potential environmental impacts of activities throughout the world. With extensive experience in environmental sciences and technical field operations, CSA is staffed and equipped to offer a complete range of services for projects in offshore, nearshore, estuarine, wetland, and freshwater environments.

MOTION SENSING EQUIPMENT

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Advanced Navigation is a privately owned Australian company that specialises in the development and manufacturing of navigation technologies and robotics. The company has a focus on generating products of the highest quality standard, both in terms of hardware and software. Advanced Navigation has specialised expertise across a broad range of fields including sensors, GNSS, inertial navigation, RF technologies, acoustics, robotics, AI and algorithms. Advanced Navigation is an ISO 9001 certified company and maintains a strict quality control system across the two research facilities and three manufacturing facilities that they operate in Australia. Advanced Navigation is a carbon neutral company, offsetting all emissions due to energy use through the planting of trees.

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EvoLogics provides the world's most advanced spread-spectrum underwater communication systems (S2C) with multi-channel data management, networking capability, built-in tracking and positioning functions with USBL. Data loggers, acoustic wake-up module and releasers optionally included. Deployments in offshore platforms (FPSO, ABS), environmental monitoring, defense systems, ROV and AUV operations and more. Applications include simple positioning and sensor information to transmission of underwater photos.

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Kongsberg Seatex is a leading international marine electronics manufacturer specializing in the development and production of precision positioning and motion sensing systems. Our commitment is to provide quality products and solutions for safe navigation and operations at sea in the commercial offshore, maritime, hydrographics and defence industries.

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- Oceanographic Products:** Acoustic Zooplankton Fish Profiler (AZFP), Ice Profiler IPS5 & shallow water SWIP, Wave Profiler, Acoustic Scintillation Flow Meter (ASF), Imagenex scanning sonar logger (IRIS), instrument cages, bottom frames. Custom acoustic system integration.
- Consulting:** Field work, data collection, analyses, numerical modelling, acoustics, remote sensing, oceanographic mooring design and system integration.
- Manufacturer's Representative:** Teledyne RD Instruments, Teledyne Oceanscience, Teledyne Benthos, Deep Water Buoyancy, WERA Northern Radar.

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EdgeTech designs, manufactures and sells industry-leading side scan sonars, sub-bottom profilers, bathymetry systems and combined sonar systems. Additionally, the company produces world class underwater actuated and transponding solutions including deep sea acoustic releases, shallow water and long life acoustic releases, transponders, reliable USBL acoustic tracking and positioning systems, and custom-engineered acoustic products.

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Kongsberg Maritime

Kongsberg Maritime is a marine technology company providing innovative solutions for all marine industry sectors including merchant, offshore, subsea, naval and fisheries. The company delivers systems that cover diverse maritime applications. Within subsea, Kongsberg Maritime's sonars, Sub-bottom profilers, multibeam and single beam echo sounders, cameras, positioning and underwater communication & monitoring systems, instruments, software and Marine Robotics are used in survey and inspection operations worldwide. Working closely with customers to develop technology that pushes the limits in subsea applications, Kongsberg Maritime is also dedicated to developing innovative environmental monitoring solutions such as the K-Lander system in addition to cutting-edge Marine Robotic platforms such as the futuristic Elumee vehicle.

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The poster features a blue and white wavy background representing water. At the top, the ICOE 2018 logo is displayed, followed by the text "BLUE ENERGY FOR A BRIGHT FUTURE" and "The first leading international event on Ocean Energy". The date "12 / 14 JUNE 2018" is prominently shown. Below this, the location "CHERBOURG NORMANDY FRANCE" is indicated with a yellow location pin. The bottom left contains the website "www.icoe2018normandy.eu". The bottom right features social media handles "@BluesignEvents" and "#ICOE2018", along with the Twitter logo. Logos for "blue sign", "OES", "Normandie", "La Manche", "le Cotenin", and "Cherbourg en Cotentin" are also present at the bottom.

ADVERTISER'S INDEX

Airmar/MSI Transducers.....	7	Ocean Specialists, Inc.....	42
www.airmar.com		www.oceanspecialists.com	
CSA Ocean Science Inc.	4	PT. Marine Propulsion Solutions.....	25
www.csaocean.com		www.marinepropulsionsolutions.com	
Evologics GmbH	67	Riptide	5
www.evologics.de		www.riptideas.com	
FarSounder, Inc.	17	RTSYS.....	37
www.farsounder.com		rtsys.eu/en	
Hawboldt Industries	68	SAAB Seaeye	9
www.hawboldt.ca		www.seaeye.com	
International Conference on Ocean Energy.....	65	Shark Marine Technologies, Inc.	35
www.icoe-conference.com		www.sharkmarine.com	
JW Fishers Manufacturing, Inc.	26	SubCableWorld.....	41
www.jwfishers.com		www.subcableworld.com	
MacArtney A/S	3	SubCtech GmbH.....	19
www.macartney.com		www.subCtech.com	
Morgan & Eklund	36	Undersea Defence Technology	58
www.morganeklund.com		www.udt-global.com	
ON&T Buyers Guide.....	49	VideoRay.....	2
www.oceannews.com/uv-buyers-guide.com		www.videoray.com	
Ocean Sensor Systems.....	47		
www.oceansensorsystems.com			

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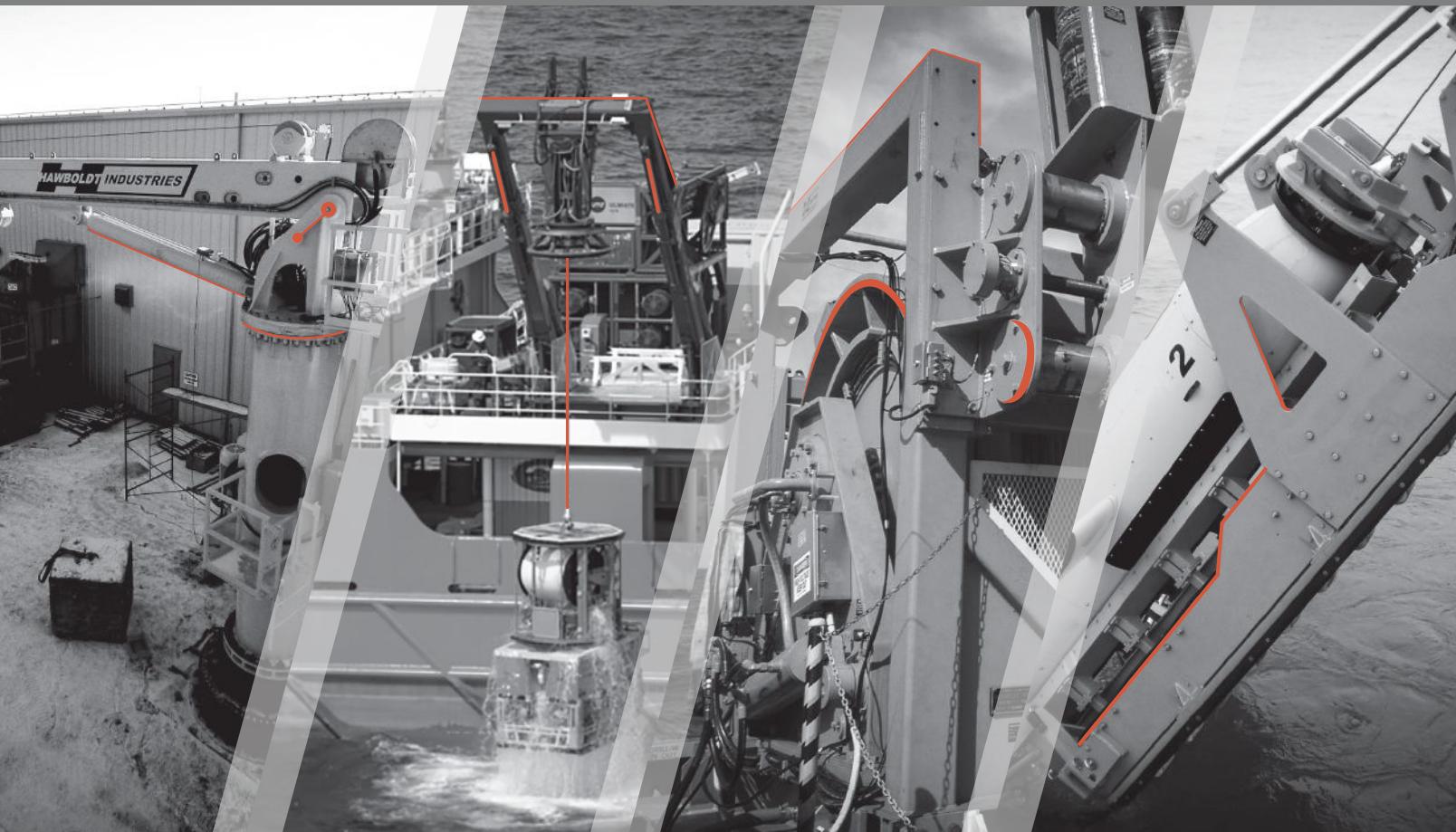
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