

December 2017

ON&T

Ocean News & Technology

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FEATURE STORY

THE OCEAN TECHNOLOGY INDUSTRY: Year in Review

Page 10



No Compromise

RELIABILITY

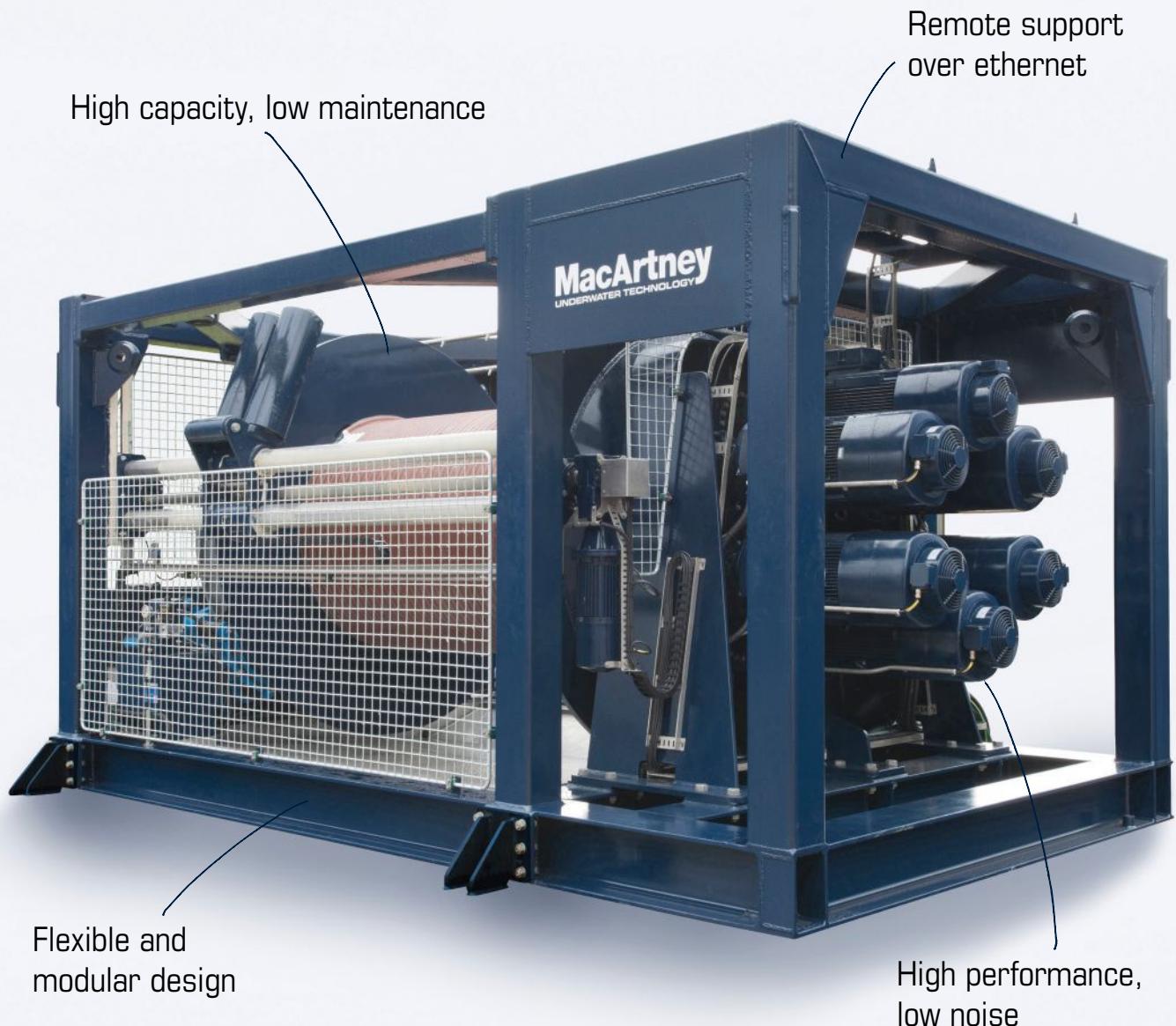
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A vibrant underwater photograph featuring a bottlenose dolphin swimming gracefully over a coral reef. The dolphin is positioned in the upper left, facing right. The reef below is composed of various corals and rocks, with patches of green seagrass and bright orange soft corals. The water is a clear, translucent blue.

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Defines portability



Defines versatility

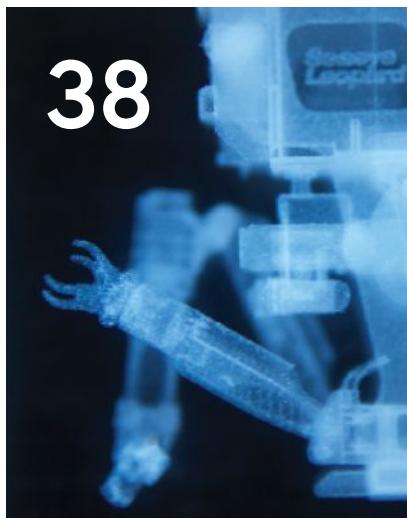
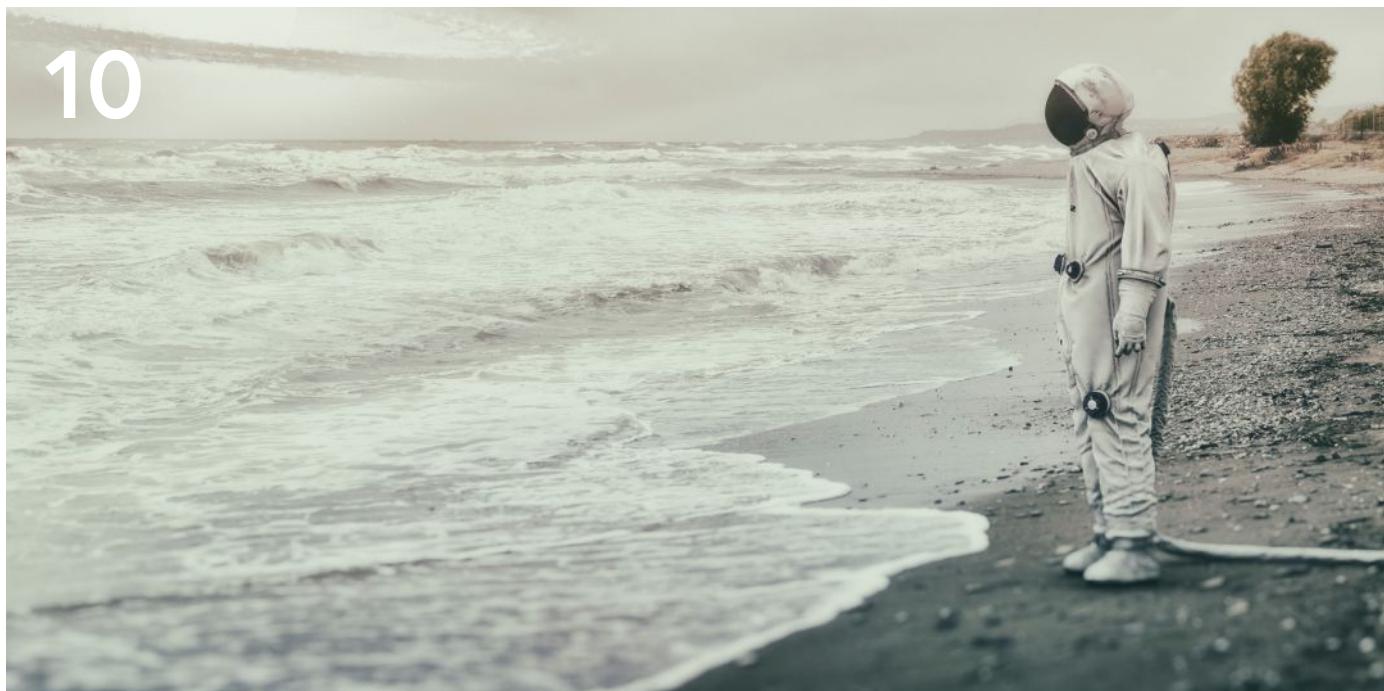


Defines capability



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10



DEPARTMENTS

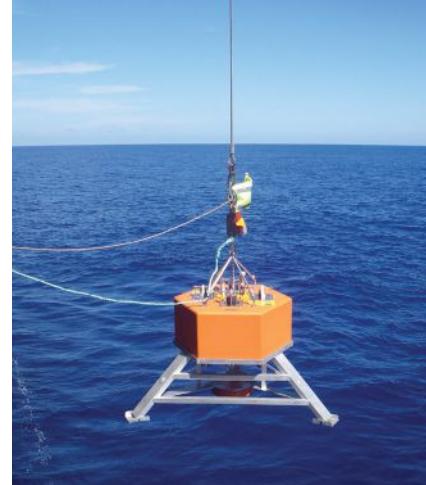
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ON THE COVER:
DeepWater Buoyancy's NOC
Benthic Lander being deployed.

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EDITORIAL

DONNA KOCAK
President,
Marine Technology Society



WORLDWIDE TRENDS in Ocean Observing

Technology and development trends often follow a common path and 2017 was no exception. Most notable is the theme of establishing and strengthening international partnerships and connections to collect and share data. For example, nearly 400 researchers from 30 countries are using Canada's OTN tag data to document movements of aquatic species.

Another trend is adding mobile data collections. Ocean drifters and vessels of opportunity, such as ferry boats, are occasionally used; but the use of glider fleets is on the rise. Most recently is the Canary Island's PLOCAN glider fleet. Australia's IMOS, together with Rutgers University, are planning the next leg of the Challenger Mission glider that will cover 6,200 km of the Indian Ocean from Perth to Sri Lanka.

Ocean observatory developments have also produced many new tools. Software and servers are needed to collect, store, process and visualize large amounts of data. U.S. IOOS has created an Environmental Sensor Map that connects over 32,000 stations, and an Environmental Data Server for visualization and analysis of integrated model output. India Ocean Observing System researchers have developed an Android mobile "app" to view both real-time and historical buoy data.

In the coming year, we can expect a wider use of autonomous vehicles and don't be surprised to see cross-domain drones working together. For example, picture a quadcopter launching from its recharging station atop an unmanned surface vehicle (USV) that is navigating a marine estuary or coastal waterway. In-flight imagery of the water's surface, possibly sub-surface, and adjacent shoreline is collected from above, while the USV gathers in situ data and water samples along a similar path. Both data sets can be fused for water quality studies. As with air drones, this will require new policies for operating near manned vessels.

We'll see the integration of smallsat and cubesat data. We'll see a wider use of scale manufacturing, less expensive sensors and autonomies working together. Low size, weight, power and cost (SWaP-C) integrated circuit (IC) and micro-electro-mechanical systems (MEMS) sensors will replace costlier traditional sensors. Spreading lower-cost, short-lived drifting sensors over large areas, using drones, will provide data to fill gaps and better inform models. These sensors may even collect environmental DNA (E-DNA).

We'll also see cooperation among sensors, whether these are intelligent sensors or just novel data fusion algorithms. Sensor data, disparate or similar, can be combined to provide a more complete picture. In some cases, even no data can be useful (data discovery). As more data is gathered by these means, we'll see better models and predictions.

Finally, expect more ocean economic services — the growth of the "New Blue Economy." There will be wider cooperation across sectors, both inside and outside of the maritime community, that take advantage of technology and deliver data that affords new ways to make more informed decisions.

For the past nine years, the Marine Technology Society has been following the progress of ocean observatories around the world and are proud to share our findings annually in ON&T. This year's full update can be found at <http://ont.news/2Bt4OWJ>.

With Great Power Comes Great Responsibility



Heavy duty subsea applications demand electromechanical cable assemblies that can be trusted to provide immense power, signal and voltage capabilities, while ensuring extreme resistance to physical abuse.

Whether it's on a work class ROV or a power drill deep in Antarctic ice, the BIRNS Primum™ connector series can take a beating while delivering precise and repeatable performance characteristics for a diverse range of applications. Open faced pressure rated to 6km, the series handles power requirements even above 3kV, with up to 40 electrical contacts in configurations from 2 to 20AWG.



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THE OCEAN TECHNOLOGY INDUSTRY: YEAR IN REVIEW

**From
the depths of our
oceans to outer space,**

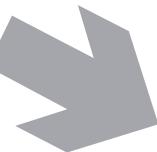
2017 has been the year that micro technology has really come to fruition. Technologies for monitoring our oceans from both above and below the water's surface are downsizing, making data more accessible and affordable than ever before. The shift towards affordable ocean sensors and micro-satellites has also catalysed the entrepreneurial movement emerging today. Start-ups and small businesses that couldn't have entered the market five years ago are doing so. Innovations in subsea drones and CubeSat space technology are helping to mainstream data collection and form a bigger picture of the health and intricacies of this planet. We are also pushing the limits of technology to the deepest depths of the oceans, revealing new species, habitats, and valuable marine resources important for sustaining our growing civilization. It has been a truly exciting year, and here is a glimpse of what transpired in the ocean-tech industry in 2017.



IT HAS BEEN A TRULY EXCITING YEAR FOR THE OCEAN-TECH INDUSTRY,

AND HERE IS A GLIMPSE OF WHAT WAS TRANSPired IN 2017.





THE MICRO REVOLUTION

At Ocean Business—the year's biggest industry event—this March, the move towards miniaturisation was more apparent than ever with the dozens of new compact sensors and platforms on show.

On the first day, Rock Seven introduced "the world's smallest two-way satellite communications platform with integrated antenna." Kongsberg had the new generation of small platforms on show, which included the REMUS 100, 600 and 6000 Autonomous Underwater Vehicles (AUVs).



The availability of smaller, smarter, and cheaper sensors has also opened the doors to several start-ups such Hydromea and ecoSUB Limited.

ecoSUB Robotics Limited is one of many new companies to launch this year, delivering advanced, low-cost micro AUVs. It was born from an idea within the National Oceanography Centre (NOC) and nurtured in the head office of Planet Ocean Limited, a UK-based marine science technology specialist. After extensive collaboration with the UK's Marine Autonomous Robotics Systems (MARS) group at NOC, the ecoSUB micro AUV range was officially on-show for the first time at Ocean Business. In June, the company took part in a successful offshore exercise, conducted by Oil Spill Response Ltd. (OSRL), designed to understand how remote sensing technologies can help detect oil spills at sea more effectively.

Swedish company, Hydromea, is a relatively new start-up founded in December 2014. For the first time this year, they exhibited at Ocean Business, displaying the Hydromea VERTEX AUV—"the smallest, most integrated commercial AUV in the world."

The main feature that separates this product from other micro AUVs is its ability to intelligently "swarm." By using the innovative swarm technology, Hydromea can create rich 3D datasets, delivering water quality measurements at an unprecedented resolution. To achieve this, they also built the "smallest optical modem on the market," which is a 10th of the volume of any other product and weighs just 200 grams.



MAINSTREAM OCEAN EXPLORATION

It's not just micro AUVs that are causing a splash in the ocean tech world; subsea drones are on the rise and opening ocean exploration up to enthusiasts, small businesses, and the wider research community.

Founded by Australian underwater robotics engineer Andrew Durrant, PicSea is the latest start-up to enter the market with their innovative concept subsea drones for ocean data collection. By June 2018, PicSea will have their first drones in the water with the capability to work individually or in coordinated groups to help businesses access and understand seafloor data.

And let's not forget CES 2018 Innovation Awards Honouree (Robotics & Drones category), Blueye Robotics. In Australia this November, the developer of Blueye Pioneer officially launched their underwater drone designed for "ocean explorers of every type who want to discover what lies beneath the ocean, yet has the professional robustness to meet with scientific and enterprise use."

Blueye's arctic-tested Pioneer underwater drone can dive up to 150 meters deep even in the harshest ocean conditions, said the company.

The rise of affordable drones, along with the increasing number of citizen science projects, offers huge opportunities and support for scientists in ocean research and data collection. Especially since now, more than ever, we need a greater understanding of how marine environments can continue to support both marine life and the weighty demands of the human race.



RISE OF THE HYBRID



DEEPSSEA DISCOVERY

Organisations are now pushing robotics to the limits by sending them deeper and deeper into our oceans.

A great example of this is the ARGGONAUTS from Fraunhofer IOSB—a German team with a goal to significantly advance the exploration of the deep ocean using unmanned, autonomous systems.

Developing a novel swarm of unmanned underwater and surface vehicles, the ARGGONAUTS are one of the 2017 semi-finalists competing to win the Ocean Discovery XPRIZE—a contest spanning three years with a seven million USD cash prize.

Leading research in deep-sea technology, Rainbowfish Ocean Technology Co., Ltd and the Hadal Science and Technology Research Center (HAST) of Shanghai Ocean University have started down its path to build a manned submersible that can reach 11,000 meters.

The project will be completed across multiple phases, culminating in 2020 when scientists will descend into the depths of the Marianas Trench and conduct scientific research work in locations not yet seen by humankind.

By 2050, 10 billion people on this planet will be more dependent on our oceans than ever before. Today's innovation in ocean technology will soon become a vital tool in helping the world's nations responsibly develop raw materials, while protecting fragile marine habitats. Once more, continued advancement in deep-affordable ocean technology will be essential to exploring this unique habitat on a large scale.

Closer to the ocean's surface, hybrids now roam. AUVs and Remotely Operated Vehicles (ROVs) are used for a range of applications from offshore oil & gas to marine conservation. Each robot has both unique capabilities and limitations. We are witnessing a new kind of unmanned underwater vehicle (UUV) that combines both technologies into one multi-purpose unit—the rise of the hybrid is here.

In February, USA-based company Strategic Robotic Systems Inc. launched the new FUSION hybrid with the premise of developing the next generation in underwater systems by approaching the challenge from a fresh perspective. As a battery-powered system, the FUSION can be autonomously operated on a preprogrammed mission without the tether connected and offer a unique Diver Module option that can be used as a diver navigation and propulsion device.

Also in February this year, Modus Seabed Intervention completed system integration of their commercially available hybrid UUV, Saab Sabretooth. Working in partnership with Saab Dynamics for over three years, they hope to drive high performance, quality, and cost-effective delivery of survey

and inspection projects in the offshore, defence, and oceanographic sectors. The first vehicle is depth-rated to 1,200 meters, but can be upgraded to reach depths of up to 3,000 meters.

In May, Italian offshore contractor Saipem offered a glimpse of its hybrid: HyDrone. HyDrone is a modular, subsea resident intervention platform, directly integrated within the subsea field and capable of working long periods without surface vessel support. The design is an evolution of work-class ROVs, intended to allow reliable remote interventions on complex or inaccessible subsea infrastructures while also integrating AUV functionalities and additional innovative features.

Finally, improvements to the technology are already being made. US-based Aquabotix recently announced a "game-changer" for the hybrid underwater robotics industry: live, remote-control technology that allows users to operate underwater vehicles and cameras remotely from anywhere in the world.



THIS YEAR HAS BEEN ABOUT INNOVATION AND THE EMERGENCE OF NEW PLAYERS TO A TRADITIONALLY STATIC MARKET. The ocean robotics world has gotten a lot bigger and more diverse in recent years. As such, Earth's biggest wilderness is more accessible than ever, expanding our knowledge and opening new opportunities for discovery—not just for the large organizations with big budgets, but to almost anyone with the desire to explore our oceans.

THE COMING YEAR IS SURE TO BRING EVEN MORE CUTTING-EDGE TECHNOLOGY TO OCEAN INDUSTRY AND EXPLORATION; AND AS WE CAN SEE FROM THE PAST 12 MONTHS, MANY OF THESE SAME COMPANIES ARE ALREADY WORKING ON IT.



2017

2018



FINNISH STEEL Takes Scientists into the Deepest Spot of the Ocean

Chinese scientific research company Rainbowfish Deepsea Equipment & Technology Co., Ltd. will construct a deep-sea research vessel. A Finnish foundry, TEVO LOKOMO LTD., has joined the project.

One of the goals of the project is to explore further down into the Marianas Trench—towards a point that has been measured to be the new deepest spot in the world.

TEVO LOKOMO has over 100 years of experience in cast steel. A manned submersible cabin casting will be manufactured at the steel foundry in Tampere, Finland. The cabin will be made from Vaculok® Maraging Steel, and it will withstand the extreme pressures at the depths of over 36,000 feet (11,000 meters). Previous MIR submersibles were manufactured in 1987 and their maximum depth was 19,685 feet (6,000 meters).

Close cooperation between TEVO LOKOMO and the Chinese specialists began in 2015 with a project for material research and testing. The project was completed in April 2017 after successful pressure tests conducted at the Rainbowfish laboratory in Shanghai, China.

In June 2017, Finland's Prime Minister Juha Sipilä led Team Finland's trip into China where 54 trade and investment contracts and letters of intent were signed between Finnish and Chinese companies and businesses.

TEVO LOKOMO's Vaculok® Maraging Steel is an ideal material for the venture due to its superior material properties. There is a thousand times higher pressure at the bottom of the Marianas Trench compared to the normal atmospheric pressure at sea level.

The multi-phase project will culminate in year 2020 when a group of scientists will descend into the depths of the Marianas Trench and conduct scientific research work in circumstances not yet touched by humans. The venture will also break the depth record set by the film director and explorer James Cameron.

Top: TEVO LOKOMO MIR Submersible Cabin Manufactured in 1987. Bottom: MIR Submersible Built in Finland in 1987, still in operation.



For more information, visit www.tevo.fi.



STATOIL'S VALEMON PLATFORM

First to be Remote-Operated from Land

On Thursday, November 9, the opening of the Valemon control room was celebrated at Sandsli in Bergen. Valemon will be the first platform in Statoil's portfolio to be remote-controlled from land.

"This is a vital milestone for Statoil. We have had land-based surveillance and control of offshore operations for a long time, however, the remote control of Valemon marks one important step forward on our digitalization journey," says Gunnar Nakken, head of the operations west cluster in Statoil.

Valemon is designed and constructed for remote control. Statoil has currently no other platforms of this kind, but this solution will undoubtedly be considered for other small and medium-sized platforms in the future, and remote control will be a central building block.

"Most of our production will still be carried out on large, manned platforms, such as Aasta Hansteen and the Johan Sverdrup platform, but for somewhat smaller platforms and fields it will absolutely be considered. First, we must gain experience from Valemon," says Nakken.

"Thanks to new technology and knowledge we can utilize the advantages of our smaller, standardized building blocks that are combined differently

from field to field for optimal resource exploitation. We want to combine the best technology, below and above water, to find optimal solutions for every project, thereby ensuring safer operation," says Nakken.

Onshore remote control of the Valemon platform is one example of how new ways of working and interacting offer new possibilities and advantages.

For more information, visit
www.statoil.com.

Above: Statoil's Valemon Platform.

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Above: Anemone and clown fish. Photo courtesy of Jennifer Smith. Opposite: Life under the sea in Palau. Photo courtesy of Brian Zgliczynski.

Ocean Supporters and Scripps Scientists Dive into Adventure in Palau

Beneath the serene seas of Palau, the ocean is teeming with marine life. From coral reefs and sharks to tropical fish and sea turtles, the island nation located in the western Pacific Ocean is home to some of the most diverse ecosystems in the world.

This summer, a group of adventurous ocean supporters embarked on a week-long diving and learning experience in Palau led by scientists from Scripps Institution of Oceanography at UC San Diego. Scripps marine ecologists Jennifer Smith and Stuart Sandin, postdoctoral researcher Brian Zgliczynski, and colleagues were visiting the remote island nation to conduct research for the 100 Island Challenge, a Scripps-led project that aims to collect coral reef data from 100 islands across the globe, providing a baseline health assessment for islands ranging from moderately to heavily fished. Researchers will use the data to gain a better understanding of how reefs are adapting to our rapidly changing planet and decipher what the future holds for these important habitats.

The 100 Island Challenge team is particularly interested in studying the coral reefs of Palau because the country has become a global example of effective marine management, thanks to conservation efforts implemented by President Tommy Remengesau. The island's strict marine conservation plan protects 80% of Palau's waters, from nearshore coral reefs all the way to offshore tuna fisheries.

The current budget for the 100 Island Challenge is not large due to the lack of available research grants, and ship access is often very expensive due to the remote locations the researchers visit. However, thanks to the support of nine generous donors, Scripps scientists were able to charter a boat for three weeks to study the coral reefs of Palau's southwest islands. These Scripps supporters joined the research team onboard during the third and final week for an immersive exploration experience.

“By partnering with this wonderful group of donors, we had two weeks of research and one week of exploration where we were able to show donors the spectacular coral reefs and beautiful marine landscapes of Palau, and also to teach them about conservation in action.”

—Stuart Sandin

"The coral reefs of Palau are magical. Every dive there is something that amazes you," said donor Mary Ann Beyster, producer-director of Yellow Warbler Media and manager of Beyster Ventures and Beyster Family Foundations. "You see hundreds of corals here, and at some dive locations, it is like diving in an underwater English garden with tropical fish, reef sharks, turtles, mantas, and more—a full spectrum of colors, textures, and structures."

During a reception held on the mainland of Palau, the entire Scripps team, including supporters, had a chance to connect with Palau community members, elders, high-level government officials, and non-government organizations (NGOs) that are working to help manifest conservation and restoration successes across Palau.

"I think Palau is one of the most beautiful places on the planet, both above water and below," said Smith, who helped launch the 100 Island Challenge more than a decade ago. "During a time when there's news about how all the coral reefs are doomed, we got this opportunity to show this amazing group of people that, no, that's actually not true. This place is the most progressive in terms of marine management and look at their reefs. These reefs have suffered from warming and bleached in the past, but they also have this remarkable capacity to recover."

A local partner included One Reef, a conservation NGO led by founder and CEO Chris LaFranchi. He

“...the current would pull you and you'd just float along with it, and you'd see thousands of different kinds of coral and fish.”



joined the Scripps team on their expedition and led discussions onboard about how science is transmitted to guide policy on a local level.

In addition to experiencing world-class diving and education, the donors were thrilled and surprised to meet President Remengesau, who stopped by their boat on the final day of the trip to discuss his environmental policies and thank Scripps for its collaborative research and conservation efforts. He stayed on the boat for nearly

two hours and had lively one-on-one conversations with everyone onboard.

"It speaks to the prestige of the Scripps scientists that the President wanted to come aboard and thank them for their work and for their collaboration," said supporter Elizabeth Oliver.

Oliver said she was left with a feeling of hope after the trip and described her overall experience as "amazing." She likened the diving in Palau to that of an "underwater

Disneyland" or something you might see in an otherworldly film like Avatar.

"There were these drift dives where you would get into these ancient river beds and the current would pull you and you'd just float along with it, and you'd see thousands of different kinds of coral and fish," said Oliver. "It was almost impossible to take it all in because there was so much biodiversity!"

Beyster also reminisced about the memorable drift dives,

where a current of three to four knots carried divers through a channel of 30-foot-high walls of coral. "Have you ever flown with turtles, groupers, and other tropical fish?" asked Beyster. "Me neither, until this trip."

Scripps Oceanography plans to organize more up-close-and-personal trips in the future where science supporters can connect with action in the field, both at sea and on land. Learn more about supporting Scripps science at scripps.ucsd.edu/giving.

BARRACUDA

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

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KONGSBERG Receives First DNV GL Cyber Security Type Approval

As the shipping industry digitalizes, vessels are becoming sophisticated hubs of connected systems and sensors that generate and exchange data both onboard and back to shore. This connectivity increases the need for cyber security and for ways of verifying the cyber safety of installed systems.

"At Kongsberg we have been delivering solutions for remote support and data collection for many years," says Bent Erik Bjørkli, VP digital performance at Kongsberg Maritime. "Over the last few years, however, we have seen an increasing focus from our customers in the cyber security of the connected systems on their vessels. This was why we were so interested to work together with DNV GL on the development of the new type approval. With the new type approval, we can now demonstrate the security of our systems through an independent verification process."

For the past year, DNV GL and Kongsberg have combined their efforts to develop a new type approval programme for the cyber security assessment of control system components: "Security Assessment of Control System Components, DNVGL-CP-0231." The pilot system has been K-IMS, a core component in Kongsberg's digital ecosystem Kognifai. Designed in accordance with the principles in IEC

62443-4-2 and IEC 61162-460, the type approval programme focuses on verifying both the technical reliability and cyber security of control systems.

"We would like to thank Kongsberg for choosing to work with us on this project, and we are very pleased that K-IMS is the first product to have received the new type approval," says Odd Magne Nesvåg, head of control systems at DNV GL – Maritime. "With the new 'Security Assessment of Control System Components' type approval programme, we have developed a rigorous certification regime to demonstrate the cyber security capability of on-board systems. By choosing this new voluntary type approval for their systems, maritime vendors now have a way to show their customers they meet a set of independently developed and verified quality standards in an area that is becoming ever more important in today's connected maritime industry."

For more information, visit www.km.kongsberg.com.

Above: Knut Omberg, principal engineer at DNV GL – Maritime (left), presents Roar Simensen, product adviser—connected vessels and information management at Kongsberg Maritime (right), with the new type approval.

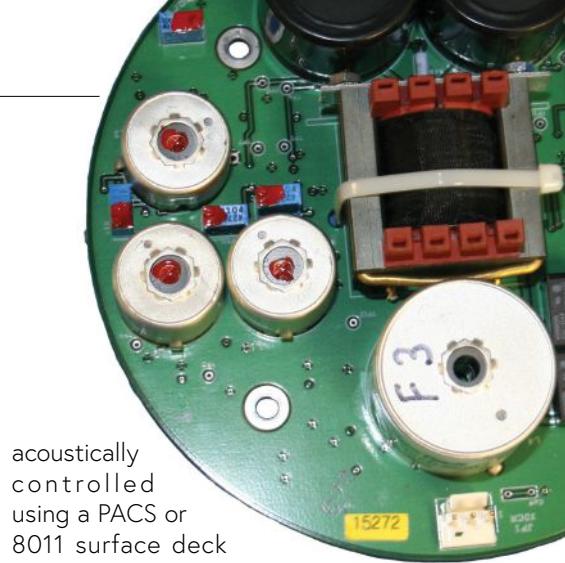
EDGETECH Introduces New OEM Acoustic Release Components

EdgeTech, a leader in high-resolution sonar imaging systems and underwater technology, recently introduced a group of new OEM acoustic release components for customizable underwater release packages.

Extending from a long line of reliable acoustic release products, EdgeTech introduced the OEM component product line for those individuals and groups that have unique underwater release requirements that often require custom-built solutions. With the ability to select individual OEM components, users can purchase the high-quality electronics, transducers, and release mechanisms that can be found in the commercial-off-the-shelf EdgeTech Acoustic Release products. Using the EdgeTech OEM acoustic release components, customers can

completely customize their underwater release package while maintaining the high-quality aspect of the core release functionality. Additionally, all electronics and transducers are compatible with the reliable EdgeTech surface deck boxes, such as the 8011 and the PACS, ensuring complete acoustic command and control of the subsea package.

A number of individual products make up the new OEM acoustic release components product line (and more will be added soon). Some examples include the BART board, the ORCA thermal release, and OEM transducers. The BART board is a single board designed to function as a complete, single channel acoustic transponder. When coupled with an EdgeTech compatible OEM transducer and an EdgeTech OEM Release Control Actuator, the entire system can be



acoustically controlled using a PACS or 8011 surface deck box. The solution can be used to release oceanographic moorings and bottom frames or can be used for long baseline transponder navigation. In addition to these typical applications there are a number of specialized uses for the OEM components, such as controlling the opening and closing valves in underwater systems and as emergency recovery systems.

For more information, visit www.edgetech.com.



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UNDERWATER SOUND WAVES Help Scientists Locate Ocean Impacts

The method, developed by researchers from Cardiff University, uses underwater microphones, also known as hydrophones, to listen for underwater sound waves that are emitted when an object hits the sea surface.

They believe the new method could be used to locate meteorites, satellites, or even parts of an aircraft that may have entered the ocean and could be used to locate underwater explosions, landslides, or the epicentre of earthquakes far out at sea.

The new method, which has been presented in the journal *Scientific Reports*, relies on the measurement of acoustic gravity waves (AGWs)—naturally occurring sounds waves that move through the deep ocean at the speed of sound and can travel thousands of metres below the surface.

AGWs can measure tens or even hundreds of kilometres in length and it is thought that certain lifeforms such as plankton, that are unable to swim against a current, rely on the waves to aid their movement, enhancing their ability to find food.

When objects hit the sea surface they cause a sudden change in water pressure which leads to the generation of AGWs.

In the first part of their study, the team dropped 18 spheres onto the surface of a water tank at varying distances and heights and measured the subsequent AGWs emitted using a hydrophone.

The team then analysed hours of data from hydrophones off the coast of Western Australia. These hydrophones are operated by the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) for detecting underwater nuclear tests, but they can also pick up signals from AGWs.

Using this data, the team were able to validate their method by successfully calculating the time and location of recent earthquakes that had occurred in the Indian Ocean.

"By using existing detectors dotted all around our oceans and listening for signatures from these deep ocean

sound waves, we've uncovered a completely novel way of locating objects impacting on the sea surface," Dr. Usama Kadri, lecturer in applied mathematics.

"Tracking these acoustic gravity waves opens up a huge range of possibilities, from locating falling meteorites to detecting landslides, snowslides, storm surges, tsunamis, and rogue waves."

MH370

The team also went one step further and analysed data from the same hydrophones from 18 March 2014 when the Malaysian Airlines Flight MH370 disappeared over the South Indian Ocean.

Between 00:00 and 02:00 UTC when it is thought the plane disappeared, they found two "remarkably weak signals" around the suggested flight path of MH370, both resulting in a relatively large area of uncertainty where there may have been some sort of impact.

"Our study was initially motivated by a desire to gain more knowledge about the incident involving flight MH370, using data analysis techniques that can pick up and locate much weaker signals," states Dr. Davide Crivelli, Lecturer, Teaching and Research.

"Though we've located two points around the time of MH370's disappearance from an unknown source, we cannot say with any real certainty that these have any association with the aircraft. What we do know is that the hydrophones picked up remarkably weak signals at these locations and that the signals, according to our calculations, accounted for some sort of impact in the Indian Ocean."

"All of this information has been passed onto the Australian Transport Safety Bureau, and we anticipate that both now and in the future, this new source of information could be used in conjunction with a whole of host of other data that is at the disposal of the authorities."

For more information, visit
www.cardiff.ac.uk.

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from the field

ON&T: Could you give us some company History?

DAVID A. CAPOTOSTO: To understand our company history, I have to take you back to 1979. In that year, David Cook founded Flotation Technologies (Flotec) to produce subsea buoyancy products made from syntactic foam. Mr. Cook was one of the inventors of syntactic foam and had been working with it for over a decade. He and his family grew Flotec into a leader in oceanographic buoyancy products, pioneering buoyancy for instruments like ADCPs and transponders. In the early 2000s, the company proceeded to develop and produce oil and gas subsea products, including drill riser buoyancy and distributed riser & umbilical buoyancy, arguably some of the most challenging subsea foam products.

Flotec was acquired in 2008 by a Houston-based subsea equipment and service provider. In 2013, DeepWater Buoyancy acquired the rights and designs for the legacy Flotec material technology and products when its parent company was in the process of closing the New England facility. Since then, DeepWater Buoyancy has been producing, improving, and growing the Flotec product line.

ON&T: What are your standard products?

DAC: Our standard product line is vast and covers applications in numerous markets. It is, of course, principally subsea buoyancy, but also includes related subsea deployment products.

At the heart of the DeepWater Buoyancy product line are the subsurface ADCP buoys. Consisting primarily of both spherical and elliptical buoys, the product line also includes the unique StableMoor® Mooring Buoys. These torpedo-shaped buoys are engineered to house ADCPs and other sensors for high current data collection applications. By design, the StableMoor® reduces drag and increases mooring stability in extreme flow regimes, thereby producing superior data sets.



**DeepWater
BUOYANCY**

is the world's largest producer
of subsea buoyancy products
for the oceanographic industry
and has a vast product line
of buoyancy solutions for
offshore oil and gas, energy
and technology companies.
Recently, ON&T sat down with
David A. Capotosto, Director
of Business Development, to
talk about the company
and product line.

However, DeepWater Buoyancy's product line goes well beyond ADCP buoys. In the oceanographic market there are bottom mounts, instrument collars, and cable floats. For offshore oil & gas, there are installation blocks, modular buoys, deepwater marker floats, and ROV buoyancy. In addition to DeepTec® syntactic foam products and custom-engineered components, there are also plastic, polyurethane, and fabricated metal products for use subsea.

We continue to develop the standard product line as projects and opportunities arise. Recently, we added mooring line fairings, a new modular installation buoy, and a pop-up buoy recovery system.

ON&T: What have been some of the challenges?

DAC: One of the largest challenges we face is lead time. There has always been downward pressure in this area. But with the changes in the oil & gas market, it seems to have intensified. Overall, project timelines are shortened and this, coupled with other factors, can affect procurement schedules.

And of course, when designing a system, buoyancy is often the last item to be specified, as the balance of the system's weight needs to be characterized before uplift can be calculated.

ON&T: Could you talk about an especially challenging case study?

DAC: We were contacted by a large offshore services provider preparing to do a large metocean study in Brazil for a subsea oil production site. They had been awarded the contract but needed seven of our 64-in. diameter elliptical buoys. Additionally, they needed to have the buoys customized. In order to meet their deployment timeline, they asked us to produce them in half of the time that would normally be required.

ON&T: How did you overcome those challenges?

DAC: Integral to our business and manufacturing strategy is the ability to execute almost all the required manufacturing processes in house. That means we have control of the sequence of operations and can expedite internally, as opposed to relying on and pressuring outside subcontractors.

Our operations team was engaged in the challenge and rose to it. The systems were delivered on time to the customer, which allowed them to deploy on schedule.

ON&T: What are your largest market sectors?

DAC: Our largest markets are oceanographic and military/government. Additionally, we have been strong in the offshore oil & gas market and are looking to see growth in that market as the industry recovers.

ON&T: What have been some of your custom products?

DAC: I am glad you asked this question. Custom products are certainly a strong suit of ours. Often, a client can't find their ideal solution in the product line. Sometimes it's simply a matter of customizing some feature of a standard product. But often it requires our team to start with a clean sheet of paper or, perhaps better stated, a new solid model file. Either way, we will design and produce a custom product to meet the requirement.

The company's design philosophy is, "A customer should have a product that meets the application and not be forced to adjust their application to an off-the-shelf product." Whether an iteration of an existing design or a completely new design, the goal is to produce the finest, most appropriate, and cost-effective solution for any given application.

Part of the strength of this custom offering is our engineering team with state-of-the-art CAD/CAM technology. But it also includes the vast manufacturing capability and know-how in house. We have a wide assortment of internal manufacturing processes and tools—from foam manufacturing to

“...the goal is to
produce the finest,
most appropriate,
and cost-effective
solution for any
given application.”



welding to machining to urethane spray coating. And we have a seasoned staff of capable technicians with decades of experience with these processes and product lines.

Using this approach, we have produced everything from small components for AUVs to acoustic baffles to custom buoyancy blocks for the OOI project that are the size of a small automobile.

One recent example of this is when the National Oceanographic Centre (NOC) in Southampton UK approached us with a requirement for a 6,000-m benthic lander for the RAPID array project. RAPID ARRAY has been deploying bottom pressure recorders across the Atlantic since 2004. The NOC team wanted to address issues in previous designs and make improvements.

We worked closely with them to design a new system from scratch using solid modeling. The system included buoyancy, framework, instrument clamps, and hardware. The lander is dropped to the seafloor where it collects data. The product is equipped with a dual acoustic release system that allows it to drop ballast when it's time for recovery. Once the ballast is dropped, the system is positively buoyant and returns to the surface.

The product was jointly developed and the system built entirely in our facility. NOC integrated all the instruments and deployed in spring of this year. Recovery is planned for spring of 2020.

ON&T: Have there been any aha moments?

DAC: Along the way there have certainly been some "aha moments". Those moments, when related to products, are often a result of collaboration with the gifted ocean scientists, ocean engineers, and the numerous instrument manufacturers with whom we work.

There have also been a few material science "ahas." After all, at the center of what we do is the development of syntactic foam, that amazing material that provides buoyancy but resists being crushed by the pressure of ocean depths.

ON&T: What have been some of the most interesting projects?

DAC: Our StableMoor® buoy has provided us with some interesting applications. It's a product that allows for a stable mooring to gather data in high current sites. Last year, the National Renewable Energy Laboratories and the University of Washington used the product in a unique way to study turbulence in potential site of subsea turbines for renewable energy production. Understanding turbulence is important in these sites as turbulence places stress on the turbine blades.

The product was fascinating in that the buoy housed a number of instruments, though the primary instruments were the turbulence sensors. To get the required data, there was a turbulence sensor placed in the nose of the buoy as well as two additional sensors at the end of special carbon-fiber wings.

These kinds of projects are interesting because they challenge us to produce unique and robust designs and because they take our buoys to some of the most hostile and chaotic areas of the ocean—and even in the midst of these difficult environments, the buoys support the gathering of important data.

Opposite: NOC Benthic Lander being deployed.

Robotics Principles Help Sandia Wave Energy Converters Absorb Power

Compared to wind and solar energy, wave energy has remained relatively expensive and hard to capture, but engineers from Sandia National Laboratories are working to change that by drawing inspiration from other industries.



Sandia's engineering team has designed, modeled, and tested a control system that doubles the amount of power a wave energy converter can absorb from ocean waves, making electricity produced from wave energy less expensive. The team applied classical control theory and robotics and aerospace engineering design principles to improve the converter's efficiency.

During a multiyear project funded by the Department of Energy's Water Power Technologies Office, engineers from Sandia's Water

Power program are using a combination of modeling and experimental testing to refine how a wave energy converter moves and responds in the ocean to capture wave energy while also considering how to improve the resiliency of the device in a harsh ocean environment.

"We are working to create methodologies and technologies that private companies can harness to create wave energy devices that will enable them to sell power to the U.S. grid at a competitive price," Sandia engineer Ryan Coe said. "By

getting more energy out of the same device, we can reduce the cost of energy from that device."

Sandia's wave energy converter is a large 1-ton ocean buoy with motors, sensors, and an onboard computer built at a scaled-down size for a testing environment. Commercial wave energy converters can be large and are generally part of a group of devices, like a wind farm with multiple turbines.

"These devices can be in open ocean and deep water, maybe 50 to 100 miles off the coast," Coe said. "An array of wave energy converters, maybe 100 devices, connected to an underwater transmission line would send the wave energy back to shore for consumption on the grid."

To capture energy from the ocean's waves, a wave energy converter moves and bobs in the water, absorbing power from waves when they generate forces on the buoy. Sandia's previous testing focused on studying and modeling how the devices moved in an ocean-like environment to create a numerical model of their device.

Using the model they developed and validated last fall, the team wrote and applied multiple control algorithms to see if the converter could capture more energy.

"A control algorithm is a set of rules you write that prompts an action or multiple actions based on incoming measurements," Sandia engineer Giorgio Bacelli explained. "The sensors on

the device measure position, velocity, and pressure on the hull of buoy and then generate a force or torque in the motor. This action modifies the dynamic response of the buoy so that it resonates at the frequency of the incoming waves, which maximizes the amount of power that can be absorbed."

The control system uses a feedback loop to respond to the behavior of the device by taking measurements 1,000 times per second to continuously refine the movement of the buoy in response to the variety of waves. The team developed multiple control algorithms for the buoy to follow and then tested which control system would get the best results.

"Controls is a pretty big field," Sandia engineer Dave Patterson said. "You can operate anything from planes to cars to walking robots. Different controls will work better for different machines, so a large part of this project is figuring out which control algorithm works and how to design your system to best take advantage of those controls."

Bacelli said that while the primary objective of the control algorithm is to maximize energy transfer between the wave and the buoy, the amount of stress being applied to the device also must be considered.

"Resonance also stresses the entire structure of the device—and to expand the longevity of the device, we need to balance the amount of stress it undergoes," Bacelli said. "Designing and using a control system helps find the best trade-off between

the loads and stress applied to the buoy while maximizing the power absorbed, and we've seen that our systems can do that."

Results from numerical modeling with the control algorithms showed a large potential, so the team took the converter to the U.S. Navy's Maneuvering and Sea Keeping facility at the Carderock Division in Bethesda, Maryland, in August to test the new control methods in an ocean-like environment. The wave tank facility is 360 feet long and 240 feet wide and has a wave maker that can generate precisely measured waves to simulate various ocean environments for hours at a time. Sandia used the wave tank to simulate a full-size

ocean environment off the coast of Oregon, but scaled down to 1/20th the size of typical ocean waves to match their device.

“The accuracy of the wave they can generate and the repeatability is outstanding,” Bacelli said. “The ability to recreate the same condition each time allowed us to conduct very meaningful experiments.”

The team ran a baseline test to see how the converter performed with a simple control system directing its movements and actions. Then

they ran a series of tests to study how the various control algorithms they had designed affected the ability of the device to absorb energy.

"This year, the device can move forward, backward, up and down, and roll in order to resonate at the frequency of the incoming waves," Bacelli said. "All degrees of freedom were actuated, meaning there are motors in the device for each direction it can move. During testing we were able to absorb energy in each of these modes, and we were able to simulate the operating conditions of a device at sea much more accurately." In fact, the tests showed theory did match reality in the wave tank. The control algorithms were able to more than double the amount of energy

the wave energy converters were able to absorb without a control system.

The team is analyzing the testing data and considering further options to refine the control systems to maximize energy transfer.

For more information, visit www.sandia.gov.

Video Link:
[www.youtube.com/
watch?v=XCB12Het4c4](https://www.youtube.com/watch?v=XCB12Het4c4)

Opposite: Sandia National Laboratories water power engineers Giorgio Bacelli, left, Dave Patterson, center, and Ryan Coe with Sandia's wave energy converter buoy. Photo courtesy of Randy Montoya.

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BLUESTREAM Successfully Inspects Several HVDC Platforms

What do the offshore HVDC platforms DolWin alpha, BorWin alpha, and DolWin beta in the German section of the North Sea have in common? The only right answer would be: all three power conversion platforms were fully inspected by Den Helder-based Bluestream, one of the leading providers of innovative inspection services for the offshore oil, gas, and wind industry.

Bluestream's ability to deliver multidisciplinary services was key in the awarding of these orders as divers, ROVs, multi-skilled rope access teams, and ultramodern drones were used for carrying out all three inspections. "One of the reasons why Bluestream was tasked with carrying out this extensive inspection work was the technical efficiency with which we approached each project," explains commercial manager Anton Janssens.

The first asset to be inspected was the DolWin alpha, the largest offshore conversion platform for windfarm energy in the German section of the North Sea. The platform was installed on a jacket consisting of six legs and comprises five decks that rise 80 meters above the water surface. Project engineer Michael van Putten says: "All accessible areas in the platform were inspected by camera, and for the inspection of the outside and underside of the platform, we deployed a rope access team. As well as checking the overall condition of the platform, the central focus of the inspection was on the coating."

The jacket on which the DolWin alpha is mounted also had to be inspected. The inspection not only covered the section of the jacket protruding above the water, but also the six legs below water level.

As an alternative for an ROV scope, Bluestream deployed the Cathodic Protection (CP) Drop Cell method for this particular activity. Van Putten continues: "Members of our rope access team climbed down the platform and lowered the drop cells along the legs to the inspection locations, so the anodes could be measured. A clump weight was used to keep the rope in a straight line."

In close consultation with the client, Bluestream also developed a reporting model for assessing any damage identified. Every item of damage, however small, can be derived from the report data and prioritised according to degree of seriousness. A special software package was developed in house for user-friendly and rapid information processing. In this way, the client is able to work towards an effective planning model. Commercial manager Anton Janssens adds: "In principle, Bluestream carries out a baseline inspection. As such, we operate as the eyes and ears of our client. We observe and analyse the situation in accordance with a regulated ISO standard. We pass on our findings to the client, who at the end of the day retains overall final responsibility."

After successful completion of this first inspection, Bluestream was awarded an order to inspect all accessible areas on the HVDC platform BorWin alpha as well. The total height of the BorWin Alpha is 84 meters, 62 meters of which consists of the support jacket. Unlike the DolWin alpha project, this inspection was carried out following a painting programme, leading to a shorter inspection period. The CP Drop Cell method was again used for this project. The extra challenge on this occasion lay in the fact that the legs of this platform were at an angle, as

compared with the legs of the DolWin alpha, which run straight up and down. Nonetheless, the Bluestream team found a smart solution to this problem.

In mid-2017, Bluestream received a further order to inspect the DolWin beta. This submersible floating platform is moored just 30 meters from the DolWin alpha. The concept behind this platform is different from that of the previous two platforms, which are mounted on separately installed jackets. The six legs of the DolWin beta are in fact an integral part of the platform itself. Bluestream was asked to carry out a general visual inspection using a drone operated by business partner Skeye, based in Alphen aan den Rijn. In just three days, pilots from Skeye inspected the outside sheeting, the legs, and the underside of the deck of the DolWin beta platform using a drone. A small part of the inspection work still had to be carried out by one of Bluestream's rope access teams. After all, there are always certain areas that require a close visual inspection. Drones are a complementary tool and will never be able to completely replace rope access.

The awarding of a fourth order is evidence that Bluestream has stood out with the use of innovative inspection services over the past year. In September of this year, Bluestream will be returning to the BorWin alpha for an extensive inspection of all components of the platform, both above the water and subsea. This time the work will not be carried out by drone but by rope access, backed up by ROVs. None of this represents a problem to Bluestream, since the company can offer all these services in house.

For more information,
visit www.bluestreamoffshore.com.



WELLO'S PENGUIN WAVE

Energy Converter is Setting Records

Wello's Penguin Wave energy converter has been permanently deployed since spring 2017.

The converter has survived several major storm waves up to 13 meters, including Hurricane Ophelia. Wello is clearly leading the way as the only wave energy company deployed throughout the year at the EMEC wave test site in Orkney Island, Scotland.

The innovative mooring system has performed very well with no maintenance requirement or even indications of component wear. Power generation has been in line with expectations based on simulations and scale tests.

"This Penguin device represents our early design and doesn't reach those figures that we expect from our next unit, which we are constructing at Netaman shipyard at the moment," says Mr. Paakkisen, CEO of Wello.

Wello has also received 2.5 million€ EU H2020 SME2-funding for its Power Module device development. Wello scored excellent points in the H2020 SME evaluation process in tough competition with Europe-wide renewable energy technology providers, all competing in the same category.

Power Module is Wello's new wave converter device, which is the next evolution from the Wello Penguin wave converter technology. Wello Power Modules can be installed on any large offshore vessel or ship, where it produces renewable offshore electrical energy. In parallel with the energy production, the device is absorbing the vessel's motion in waves, which helps vessel stability and thereby improves vessel safety and comfort at sea. Wello sees great potential

for the Power Module installations in offshore vessels for the oil and gas industry and fish farms as well as for next generation cruise liners that target a high level of sustainability.

For more information, visit www.wello.eu.

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ROVCO Wins Three-Year Gwynt y Môr Offshore Windfarm Contract

UK subsea company Rovco has been awarded a three-year contract to support one of the world's largest offshore windfarms, Gwynt y Môr, which lies eight miles off the coast of North Wales in the UK.

Rovco will be providing its ground breaking underwater ROV 3D visual survey solution alongside traditional video, blueview sonar, and cathodic protection analysis techniques.

Gwynt y Môr consists of 160 turbines that generate enough energy for more than 400,000 homes across the country. It extends over an area of about 80 kilometer² and includes two offshore substations and 134 kilometer of onshore cable installations.

The contract with windfarm operator Innogy was won in a competitive

tender. It will see the Bristol-based ROV firm provide inspection services to the 576-MW windfarm's offshore assets as part of its ongoing maintenance plan.

Rovco will deploy its Sub-Atlantic Mojave ROV from its fleet, kitted out with 3D inspection equipment as part of the bespoke inspection programme. These observation-class ROVs are best suited to the issues associated with the strong currents found in the Liverpool Bay area.

This announcement is the latest in a series of significant contract wins for Rovco since the business launched in September 2016. To date, it has worked with clients in the renewable and oil and gas industries across the North Sea, Middle East, and Asia Pacific regions.

For more information, visit www.rovco.com.



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STATOIL Signs LOI for the Construction of the JOHAN CASTBERG HULL

Statoil is signing a letter of intent with Sembcorp Marine Rigs & Floaters Pte. Ltd in Singapore for the construction of the hull and integrated living quarters for the floating production, storage and offloading (FPSO) vessel that will be located on the Johan Castberg field in the Barents Sea.

The contract will be signed at the final investment decision scheduled before Christmas. Covering engineering, procurement, and construction the contract has a value of NOK 4 billion. The contract, which was won through international competitive bidding, marks an important milestone for the progress of the Castberg project. There were no Norwegian bids for the contract.

"We will be working closely with Sembcorp Marine to ensure safe and efficient delivery based on our requirements for HSE, quality, time, and cost. The remaining procurement work will be progressed in parallel with this," says Statoil's chief procurement officer, Pål Eitrheim.

The construction of the hull is the most time-critical delivery for the completion of the Johan Castberg project

for the scheduled start-up in 2022. The contract will have a separate cancellation clause linked to the approval of the plan for development and operation (PDO).

"Johan Castberg is the next major field development on the Norwegian continental shelf and important to future infrastructure in the Barents Sea. Analyses from Agenda Kaupang show that the project will generate some 47,000 man-years of employment in Norway in the development phase from 2018-2022, given a competitive Norwegian supply industry," says Torger Rød, Statoil's senior vice president for project development.

The estimate for Norwegian content is approximately 50% in the project phase and about 80% in the operations phase for Castberg.

The Johan Castberg field will generate ripple effects for all of Northern Norway. On behalf of the partnership, Statoil has decided to locate the operations organisation in Harstad, whereas the helicopter and supply base will be located in Hammerfest. The Castberg project is actively pursuing ways of increasing the percentage of pre-qualified suppliers from Northern Norway. The Johan



Castberg development is planned to consist of a large subsea system tied into a FPSO vessel. Recoverable resources are estimated at 450 to 650 million barrels of oil equivalent. The field is located in the Barents Sea, 240 kilometers north-west of Hammerfest. 30 wells are planned to be drilled on the field in the period 2019-2024.

The partnership consists of Statoil (50%), Eni (30%), and Petoro (20%).

For more information, visit www.statoil.com.

Johan Castberg floating production vessel. Illustration courtesy of Statoil.

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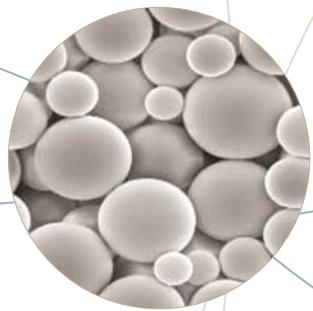
A vertical advertisement for maxon thrusters. At the top, it mentions "Oceanology International" and the date "13-15 March 2018, London, Excel" with the instruction "Visit us at stand A500". The main headline is "The maxon thruster." Below this, three descriptive phrases are listed: "Pressure compensated", "Compact design", and "Energy efficient". A technical specification for the MT40 model is provided: "Max. forward thrust 10.7 kg / 23.6 lbs", "Max. reverse thrust 8.6 kg / 18.9 lbs", "Max. depth limit 6000 m / 19685 ft", and "Max. efficiency 80 %". To the right of the text is a graphic of a black cylindrical thruster tube with a red band near the bottom, emitting a stream of bubbles into a dark blue background. At the bottom of the ad is the "maxon motor" logo with the tagline "driven by precision".

WILL RICCI
Business Development Manager, Trelleborg Applied Technologies

Trelleborg's Custom Buoyancy

Many people may think of empty space or air as nothingness—space that's perhaps waiting to be filled with something useful—but scientists and engineers know that the voids are intrinsically valuable. They can fortify structures to make them stronger without burdening them with weight. The ability to manipulate that nothingness brings new opportunities to many fields, especially in deep-sea exploration.

Through the use of high-tech hollow glass microspheres (HGMs), the issue of weight for deep-sea exploration vehicles can be overcome. Manufacturers can incorporate microspheres into a wide range of polymers to create composite solutions such as subsea foam buoyancy.



Hollow Glass Microspheres (HGMs) under microscope.



Hollow Glass Microspheres

HGMs combine an inherently efficient spherical geometry with the strength and stiffness of glass to encapsulate microscopic air pockets. The resulting fine white powder is a material ready for easy blending into liquid polymer systems. This genre of composite material offers the highest strength/weight ratios for subsea buoyancy application.

This lightweight micro-technology is a key material used to manufacture buoyancy products that allow Remotely Operated Vehicle (ROV) manufacturers to dramatically increase the uplift of a vehicle's buoyancy package at all depths.

At the microscopic level, there are three inherent components of a composite buoyancy package: the microspheres themselves, the polymer matrix, and the interface between the two. Examples of targeted functionalization include customized surface treatments, glass chemistry selection, density, and particle size distribution. Using this basic material understanding in combination with in-house vertical integration of technologies from microspheres to finished turn-key buoyancy packages allows for infinite tailoring of the composite products to their applications.



Eccospheres® manufactured by Trelleborg being weighed before testing.

Testing

When choosing a supplier for buoyancy for ROVs, manufactures should look for a company that not only manufactures HGMs but can also carry out testing of density, strength, moisture content, and more before the HGMs are incorporated into composite buoyancy systems. Following this, the finished buoyancy package should then go through its own testing to ensure the final product meets the density, weight, and strength parameters for the project.

There are four typical buoyancy tests that should be performed on the final package:

1. Hydrostatic testing of full cubic feet buoyancy blocks.
2. Cycle testing for 1,000 times.
3. Full testing to hydrostatic pressure on random samples.
4. 10% of manufactured blocks tested at service pressure for 24 hours.

Finished ROV unit being tested in the on-site buoyancy pool.



Final Thoughts

Microspheres are intrinsically valuable voids because they can fortify structures to make them stronger without burdening them with extra weight. Through customization and testing of HGMs, deep-sea exploration vehicle manufacturers are able to meet their strength and weight specifications for each unique vehicle.

The ability to manipulate, customize, and test buoyancy foams manufactured with enhanced HGMs for deep-sea exploration vehicles is a critical aspect that must not be overlooked when specifying buoyancy packages for these vehicles. As such, vehicle manufacturers should look to work with suppliers that can manufacture and test these small, but essential, microspheres for use in their buoyancy.



ASV GLOBAL AND TERRASOND: First Ever USV-Supported Cable Route Survey

ASV Global and TerraSond announce completion of the first-ever seabed cable route survey supported by an unmanned surface vehicle (USV). The survey route included various water depths and strong currents, while facing difficult wind and sea conditions in the Bering Sea offshore Alaska.

The project was mobilized immediately following a 9,000 kilometer nautical charting survey by TerraSond, of which 4,750 kilometer (53%) was executed by an ASV Global C-Worker 5 autonomous surface vehicle (ASV). The cable route survey required a new payload, including a hull-mounted multibeam sonar, a sub-bottom profiler, and a towed sidescan sonar with 250 meter of armored sonar cable. The payload swap on the ASV was integrated, calibrated, and demonstrated in the field in less than 48 hours. A total of 1,220 km of cable route survey lines was then successfully executed by the ASV C-Worker 5 system.

Thomas Chance, CEO of ASV Global stated: "This is a landmark achievement for ASV technology, and we are pleased to be supporting TerraSond in this effort. The fast re-tasking of the system from one type of mission to another illustrates

the flexibility of the C-Worker ASV, and its consistent performance in difficult sea conditions further underscores the value of this highly efficient approach to offshore operations."

Throughout the operation, the C-Worker 5 was remotely monitored using ASV Global's ASView™ control system from a station on TerraSond's mother ship. ASView™ used exported .dxf survey lines from the TerraSond survey planning system to autonomously execute an accurate survey with minimal human intervention.

ASV Global has supported TerraSond for three consecutive years refining the use of autonomous systems in hydrographic survey applications. This year's deployments follow on from a 2016 charting survey completed in the Bering Sea off Alaska where ASV Global and TerraSond marked an industry first by completing a 9,578km hydrographic survey, 4,213 kilometer of which were completed unmanned. Combined, these operations result in over 10,000 kilometer in unmanned survey lines.

Tom Newman, president of TerraSond expressed his satisfaction: "We continue

to be impressed after several projects with ASV's C-Worker 5 in a variety of missions. Together with ASV we have performed the first use in charting, first use in the arctic, first use for a cable route survey, and first to accumulate over 10,000 kilometer in use. ASV's team has risen to each challenge, and the system has proved to be a reliable and cost-effective force multiplier, often doubling our production, operating in areas unsafe for a larger vessel and allowing multitasking on projects."

ASV Global is a world leader in autonomous marine technology. ASV Global has produced more than 90 USVs and developed more than 40 different payload packages. Products are available for lease and purchase alongside comprehensive support and training packages. The company has also converted numerous existing vessels to operate autonomously using its proven ASView™ control system. With offices in the US, UK, and South America, ASV Global's 100+ employees support commercial, scientific, and military clients across the globe.

For more information, visit asvglobal.com or terrasond.com.



SONARDYNE DELIVERS MINI-RANGER 2 to Deep BV Support UXO Surveys



Deep BV, a Dutch survey company specializing in hydrography, marine geophysics, and oceanography, has purchased underwater acoustic technology supplied by Sonardyne International, UK, to support its inshore, harbor, coastal, and offshore activities.

The two Mini-Ranger 2 Ultra-Short BaseLine (USBL) tracking systems and WSM 6+ mini transponders were delivered to Deep BV's headquarters in Amsterdam within days of the order being placed and put straight to work during an operation to search for unexploded ordnance (UXO).

Mini-Ranger 2 boasts a number of features that make it ideal for underwater operations such as UXO surveys that require high-accuracy positioning but without the cost and complexity associated with a deepwater USBL solution. It can simultaneously track 10 targets at very fast update rates, it is quick to install on small vessels, and has a tracking range of 995 meters, extendable to 4,000 meters.

For its first project with Mini-Ranger 2, Deep BV installed one of the systems onboard their 15 meter, twin hull research vessel, Deep Volans, and configured it to track a WSM 6+ transponder mounted on the remotely operated towed vehicle (ROTV) Iron Lady. Accurate positioning is paramount for the Iron Lady's control software in order to "fly" the 6 meter-wide, gradiometer UXO set-up just 2 meters above the seabed.

Sonardyne Mini Ranger 2 Deep BV Iron Lady WSM 6Klaas Visser, chief technology expert at Deep BV said, "We've been a user of Sonardyne's pre-generation Scout USBL system for several years and are pleased with the results it's delivered. However, now was the right time to replace these systems and upgrade to Sonardyne's 6G product family with all of its attractive features and performance gains."

Speaking about the contract, Sonardyne sales manager, Alan MacDonald explained that Mini-Ranger 2 is ideally suited to the type of work carried out by Deep BV. "For example, the transceiver that's used to track transponders can be mounted alongside the multi-beam system in the moon pool of the Deep Volans. Then afterwards, it's simple to move it to a different vessel. And thanks to its excellent noise rejection properties, the system's optimized to provide reliable tracking in shallow water, near the surface where vehicles such as Iron Lady operate."

For more information, visit www.sonardyne.com.

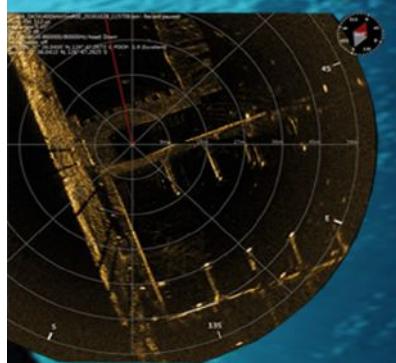
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DeepWater Buoyancy Develops Pop-Up Buoy Recovery System

DeepWater Buoyancy, Inc. announces that it has developed a Pop-Up Buoy Recovery System (PUB) and added it to their line of subsea buoyancy products. The PUB allows for direct retrieval of seabed packages, such as anchors, anchor lines, and bottom-mounted frames and instruments.

The new product was introduced in October at the 2017 Teledyne Marine Technology Workshop in San Diego, California. It was well-received by representatives, distributors, partners, and end-users. "We are excited to add the pop-up system to our product line," said Dan Cote, sales manager. "It gives our customers yet another buoyancy tool for deploying and recovering subsea equipment."

Easily mounted to any framework, the assembly sits on the seafloor until the acoustic release is activated. Once the release completes its disconnection, the buoy subassembly lifts free from the canister subassembly and rises to the

surface. A synthetic line connects the buoy directly to the framework of the seabed item and allows for retrieval.

The standard recovery system is designed to work with both the legacy Teledyne Benthos 875 shallow water release as well as the new R500 series release. Though this model is built specifically for the Teledyne Benthos acoustic releases, the company can also fit the design to releases from any manufacturer.

"This year, Teledyne Benthos discontinued its long-standing product offering, the PUB-875," explained David Capostosto, director of business development. "This left our distributors and the end users in a supply dilemma. We saw this change and the introduction of the new R500 release from Benthos as an opportunity to serve our clients and, at the same time, to improve the concept. As with all DeepWater Buoyancy designs, the unit is thoughtfully designed and ruggedly built for the offshore environment."



For more information, visit deepwaterbuoyancy.com.

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iXblue LAUNCHES NEW Multi-Purpose Autonomous Unmanned Surface Vessel

With proven offshore navigation capabilities and a top-speed unique in its category, DriX takes the AUSV role several steps further. This new asset, developed through a proper vertical integration and a third-party-friendly approach, offers a comprehensive solution for advanced sea operations. Born from an in-house survey need, DriX has been especially designed around its unmanned nature. Made out of composite material and with a revolutionary hull shape optimized for both coastal and offshore missions, DriX operates with the utmost stability, guaranteeing the best possible results, with excellent and unmatched performances on the high sea. DriX can operate independently in the most hostile weathers and environments, with the least number of hoisting manoeuvres possible, exponentially saving vessel time.

"Our aim was to create an AUSV that was truly multi-role and which would expand the working domains of a traditional research vessel. In order to do that, we needed a vehicle that was light, resilient, and with high-endurance." Guillaume Eudeline, business development manager for the Shipyard Division at iXblue explains. "We also wanted to take full advantage of its unmanned nature, which meant that it was designed by our shipyard, without any references to a human carrier hull shape. This is how we created a truly independent, safe, multi-role AUSV that saves manpower. DriX is really bringing an added value to the market."

Consisting of a main body, a mast, and a gondola bolted onto a drop keel, DriX is 7.7 meters long and 0.7 meters wide, with a draft of 2.0 meters. The possible change of the gondola and its payloads, with its third-party-friendly architecture, makes it especially suitable for multiple applications such as exploration, pre-site installation, touchdown monitoring, undersea inspection, m etocean,

and decommissioning, as well as environmental, geophysical, and hydrographic surveys. Should a change of payload occur, the electronic cabinets, housed in the main body, are easily accessible and removable, allowing for a swift and easy switch.

Regardless of the application, data acquisition is made excellent, even at high-speed, thanks to a number of design improvements, such as a wave piercer shape that keeps the slamming effect to a minimum, even in rough seas. The payload, embedded in the gondola, is in an optimum data-gathering environment, 2 meters under the surface, in noise-reduced and bubble-free surroundings. The data gathered can be transmitted through WIFI or radio waves. It can also, if necessary, be retrieved manually through an on-board retrieval plug.

Powered by a single propeller that enables an unmatched top-speed of 15 knots, DriX offers up to 7 days of endurance. Multiple navigation options are also available such as autopilot, remote supervisor action, a "follow me" function, and a "hovering" mode, all COLREG compliant. With DriX, iXblue certainly positions itself as a serious contender on the AUSV market. With this new state-of-the-art unmanned vessel, iXblue offers a comprehensive solution for a number of advanced applications, making DriX a real game-changer for smarter sea operations.

For more information, visit www.ixblue.com.

iXblue, a global company that provides innovative solutions for the geosciences, offshore energy, and defense markets, announces the launch of its new multi-purpose Autonomous Unmanned Surface Vessel (AUSV), DriX.



NOAA and LIQUID ROBOTICS Collaborate to Protect Marine Sanctuaries

Liquid Robotics and NOAA's Office of National Marine Sanctuaries (ONMS) Pacific Islands Region (PIR) announced a multi-year agreement to develop solutions to help protect and preserve the Hawaiian and American Samoa marine sanctuaries and monuments.

Liquid Robotics' Wave Glider, an autonomous surface ocean robot, will be the core technology to conduct long-term environmental monitoring and surveillance of the Pacific's most diverse and endangered underwater ecosystems. This partnership will help address the critical long-term monitoring and

scientific data collection gaps that are not economically feasible with traditional research assets.

"The Office of NOAA's National Marine Sanctuaries Pacific Islands Region is honored and excited about the possibilities that this new partnership will bring to both our programs," said Allen Tom, regional director, Office of NMS Pacific Islands. "Utilizing the latest technology in marine sciences helps us protect some of the older marine ecosystems in the world—a truly groundbreaking opportunity for ONMS and Liquid Robotics."



The innovative use of autonomous systems and services to augment NOAA's ONMS current resources will greatly enhance their ability to assess and evaluate the increasing threats posed by:

- Illegal, unreported and unregulated fishing (IUU);
- Water quality and marine debris;
- Coral reef damage and bleaching;
- Climate change.

"Over the past decade, we've partnered with NOAA scientists on projects ranging from ocean acidification to measuring Arctic waves to collecting storm intensity data from the surface of the hurricane," said Gary Gysin, president and CEO of Liquid Robotics. "This collaboration takes our partnership to a new level as we provide Wave Glider technology and services to help preserve, protect, and sustain the Hawaiian and American Samoan marine sanctuaries and ocean we all hold dear."

This partnership provides services to the National Marine Sanctuary System's six sanctuary units, as well as:

- NOAA's National Ocean Service (NOS);
- The State of Hawaii and the Territory of American Samoa;

- The Humpback Whale National Marine Sanctuary (HHWNMS);

- National Marine Sanctuary of American Samoa (NMSAS);

- Papahānaumokuākea Marine National Monument (PMNM) and remote Northwestern Hawaiian Islands;

- National Marine Sanctuary System (ONMS).

NOAA's ONMS serves as the trustee for a network of underwater parks encompassing more than 600,000 square miles of marine and Great Lakes waters from Washington state to the Florida Keys, and from Lake Huron to American Samoa. The network includes a system of 13 national marine sanctuaries and Papahānaumokuākea and Rose Atoll marine national monuments.

For more information, visit www.liquid-robotics.com/platform/overview.

Above: Liquid Robotics Copper Wave Glider.

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Battery Systems

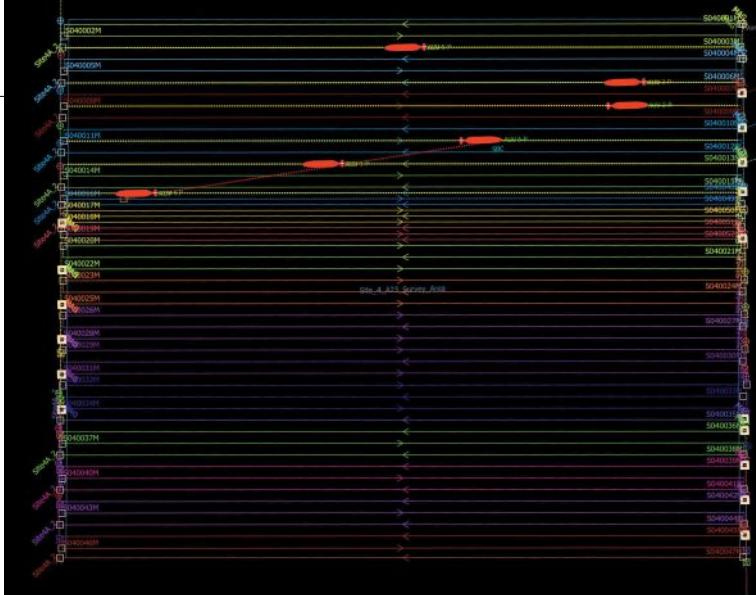
5,000+ METER DIVE with SIX HUGIN AUVs Operating Simultaneously

Upon the completion of sea trials in late July, Ocean Infinity has performed surveys at five different locations using the multiple AUV fleet all launched, monitored, and recovered from a 115-meter multi-purpose offshore vessel. The mission of each AUV is observed by the operators onboard the vessel and created within the custom mission planning software InfinityView, developed by

4D Nav. The coordination of the launch and recovery for each AUV is a vital part of every mission. The recovery of the AUVs for this mission began on the evening of October 19th.

The HUGIN AUV is rated for a water depth of 6,000 meters. Ocean Infinity plans to descend to the 6,000-meter water depth with all eight AUVs by mid-2018.

For more information, visit oceaninfinity.com.



ON OCTOBER 18TH, Ocean Infinity launched six HUGIN AUVs, each with an independent mission that has surpassed a water depth of 5,200 meters. This is the deepest dive undertaken by multiple AUVs commercially known. It is also a first for six HUGIN AUVs to simultaneously descend further than 5,000 meters.



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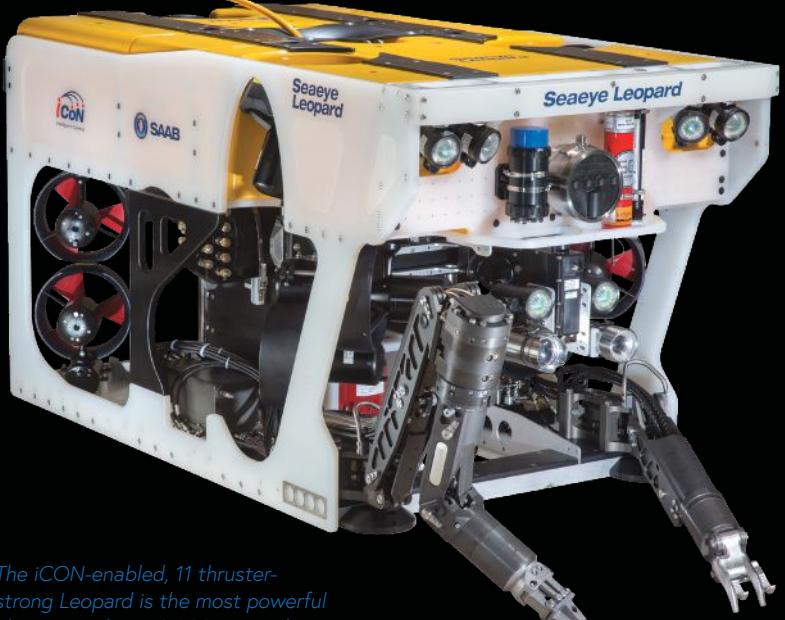
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ELECTRIC REVOLUTION

A large, abstract fractal pattern in shades of blue and white occupies the left side of the page. It has organic, flowing, and branching structures, resembling a complex network or a microscopic view of a material. The right side of the page is a solid dark blue.

An *ELECTRIC*
REVOLUTION
is underway
that will see
electric robotic
vehicles performing
every task in the
underwater domain.
It comes as
task resolution
drives the market,
rather than
class of vehicle.



The iCON-enabled, 11 thruster-strong Leopard is the most powerful electric e-robotic 3,000-m rated system in the world—and is half the size of a comparable hydraulic system and costs far less to own and operate.

SMART ELECTRIC TECHNOLOGY offers boundless possibilities across many underwater sectors, from offshore energy operations to marine science, aquaculture, nuclear installations, hydro facilities, and security, to name a few. In the offshore energy industry alone, where underwater vehicle technology operates at the extremes, hydraulic vehicles once performed almost 100% of work tasks. Today, the entire drill support operation is now in the realm of electric robotics with only blowout preventer (BOP) override and the manoeuvring of multi-ton objects being beyond their current scope. In the future, 100% of tasks will be undertaken by electric systems. Importantly, the electric

revolution is cutting costs worldwide, with significant savings reported by those offshore operators who have opted for electric robotic vehicles as their system of choice.

For example, Australia-based Dive Works saved millions of dollars for a client by performing a seemingly impossible Inspection-Repair-Maintenance (IRM) work scope using an electric Leopard in a procedure that previously could only be achieved by large and expensive hydraulic systems and divers.

Behind electric's success are rapid advances in technology with miniaturisation and enhanced capability creating robotic systems that are smaller, smarter, lighter, more agile, and more powerful—making electric robotics 50% more efficient than hydraulic systems.



Jon Robertson, managing director of Saab Seaeye, the world's largest manufacturer of electric underwater robotic systems, sees an all-electric future as pioneering technology opens new horizons and brings multimillion dollar operational savings.

For instance, when comparing a 30-ton complete electric package to a 60-ton hydraulic equivalent, the electric package has a much smaller footprint, faster mobilisation time, lower maintenance cost, and needs fewer staff at the work site. It also has a much greater ratio of thrust to volume that increases speed through the water and provides the payload, power, and control stability to carry the range of tooling and sensors usually associated with much larger systems.

Important for many operators is that electric systems can tolerate higher environmental temperature ranges than hydraulic systems and have the agility and ability to handle strong currents—which also enables them to stay longer on task.

BOUNDLESS INNOVATION

Giving life to innovation that can master the most challenging multi-dimensional environment on the planet is the boundless potential of intelligent electric systems. It inspires innovations that will continue to expand the future of underwater robotics, whilst every day empowering our customers to find imaginative ways to meet challenges and opportunities.

Over the years, we have led the industry with pioneering concepts that have advanced the capability of underwater robotic systems. One such far-reaching concept was the early introduction of intelligent distributed control.

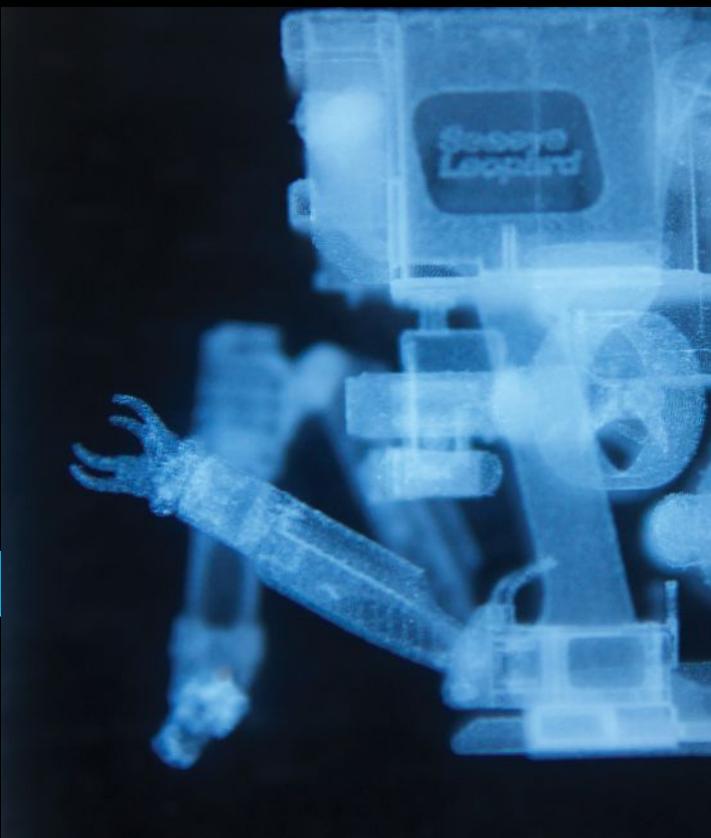
This has evolved into the all-empowering introduction of intelligent electric architecture, which we call iCON. This comprises a set of proven, common hardware and software building blocks that can be rapidly configured for custom-built solutions and will allow the rapid and harmonious migration of options across different systems whilst also accelerating development and innovation.

Electrification of actuators and tools offers the benefit of a simplified, reliable interface, and—when complemented with an internal processor and suitable micro-sensors—valuable data can be extracted to enhance control options and increase total system reliability. Having more data available from a device through continuous internal monitoring can assist with pre-emptive maintenance planning and, when coupled with a non-hydraulic interface, allows for remote long-term deployment underwater.

It is the emergence of transformative technology such as this that has allowed us to pioneer the development of seabed resident systems for operating at deep or remote locations over extended periods where interchangeable tooling packages are stored at docking stations, batteries are recharged, data and video downloaded, and new missions uploaded over the Internet. A vehicle controlled remotely through low-bandwidth, high-latency links can accurately perform inspection and light intervention tasks.

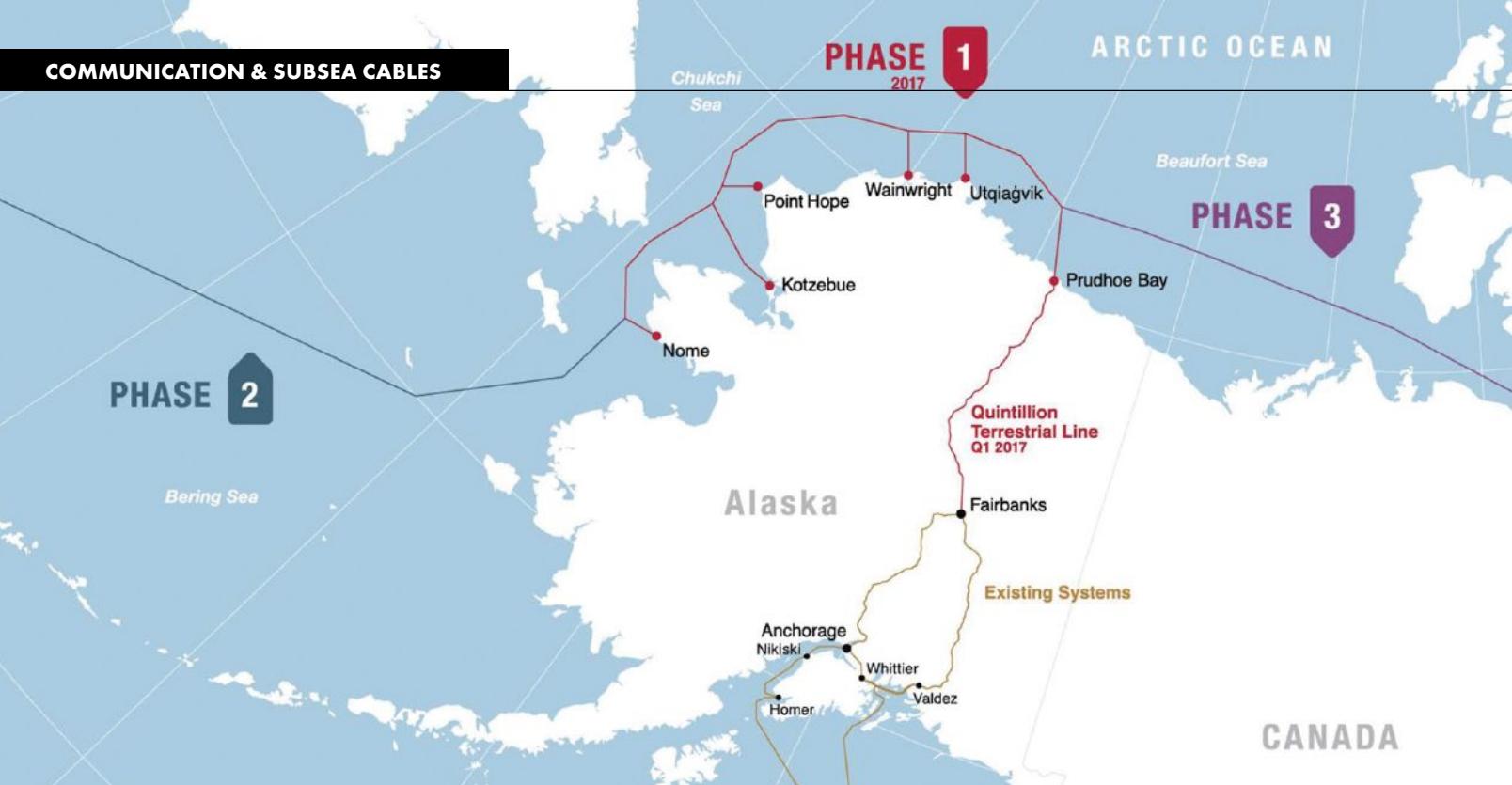
Essentially, the creation of harmonious modularity through a versatile and simple, yet highly refined building block concept makes it far easier to create advanced robotic systems that can undertake the most exacting of tasks.

Ever-advancing levels of technological excellence and imagination are opening up new possibilities every day. Electric robotic systems are empowering all who operate in the underwater world and offer boundless possibilities for the future.



PHASE 2

PHASE 3



QUINTILLION

Completes Installation of Historic Alaska Submarine System

Crews aboard the Alcatel Submarine Networks' C/V Ile de Batz installed the last segment of cable beneath the ocean floor, completing physical installation of the Alaska portion of the international Quintillion Subsea Cable System. The system is on schedule to be in service this December, enabling 21st century communications in the North American Arctic for the first time.

The Alaska portion will deliver gigabit and higher bandwidth services on a 1,400 mile subsea and terrestrial fiber optic network, including a subsea trunk line from Prudhoe Bay to Nome with branching lines to Utqiagvik, Wainwright, Point Hope, and Kotzebue. Most of the installation occurred last year. Crews were back on the water this summer adding resiliency to the system and installing the last 40 miles of cable.

The portion of the system installed in 2016 has been operating in test mode since last November and was closely monitored over the winter and during the critical spring ice break season. The installation has operated perfectly

through this test period, and we look forward to completing system testing activities prior to commercial launch this December.

In addition, Quintillion's new terrestrial fiber has been installed between Fairbanks and Prudhoe Bay that connect these northern Alaska communities to the Pacific Northwest as well as serve the Prudhoe Bay oil fields. This terrestrial system was launched and has been providing commercial service since last spring. The three-phase Quintillion Subsea Cable System is ultimately intended to connect Asia to Western Europe via the southern portion of the Northwest Passage through the Alaska and Canadian Arctic.

"Completing the Alaska phase is a significant step for our groundbreaking project," said George M Tronsrue III, Quintillion's Interim CEO. "Our team overcame considerable challenges, including operating in a short, harsh, and unpredictable Arctic construction season. We're proud of our work and what it will mean to these Alaska communities."

The Quintillion system will provide access to high-speed broadband capacity for telecommunication service providers at lower wholesale cost and improved quality of service than existing satellite and microwave options. Introduction of high-speed internet to Quintillion's markets will enable improved health and education services, help spur economic development, empower local businesses, and allow consumers access to video and other high-speed applications.

"Our mission is to deliver the same capacity to our Alaska markets the rest of the US has enjoyed for the past two decades," said Tronsrue. "We believe this will drive new growth and innovation and enhance education, medicine, and other essential services."

For more information, visit qexpressnet.com.



Deep Blue to Extend Caribbean Network to Colombia and Panama

Deep Blue Cable, the developer, owner, and operator of a state-of-the-art subsea fiber-optic system providing connectivity across the Caribbean islands and to the Americas, has announced plans to extend its pan-Caribbean subsea network to Colombia and Panama as well as expand to additional landing points throughout the region.

The Phase 1 extension of the Deep Blue cable system to Colombia and Panama will necessitate an adjustment to the project timeline. Route survey activities for the pan-Caribbean undersea cable will commence in Q1 2018, with manufacturing and installation continuing through 2018 and into 2019. Meanwhile, in view of the recent extreme weather events in the region, Deep Blue Cable is continuing to consider the design of the system to mitigate any future environmental and connectivity concerns. The projected Ready for Service date of the Deep Blue subsea cable system is Q2 2020.

"With the planned extension of our subsea fiber-optic cable system to Colombia and Panama, Deep Blue underscores its commitment to the long-term solution of providing advanced subsea connectivity across the Caribbean islands and to the Americas," commented Stephen Scott, CEO of

Deep Blue Cable. "The Deep Blue subsea cable network will have a profound impact not only on the communications ecosystem of the Caribbean, but also on the economic growth potential of an underserved region. Now more than ever, the Caribbean needs resilient communications infrastructure."

The Deep Blue subsea cable spans nearly 12,000 kilometer with initial landing points in fourteen markets throughout the region, including the British Virgin Islands, the Cayman Islands, Colombia, Curaçao, the Dominican Republic, Haiti, Jamaica, Panama, Puerto Rico, Trinidad & Tobago, and Turks & Caicos Islands, with dual diverse landings in the US, which will include the first landing of a cable on the Gulf Coast of Florida. The Deep Blue cable system will play a critical role in serving developing Caribbean countries that are now experiencing a surge in demand for advanced telecom services but currently rely on fiber-optic connectivity that is technologically and economically disadvantaged.

The Deep Blue subsea cable network, which has up to 8 fiber pairs with an initial capacity of 6 Tbps, and ultimate capacity of approximately 20 Tbps per fiber pair, will ensure availability, competitive

pricing, and capacity resilience throughout the Caribbean. The Deep Blue cable system will benefit the region's businesses and consumers by offering significantly higher design capacity, lower unit costs, lower latency through direct connectivity, and the ability to leverage advancements in reliability such as improved route planning and installation techniques.

For more information, visit www.deepbluecable.com.

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The VOCUS SUBSEA CABLE Serving Ichthys and Prelude is Live

Vocus Group Limited announced the successful connection of its high-speed fiber-optic North-West Cable System (NWCS) to the INPEX-operated Ichthys LNG Project and Shell's Prelude FLNG facility located off the north-west coast of Australia.

The North-West Cable System, recently constructed by Vocus in partnership with Shell and INPEX, comprises 2,100 kilometers of submarine cable between Darwin to Port Hedland. The system can deliver speeds of up to 40 Gb/s to both INPEX and Shell facilities and serves to increase the reach and resiliency of the Vocus Australian telecommunications network. The NWCS has been designed to enable high-speed data connections to other key hydrocarbon prospects along the cable route.

"Connection of these services isn't just an important milestone for Vocus, it's an improvement to the essential telco services in an often-neglected part of Australia and a fast and secure connection to families and teams for the fly-in-fly-out crew on these platforms," said Geoff Horth, Vocus CEO.

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"INPEX is proud of the close industry collaboration that enabled this cutting-edge communications system to be put in place. Not only is this initiative strengthening the safe operations of the INPEX-led Ichthys LNG Project's offshore facilities—it is also delivering immediate benefits to our teams and the Northern Territory and Western Australia communities connected to the cable," said Louis Bon, managing director Ichthys Project.

"Shell is extremely pleased of the partnership with Vocus and INPEX. The NWCS will improve the collaboration of our onshore and offshore teams during the commissioning and operation of Prelude, and importantly, will transform the offshore experience for our offshore teams ensuring they are well connected to home and family," said David Bird, VP Prelude.

For more information, visit vocusgroup.com.

MONTH IN REVIEW

Work Commencing on IOX Submarine Cable Linking India and South Africa

IOX Cable Ltd and Alcatel Submarine Networks, part of Nokia, have commenced work for cable route survey for the IOX Cable System, which will span more than 8,850 kilometers.
<http://ont.news/2mBcy5H>

KVH TracPhone V7-HTS Delivers Maritime Broadband at Triple the Speed

A 60-cm marine satellite antenna system designed to deliver the fastest data speeds globally to the maritime market was unveiled by KVH Industries, Inc.
<http://ont.news/2zPeaOs>

PLDT to Open AAE-1 International Submarine Cable System by End of 2017

PLDT is set to open another international submarine cable link for the Philippines to three continents with the launch of the new Asia-Africa-Europe 1 Submarine Cable System (AAE-1) before the end of the year.
<http://ont.news/2iq6hVW>

TE SubCom Announces Contract in Force for JUPITER Transpacific Cable

TE SubCom, together with a consortium of six prominent telecom and content service providers, announced that the supply contract for the JUPITER Cable system has come into force.
<http://ont.news/2hzLXQM>

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KNIFEFISH Unmanned Undersea Vehicle

Completes Contractor Trials

The General Dynamics Mission Systems' Knifefish team successfully completed contractor trials for the U.S. Navy's Knifefish program, a mine countermeasure (MCM) unmanned undersea vehicle (UUV). The Knifefish UUV operated in multiple mine test target fields at-sea using buried, bottom, and volume type mine-test targets.

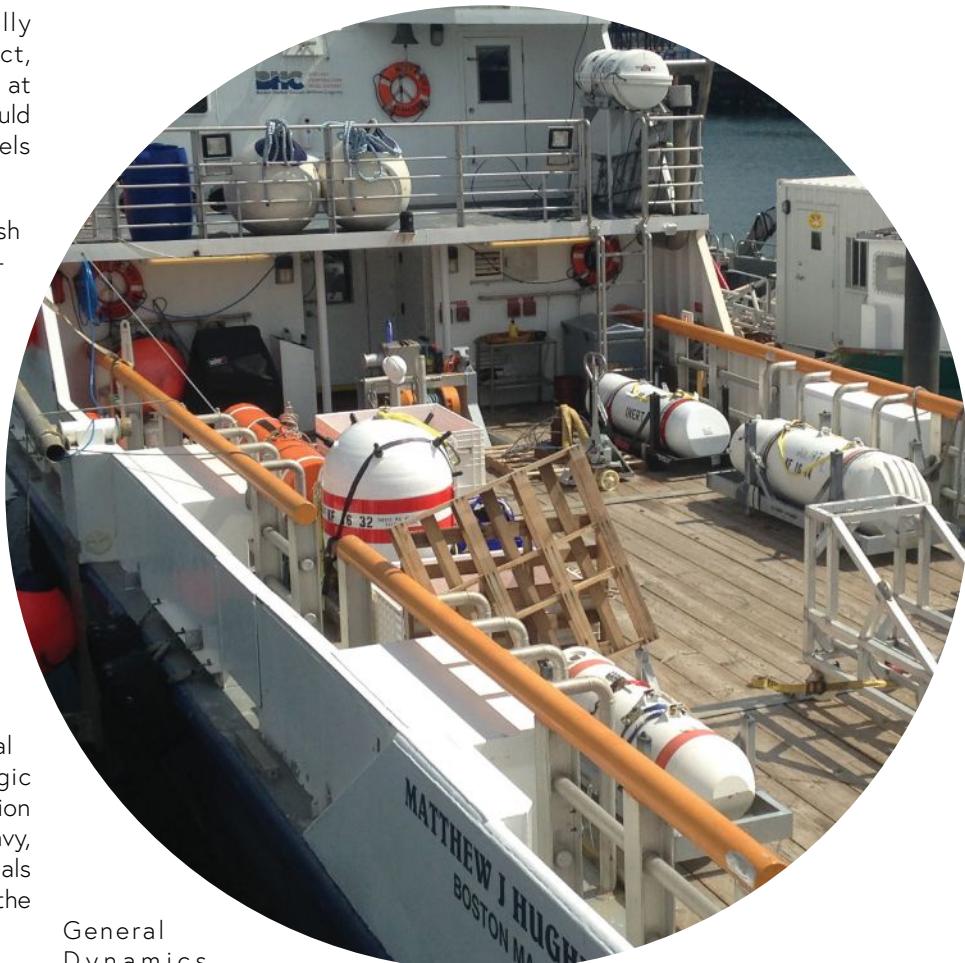
The Knifefish system successfully demonstrated its ability to detect, classify, and identify potential mines at a variety of depths, each of which would pose a unique threat to naval vessels operating in a mission area.

"The Navy is pleased with the Knifefish performance during the recent contractor trials, as the system demonstrated its ability to reliably find mines in different environments," stated Capt. Jonathan Rucker, PMS 406 Program Manager. "Knifefish provides the Navy a critical means to find and identify bottom, buried, and volume mines, providing a much-needed capability for the warfighter."

"This round of contractor testing demonstrated the continued improvement in the performance of the Knifefish UUV," said Carlo Zaffanella, vice president and general manager of Maritime and Strategic Systems for General Dynamics Mission Systems. "Working closely with the Navy, we look forward to Sea Acceptance Trials in 2018 and continued refinement of the Knifefish system."

Contractor trials, managed by General Dynamics Mission Systems, took place off the coast of Boston using submerged Navy mine-test targets. These trials differed from previous evaluations of the Knifefish UUV by demonstrating end-to-end performance of the Knifefish system in realistic at-sea mission scenarios over the course of hundreds of hours of at-sea operation and more than one hundred simulated missions.

Knifefish is a medium-class mine countermeasure UUV intended for deployment from the Navy's Littoral Combat Ship and other Navy vessels. Knifefish will reduce risk to personnel by operating in the minefield as an off-board sensor while the host ship stays outside the minefield boundaries.



General Dynamics Mission Systems is the prime contractor for the Knifefish program. The company designed the tactical UUV using an open architecture concept that can be quickly and efficiently modified to accommodate a wide range of missions that may face future naval operations. The Knifefish UUV is based on the General Dynamics Bluefin Robotics Bluefin-21 deepwater Autonomous Undersea Vehicle (AUV).

For more information, visit gdmissionsystems.com.

Above: Knifefish test targets.
Photo courtesy of General Dynamics Mission Systems.

LOCKHEED MARTIN to Design Extra Large Unmanned Undersea Vehicle

Lockheed Martin will support the growth of the U.S. Navy's family of unmanned undersea systems under a design phase contract valued at \$43.2 million for Orca, the U.S. Navy's Extra Large Unmanned Undersea Vehicle (XLUV).

XLUV Orca is a two-phase competition, including the currently awarded design phase and a competitive production phase for up to nine vehicles to meet increasing demands for undersea operational awareness and payload delivery.

This long-range autonomous vehicle will perform a variety of missions, enabled by a reconfigurable payload bay. Key attributes include extended vehicle range, autonomy, and persistence. Orca will transit to an area of operation; loiter

with the ability to periodically establish communications, deploy payloads, and transit home. A critical benefit of Orca is that Navy personnel launch, recover, operate, and communicate with the vehicle from a home base and are never placed in harm's way.

"With each new undersea vehicle that Lockheed Martin designs, we bring to bear the state-of-the-art in technology and innovative system integration of those technologies to increase the range, reach, and effectiveness of undersea forces and their missions," said Frank Drennan, director, submersibles and autonomous systems, business development. "With decades of experience supporting the U.S. Navy's mission, our engineers are approaching

For more information, visit www.lockheedmartin.com/XLUUV or www.lockheedmartin.com/unmanned.

this design with a sense of urgency and continued agility."

Lockheed Martin has over four decades of experience in unmanned and robotic systems for sea, air, and land. From the depths of the ocean to the rarified air of the stratosphere, Lockheed Martin's unmanned systems help our customers accomplish their most difficult challenges.

Lockheed Martin employees in Palm Beach, Florida, will perform the work on Orca, with additional support from employees at the company's locations in Manassas, Virginia; Syracuse, New York; and Owego, New York.



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Conference Centre (AECC)
07-09 February 2018



BOLLINGER Delivers Fast Response Cutter to US Coast Guard

Bollinger Shipyards has delivered the USCGC Joseph Gerczak, the 26th Fast Response Cutter (FRC) to the U.S. Coast Guard. The Coast Guard took delivery on the 9th of November 2017 in Key West, Florida. The vessel's commissioning is scheduled for March 9, 2018 in Honolulu, Hawaii.

"We are excited to announce the delivery of the latest FRC, the USCGC Joseph Gerczak," said Ben Bordelon, Bollinger President & C.E.O. "This FRC built by Bollinger Shipyards will be the second FRC to be stationed in Honolulu, Hawaii. Previous cutters have been stationed in Florida; San Juan, Puerto Rico; Cape May, New Jersey; Ketchikan, Alaska; and Pascagoula, Mississippi. FRCs already in commission have seized multiple tons of narcotics, interdicted thousands of illegal aliens, and saved many lives. The FRC program is a model program for government acquisition and has surpassed all historical quality

benchmarks for vessels of this type and complexity. The results are the delivery of truly extraordinary Coast Guard cutters that will serve our Nation for decades to come. We are extremely proud that the Fast Response Cutters built by Louisiana craftsmen here at Bollinger Shipyards are having such a major impact on our country's safety and security."

The 154 foot patrol craft USCGC Joseph Gerczak is the 26th vessel in the Coast Guard's Sentinel-class FRC program. The FRC has been described as an operational "game changer" by senior Coast Guard officials. To build the FRC, Bollinger used a proven, in-service parent craft design based on the Damen Stan Patrol Boat 4708. It has a flank speed of 28 knots, state-of-the-art command, control, communications, and computer technology; and a stern launch system for the vessel's 26 foot cutter boat.

Each FRC is named for an enlisted Coast Guard hero who distinguished him or herself in the line of duty. This vessel is named after Coast Guard Hero Joseph Gerczak. Gerczak, a signalman third class, was on board the USS LST-66 during the initial assault against the Japanese-held Borgen Bay Area of New Britain on December 26, 1943. As Japanese dive bombers attacked his ship, Gerczak manned his battle station with expert marksmanship and unwavering perseverance. In recognition for having gallantly given his life for his country, Joseph Gerczak was posthumously awarded the Silver Star. He also posthumously received the Purple Heart and Presidential Unit Commendation that was awarded to LST-66 for meritorious service in action against the Japanese.

For more information, visit www.bollingershipyards.com.

MONTH IN REVIEW

Kongsberg, thyssenkrupp Establish Submarine Systems Joint Venture

thyssenkrupp, its subsidiary Atlas Elektronik, and Kongsberg joined forces and established a 50/50 joint venture company to shape the future combat systems of conventional submarines.
<http://ont.news/2yU6GWy>

NAVOCEANO Collaborates, Carderock Conduct Autonomous Demonstration

Engineers at the Naval Oceanographic Office remotely collaborated with the Naval Surface Warfare Center on a vehicle demonstration.
<http://ont.news/2AQsD9D>

Navy Expands Electromagnetic Maneuver Warfare for 'Victory at Sea'

New electromagnetic maneuver warfare capabilities are emerging from laboratories to make a vital impact in the Fleet, Naval Surface Warfare Center Dahlgren Division (NSWCDD).
<http://ont.news/2zPswy4>

HII Authenticates Keel of Fort Lauderdale (LPD 28)

Huntington Ingalls Industries' (HII) Ingalls Shipbuilding division authenticated the keel of the San Antonio-class amphibious transport ship Fort Lauderdale (LPD 28) on October 13.
<http://ont.news/2mzzJwU>

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The Clock Ticks for OPEC Meeting and Oil Price Direction

BY G. ALLEN BROOKS

Author, Musings From the Oil Patch

www.energymusings.com

The members of the Organization of Petroleum Exporting Countries will gather for their semi-annual conclave in Vienna to discuss the state of the global oil market. Their goal is to figure out to get oil prices up, without risking sending them lower.

OPEC represents its role as the balancing supplier to the world. In other words, once OPEC's market analysts assess and project the total amount of oil needed to meet world demands for 2018, as well as the volume of oil supplies that will be coming from the various non-OPEC sources, it can then determine the "call-on OPEC" oil. Given the overall number, then the negotiations begin among the OPEC members as to how much of the call each exporter can supply. For many, the decision is simple—it is whatever they can produce, less whatever amount must stay in the country to meet domestic needs. Traditionally, the last country to step up is Saudi Arabia, who traditionally has set its production and export targets to meet the remaining unsatisfied global oil need.

In 2014, after three years of \$100-plus per barrel oil prices, the November OPEC meeting concluded with production and export numbers leaving Saudi Arabia to having to once again cut its output in order to balance the global oil market. That outcome was no longer acceptable to the kingdom. It was facing increased pressure for revenues, while also needing to meet growing internal oil consumption. By having dutifully played the balancing role in OPEC for years, Saudi Arabia had lost market share, especially in the attractive growth market of Asia, a region the kingdom knows represents the only assured growth market for the foreseeable future, and thus crucial for its long-term business interests. This reckoning led Saudi Arabia to balk at continuing

to play the balancing role. Instead, Saudi Arabia announced it would be boosting its production to recapture the market share it had lost over the prior three years when oil prices soared and demand was constrained.

inventories sending signals that the world market is now rebalancing. That is important for OPEC, and the entire oil producing industry, as a rebalanced oil market leads to higher oil prices and more income.

“So, are the oil speculators, who have bet on higher oil prices, once again calling a near-term top in oil prices? It is a distinct possibility.”

Three years after that 2014 fateful meeting, OPEC oil ministers are set to reassemble in Vienna for another get-together—only this time the outlook is better. Crude oil demand has been growing faster than anticipated earlier. The International Monetary Fund is now projecting faster global economic growth in 2018 than this year, translating into higher oil demand growth. In fact, the three major oil forecasting organizations—the International Energy Agency, the U.S. Energy Information Administration, and OPEC—have all raised their demand growth forecasts in the past several months. These higher demand growth projections, combined with OPEC's and its non-OPEC supporters' production cut agreement, has contributed to shrinking global oil

Our chart showing West Texas Intermediate and Brent oil prices for 2017 through mid-November also shows the estimated global change in inventories for each quarter of the year. It is important to note that oil prices entered the year in the mid-\$50s a barrel range in response to expectations that the production cut agreement negotiated in the fall of 2016, and scheduled to come into effect on January 1, 2017, would accelerate the oil market's rebalancing. But as the optimists learned, agreeing to cut production and having its impact immediately felt in the market turned out to be two different things. We learned in January how much OPEC producers had lifted their output prior to being subject to reduced production quotas. All of that extra oil began flowing into the market starting in January and lasting through most of the first quarter.

As our chart shows, the implied quarterly global inventory changes calculated on a daily basis (the difference between global production and consumption) showed almost no reduction during the first quarter of 2017. What happened was we experienced meaningful reductions in the second and third quarters. With that knowledge, it was not surprising that oil prices fell during the first part of 2017 as the 2016 year-end market optimism waned when inventories failed

to decline measurably. However, when inventories began falling, oil prices started marching from the mid-\$40s a barrel to the upper \$50s/low-\$60s range, now.

The most recent decline in oil prices likely reflects a combination of speculators taking profits after a nearly 25% price rise. Traders are also recognizing that the new quarterly forecast calling for inventories in the fourth quarter to increase will retard the oil price advance.

Another measure of how this pricing movement works shows up in the latest data on crude oil futures contracts held by speculators. The early November weekly data shows traders hold the highest level of long positions (bullish bets for higher oil prices) they have held since mid-April. That earlier point coincided with oil prices near their high for the year in the mid-\$50s before ultimately falling to the mid-\$40s two months later. So, are the oil speculators, who have bet on higher oil prices, once again calling a near-term top in oil prices? It is a distinct possibility.

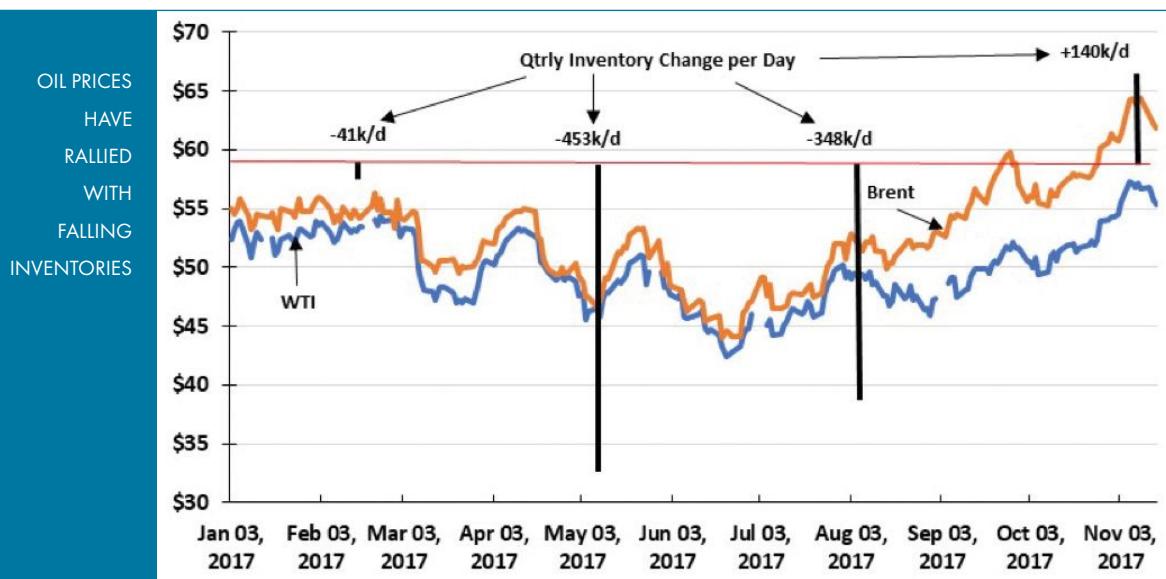
If we think about the oil market in its broadest context, the pattern of oil prices reflects perfectly the observable trends. The early price expectations

based on an instantaneous inventory response to the OPEC/non-OPEC production cut agreement was overdone. When the data began showing that oil inventories were falling and the market was on a path to rebalancing, oil prices were down but started rising. It was also not surprising that oil demand forecasts began ramping higher. Supporting data in the U.S. came from the monthly vehicle miles traveled figures that showed healthy year-over-year monthly gains. In other words, we were set up for a climb for oil prices.

Now, we see that the IEA has cut its 2017 fourth quarter and 2018 oil demand growth projections, weekly U.S. oil export volumes have reached record levels, U.S. drilling rigs are returning to work, and the most recent monthly VMT data shows miles driven growing at a declining rate. In effect, what we are seeing are the early signs of a world reacting to a mid-\$50s a barrel oil world, rather than the mid-\$40s world of this spring and summer. It makes perfect sense that demand growth would slow as gasoline prices and crude oil prices move higher, which then helps create a market overhang, which is reflected in a projection for a meaningful fourth quarter oil inventory build, rather than a continuation of shrinking quarterly inventories.

The question of whether the world has adopted to a low oil price environment, and will experience weaker demand fundamentals as oil prices rise will weigh heavily on the minds of the OPEC oil ministers as they arrive in Vienna. They also have to think about how higher oil prices will influence American oil producers to drill and produce more oil. Do the ministers extend their oil production cut? More importantly, for how long might they extend it, given the financial pain it is inflicting on its small and poor members? This decision is critical as high compliance is important for its success. Too long an extension, and sharply higher oil prices could undercut the agreement's effectiveness. Too short and the speculators will trash oil prices.

There are never any easy decisions at OPEC meetings, especially when the organization's decisions can actually influence prices, rather than merely riding the market tide higher. For those watching for news from the OPEC meeting, be prepared for the unexpected.



CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF NOVEMBER 13, 2017

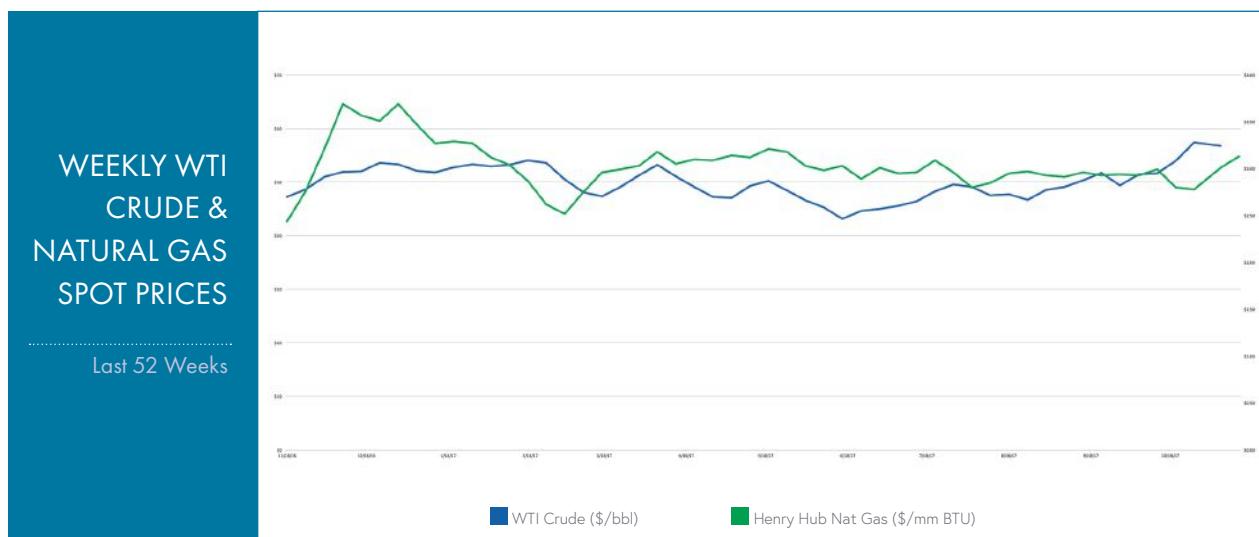
Energy prices moved upward during the last reporting period, with WTI Crude hitting \$57.77/bbl on November 13, up from \$51.43/bbl a month before. The improvement in prices appears to be driven by OPEC and Russia's compliance with agreement to reduce supply. As we reached our publishing deadline, however,

a report from the International Energy Agency (IEA) lowered its forecast for oil demand growth by 100,000 per day for 2017 and 2018. The report is expected to negatively impact oil prices in the short term. On a separate note, the U.S. Energy Information Administration reported that production in the Gulf of

Mexico would decline slightly in the second half of 2017 by about 7,000 barrels per day.

Henry Hub natural gas spot prices passed the \$3.00 mark to reach \$3.13 mm BTU on November 13. This is the highest that it has been since May, but still well below the price at the start of 2017,

which stood at \$3.69. The November 13 price represents a modest increase over the past month of about 4.5%. Natural gas stocks are down slightly from the same period in 2016, but are still within the five-year average.



\$57.77

+\$5.34 from previous month



TRENDING UP



**Cushing, OK
WTI Spot Price**

\$3.13

+\$0.14 from previous month



**Henry Hub
Spot Price**



TRENDING UP

KEY EQUITY Indexes

PRICES IN US DOLLARS AS OF NOVEMBER 13, 2017

U.S. EQUITY MARKETS

continued a string of record highs since last month's report, but by mid-November had fallen back a bit.

The DJIA reached a high 23,563 on November 8 before retreating to 23,439 by November 13.

The S&P 500 showed a similar trend. Poor trade reports from Europe and lower commodity prices in Asia are expected to impact the markets in the short term, according to CNBC, as well as the impact of the International Energy Agency report on 2017-2018 oil demand.

The Philadelphia Oilfield Services Index (OSX) continued to struggle, dropping to 132.82 on November 13.

SELECTED EQUITY INDEXES

Cumulative Percentage Change Last 52 Weeks



23,439.70

+442.26 from previous month



TRENDING UP

DJIA

2578.87

+19.51 from previous month



TRENDING UP

S&P 500

132.82

-4.50 from previous month



TRENDING DOWN

OSX

AUVSI XPONENTIAL

Denver, CO
April 30-May 3, 2018
www.xponential.org/xponential2018/public/Enter.aspx

SATELLITE

Washington, D.C.
March 12-15, 2018
2018.satshow.com

International Telecoms Week

Chicago, IL
May 6-9, 2018
www.internationaltelecomsweek.com/

International Offshore Wind Partnering Forum

Princeton, NJ
April 3-6, 2018
www.bizmdosw.org/2018ipf

CUCE

Vancouver, Canada
March 25-27, 2018
www.underwaterconference.ca

Telecom Exchange

New York City
June 20, 2018
thetelecomexchange.com/nyc

Subsea Expo

Aberdeen, UK
February 7-9, 2018
www.subseaexpo.com

UDT

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

Ocean Sciences Meeting

Portland, OR
February 11-16, 2018
osm.agu.org/2018

Clean Pacific

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

World Ocean Summit

Riviera Maya, Mexico
March 7-9, 2018
events.economist.com/events-conferences/americas/world-ocean-summit

OTC

Houston, TX
April 30 – May 3, 2018
2018.otcnet.org

Decommissioning & Abandonment Summit

Houston, TX
February 20-21, 2018
www.decomworld.com/gom

GoM Oil Spill & Ecosystem

New Orleans, LA
February 5-8, 2018
www.cvent.com/events/2018-gulf-of-mexico-oil-spill-and-ecosystem-science-conference/event-summary-6ae61bf76b204d0392d48b8bf15ed1eb.aspx

Underwater Intervention

New Orleans, LA
February 6-8, 2018
www.underwaterintervention.com

ICOE

Normandy, France
June 12-14, 2018
www.icoe-conference.com

OMAE

Madrid, Spain
June 17-22, 2018
www.asme.org/events/omae

Tug, Salvage & OSV

Marseille, France
June 25-29, 2018
www.tugandosv.com/its2018-home



2017 EDITORIAL CALENDAR

CALENDAR

JANUARY

Editorial: Underwater Navigation; Manned Submersibles Research & Development Services
Focus: Multibeam & Side Scan Sonar; Research & Development

FEBRUARY

Editorial: Oceanology & Meteorology; Decom & Abandonment
Focus: Buoys & Monitoring Instrumentation; Environmental Monitoring/Testing Services

MARCH

Editorial: Subsea Fiber Optic Networks; Maritime Security
Focus: Connectors; Cables & Umbilicals; Diver Detection Systems

APRIL

Editorial: Offshore Technology; Ocean Mapping & Survey
Focus: Subsea Tools & Manipulators; Batteries; Training/Safety

MAY

Editorial: Autonomous Unmanned Vehicles; Defense & Naval Systems
Focus: Tracking & Positioning Systems; Seismic Monitoring; Equipment Leasing/Rental Services

JUNE

Editorial: UW Imaging & Processing; Marine Salvage/Underwater Archaeology
Focus: Magnetometers; Water Dredges & Airlifts; Diving Services

JULY - Digital Distribution

Editorial: Ocean Engineering; Marine Construction
Focus: Navigation, Mapping & Signal Processing; Data Processing Services

AUGUST

Editorial: Workclass ROVs; Deepwater; Pipeline/Repair/ Maintenance
Focus: Cameras, Lights & Imaging Sonars; Oil Spill Clean-Up

SEPTEMBER

Editorial: Ocean Observing Systems; Subsea Telecom; Offshore Wind Installation & Maintenance; Product & Services
Focus: Water Sampling Equipment; Cable Installation Services

OCTOBER

Editorial: Offshore Communications; Subsea Inspection, Monitoring, Repair & Maintenance
Focus: Acoustic Modems, Releases & Transponders; Marine Communications; Survey & Exploration Services

NOVEMBER - Digital Distribution

Editorial: Offshore Support, Supply & Emergency Vessels; Deep Sea Mining
Focus: Ship Protection Systems; Cranes, Winches & Control Systems; Vessel Charter/Leasing Services

DECEMBER

Editorial: Light Workclass ROVs; Commercial Diving; Year in Review
Focus: Diving Equipment & Services; Buoyancy Materials; Construction & Repair Services

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UDT Asia - January 17-18*
Marine Data Infrastructure GCC - January 30-31*
Euromaritime - January 31-February 2
GoM Oil Spill & Ecosystems - February 1-9
Oil North America - February 14-16

FEBRUARY

Underwater Intervention - February 21-23
US Hydro - March 20-23*

MARCH

Canadian Underwater Conf & Expo - March 26-28
Ballast Water Management - March 29-30
MCE Deepwater Development - April 3-5
Ocean Business - April 4-6
Telecom Exchange - June 20-21*

APRIL

Int'l Offshore Wind Forum - April 19-21*
OTC - May 1-4
AUVSI XPONENTIAL - May 8-11
IOSC - May 15-18
Deepwater Decomm Workshop - May 23-24*

MAY

UDT - May 30-June 1
Offshore Wind Energy Europe - June 6-8
Seawork Int'l - June 13-15

JUNE

Teledyne CARIS User Workshop - June 19-22*

JULY - Digital Distribution

TBD

AUGUST

SPE Offshore Europe - September 5-8

SEPTEMBER

Oceans 17 - September 17-21
AWEA Offshore Wind - October 24-25◊
WindEurope - November 28-30

OCTOBER

MTS Dynamic Positioning - October 9-11
Offshore Energy - October 9-11
Teledyne Marine Technology Workshop - October 15-18
Clean Gulf - December 5-7
Oilcomm - December 6-7

NOVEMBER - Digital Distribution

World's Congress of Ocean - November 3-5*
International Workboat - November 29-December 1*

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* Digital Distribution

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E-mail: gavinwilloughby@appliedacoustics.com
Website: www.appliedacoustics.com
Contact: Gavin Willoughby



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.

HIGH TECH, INC
21120 Johnson Road
Long Beach, MS 39560, United States
Tel: 228 868 6632
Email: high_techinc@bellsouth.net
Website: www.hightechincusa.com
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.

OCEAN SONICS LTD.
11 Lornevale Road
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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-

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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E-mail: info@rtsys.eu
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

NORTEK AS
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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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Contact: Chris Arends, Global Sales Director



Rowe Technologies Inc. [RoweTech] specializes in the design and manufacture of underwater acoustic Doppler products and imaging systems for the oceanographic, hydrographic and hydrologic markets. Founded in 2009, Rowe Technologies is a technology-based private company with the main office located in Poway CA, USA. Rowe's ADCP/DVL competitive advantage is single-unit configuration which allows simultaneous current profiling and bottom tracking.

BOOYS

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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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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.

NAUTILUS MARINE SERVICE GMBH
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Fax: 401-884-8868
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Website: www.subsalve.com
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: Ross Taylor

In the past 20 years, A-2-Sea Solutions Ltd has had significant involvement in major submarine cable installations, on behalf of manufacturers, purchasers and installers of sub-sea cable systems – operating worldwide.

From initial beginnings in submarine cable joint design and system maintenance, A-2-Sea are now providing customers with turnkey solutions for short haul cable system installations. Other key business areas include: product design and development, coastal and offshore survey, provision of beach and subsea cable joints, cable system maintenance with a 365/24/7 emergency hotline rapid response service.

In 2016, A-2-Sea Solutions was ranked 13th on the UK Sunday Times SME Export Track 100 league table and 21st on the Fast Track 100.

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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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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 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.

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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.

TELEDYNE MARINE INTERCONNECT SOLUTIONS

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Daytona Beach, FL 32114
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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. TMS 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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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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Fax: 985-346-8444
E-mail: Bleblanc@okeanus.com
Website: www.okeanus.com
Contact: Benton LeBlanc



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 submarine fiber optic network development company 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.

GYRO COMPASSES

KONGSBERG SEATEX AS

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Kongsberg Seatec 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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Fax: +1 201 825 1962
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Contact: David Dack



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, ethylene glycol, hydraulic fluids and chemical cleaning cocktails. Expedited deliveries are also available.

MARINE ENVIRONMENTAL CONSULTING SERVICES

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Fax: +1 772 219 3010
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Website: www.csaocean.com
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.

EVOLOGICS GMBH

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E-mail: sales@evologics.de
Website: www.evologics.de



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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OCEANOGRAPHIC INSTRUMENTS/SERVICES

ASL ENVIRONMENTAL SCIENCES, INC.

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- Metoceane Equipment Leasing: Acoustic Doppler Current Profiler ADCPs (including StreamPro & RiverRay), Ice Profilers, AZFP, acoustic releases, wave/tide gauges, pingers, satellite beacons, CTD+DO+Tu profilers, DO & turbidity loggers, weather station, cages, flotation, bottom frames.
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- 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, WERA Northern Radar.

NKE INSTRUMENTATION

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- Intelligent network: environmental parameters (meteorologic and oceanographic), Ecosystems Approach to Fisheries (EAF - Voluntary fishing vessels), Webdata application. Contact: Valérie Le Pen - vlepen@nke.fr or Goulven Prud'homme - gprudhomme@nke.fr
- Provor and Arvor profiling subsurface floats (ARGO project): CTD, dissolved oxygen, BGC, deep; Argos and Iridium transmission.
- Drifting surface buoys with temperature and GPS receiver for Surface velocity project. Contact: Nathalie Le Bris - nlebris@nke.fr or Jérôme Sagot - jsagot@nke.fr

RBR

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RBR creates instruments to measure the blue planet. From the ocean abyss to the polar ice caps, our sensors track water parameters – temperature, depth, salinity, dissolved gases, pH, and many others. With design and manufacturing centrally located in Ottawa, Canada, our team works in a fast-paced, dynamic atmosphere to serve customers all over the globe.

OCEANOGRAPHIC INSTRUMENTS/ SERVICES (cont)

ROMOR OCEAN SOLUTIONS

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ROMOR Ocean Solutions provides instrumentation solutions for the geophysical, oceanographic, defense, security, oil & gas, and renewable energy industries. By partnering with world renowned manufacturers, ROMOR is able to offer technical knowledge, value added services, logistics expertise, and the most reliable instrumentation on the market.



SEA-BIRD SCIENTIFIC

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A manufacturer of miniature data loggers with sensors as temperature, depth/pressure, salinity, tilt/acceleration, compass direction/magnetometer, light levels, acoustic receiving/transmitting. The loggers are used for various researches, including oceanography, fishing gear studies, equipment behavioral monitoring and fish tagging. Data is presented in the application software with a time-stamp for each measurement.

ROV SUPPLIES/TOOLS

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ROVSCO is an ROV supply company, focused toward supporting worldwide the needs of work-class ROV operators for any small component or any large equipment. We have extensive experience in this and have been doing it for 31 years. Contact us for (all original brand) consumables, ROV electrical connectors, cable assemblies, hydraulic filters, parts & components. We will respond with a quick response, excellent service and great low prices.

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SMART TELEMETRY

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Email : info@oceanwise.eu
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E-mail: info@edgetech.com
Website: www.edgetech.com
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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.

MARINE SONIC TECHNOLOGY

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Marine Sonic Technology builds high quality, high resolution side scan sonar systems.

Located in Yorktown, Virginia, Marine Sonic has been in business for more than 25 years.

Our towed systems are rugged, easy to deploy and simple to operate. We also offer highly efficient AUV/ROV embedded systems, which occupy minimal space and low power consumption.

SOUND VELOCITY PROBES/CTDS

SAIV A/S

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Environmental Sensors & Systems

- STD/CTD, Sound Velocity probes/recorder with optional multi-parameter facilities; Turbidity, Fluorescence, Oxygen etc. The new CTD/STD model SD208 with wireless communication and high accuracy: 0.002 m/s/cm, 0.002 °C
- Precision pressure /depth (0.01% accuracy) and temperature sensors/recorders. Applications: hydrographic profilings, installation on ROVs and towed systems, etc. Robust and compact designs are combined with accuracy and "plug and play" compatibility. Output format for sonar equipment, e.g. EM1002, EM3000, SSP, HiPAP and Reson 8125.

SUBSEA FABRICATION

NEW INDUSTRIES

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Contact: Bill New



New Industries provides quality fabrication services to the offshore oil & gas and marine industries focusing on large diameter pressure vessels, suction piles, DNV buildings and deepwater subsea production equipment such as jumpers, PLETs, PLEMs and manifolds.

SUBSEA TECHNOLOGY

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Website: www.km.kongsberg.com



KONGSBERG

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 Euleme vehicle.

UNDERWATER VEHICLES/AUVS

HYDROID, INC.
A SUBSIDIARY OF KONGSBERG MARITIME

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Pocasset, MA 02559
Tel: +1 508 563 6565
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E-mail: glester@hydroid.com
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Contact: Graham Lester



Located in the U.S. and a subsidiary of Kongsberg Maritime, Hydroid is the world's most trusted manufacturer of advanced Autonomous Underwater Vehicles (AUVs). Our Marine Robotics systems provide innovative and reliable full-picture solutions for the marine research, defense, hydrographic and offshore/energy markets. Our products represent the most advanced, diversified and field-proven family of AUVs and AUV support systems in the world.

Developed by a veteran team of engineers, the innovations of Hydroid and Kongsberg Maritime provide a safe and reliable answer to the challenges that have hampered ocean exploration and security. For more information on REMUS technology, please visit www.hydroid.com.

OCEANSERVER TECHNOLOGY, INC.

151 Martine Street
Fall River, MA 02723 USA
Tel: +1 508 678 0550
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Website: www.iver-auv.com
Contact: Jim Kirk



OceanServer Technology, Inc. is a leading provider of man-portable Autonomous Underwater Vehicles (AUVs) with over 250 AUVs deployed worldwide. The Iver AUV is an affordable, commercial vehicle used for general survey and sub-surface security work, and serves as a research platform for autonomy, behavioral and sensor development studies at universities and navy research facilities.

UNDERWATER VEHICLES/ROVs

DEEP OCEAN ENGINEERING INC.

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Deep Ocean Engineering, Inc. provides remotely operated and unmanned surface vehicle (ROV / USV) solutions which are used by a broad range of industry applications - security, military, nuclear and hydroelectric power plants, inshore dams and lakes, oil and gas, scientific research, fisheries, salvage, search / recovery, and pipeline inspections.

OCEANEERING INTERNATIONAL, INC.

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Contact: Bill Mallin



At Oceaneering, we do things differently, creatively, and smarter. As your trusted subsea partner, our unmatched experience and innovative technologies and solutions allow us to adapt and evolve regardless of market conditions. Only by working together will we safely and reliably re-shape the future of the oil and gas industry.

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Offering the most rugged equipment and unsurpassed customer service, Outland Technology has been the world's leading manufacturer of underwater video, lighting and ROV equipment for over 30 years. We recognize that no two jobs are the same and specialize in products that are customizable for your specific applications.

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Teledyne SeaBotix is a world leading manufacturer of capable underwater MiniROVs that perform a multitude of tasks including maritime security, search and recovery, hull and pipeline inspection, hazardous environment intervention, aquaculture, sensor deployment and oceanographic research. The Little Benthic Vehicle systems have become the benchmark in compact ROVs around the world and ROV equipment for over 30 years. We recognize that no two jobs are the same and specialize in products that are customizable for your specific applications.

UNDERWATER VEHICLES/ROVS (cont.)

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Contact: Chris Gibson



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TELEDYNE OCEANSCIENCE Welcomes **VITAD PRADITH** to Their Team

Teledyne Oceanscience announces the addition of Vitad Pradith to the team in the role of technical sales manager. Pradith was the project lead for Unmanned Systems at HYPACK where he successfully led the development of the NEXUS Unmanned Aerial LiDAR System. Pradith facilitated HYPACK installations aboard many Unmanned Surface Vessels, including the integration of new sensors and improving the user experience with these platforms.

Additionally, Mr. Pradith was a Physical Scientist for the National Oceanographic and Atmospheric Administration (NOAA) Office of Coast Survey for over a decade, providing technical direction and support to the Navigation Response Teams (NRT). He led many sensor and technology evaluations related to hydrography and emergency response applications and introduced hydrographic data processing improvements using high-performance FOG computing.

<http://ont.news/2mwjDnM>



ASV Global Prepares for Continued Growth with Managing Director

ASV Global, a global leading developer of autonomous vessel technology, has named Mark Exeter as the new managing director of its Portchester, UK office. Exeter's predecessor, Dan Hook, moves into a new role as senior director – business development, focussing on further market expansion.

<http://ont.news/2z9Oht3>



KREUZ SUBSEA Announces New Senior Management Team

Kreuz Subsea has announced AJ Jain as chief executive officer and Balaji Bhashyam as chief operating officer. Jain brings over 25 years of executive industry experience to the role having held a number of leadership positions in the oil and gas industry across the globe.

His previous posts include managing director at Harkand Group where he was responsible for operations in North America and Africa. Prior to Harkand, he was also part of the senior management team at Dynamic Industries International LLC, responsible for international operations. He also held several senior executive assignments at Global Industries Ltd, including chief operating officer and sr. vice president responsible for Asia Pacific and the Middle East earlier in his career. Global Industries was acquired by Technip in 2011.

<http://ont.news/2zGsbOt>



Harvey Gulf announces the delivery of the Second Large-capacity 340-foot Multi-Purpose

Chairman and CEO Shane Guidry of Harvey Gulf International Marine announces the delivery of the second, large capacity 340-foot Multi-Purpose Support Vessel (MPSV), significantly enhancing the domestic Jones Act Fleet.

This vessel, the M/V HARVEY BLUE-SEA, is a "best-in-class" Jones Act-qualified vessel that has the technical capabilities to efficiently, effectively, and safely perform high-quality field development activities.

<http://ont.news/2A5NQjR>

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