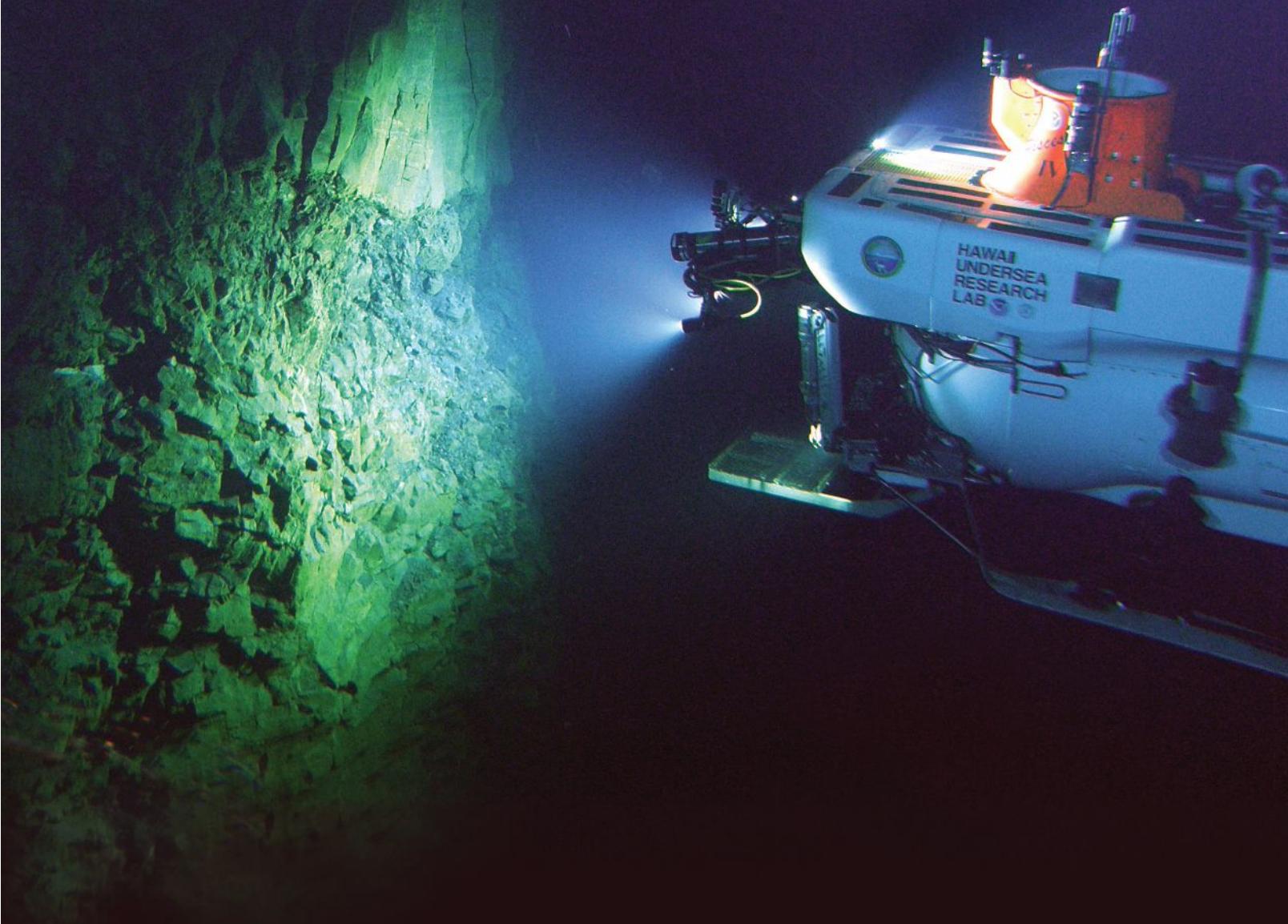


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## CHALLENGES IN THE DEEP: The Role of Manned Submersibles in an Autonomous Age

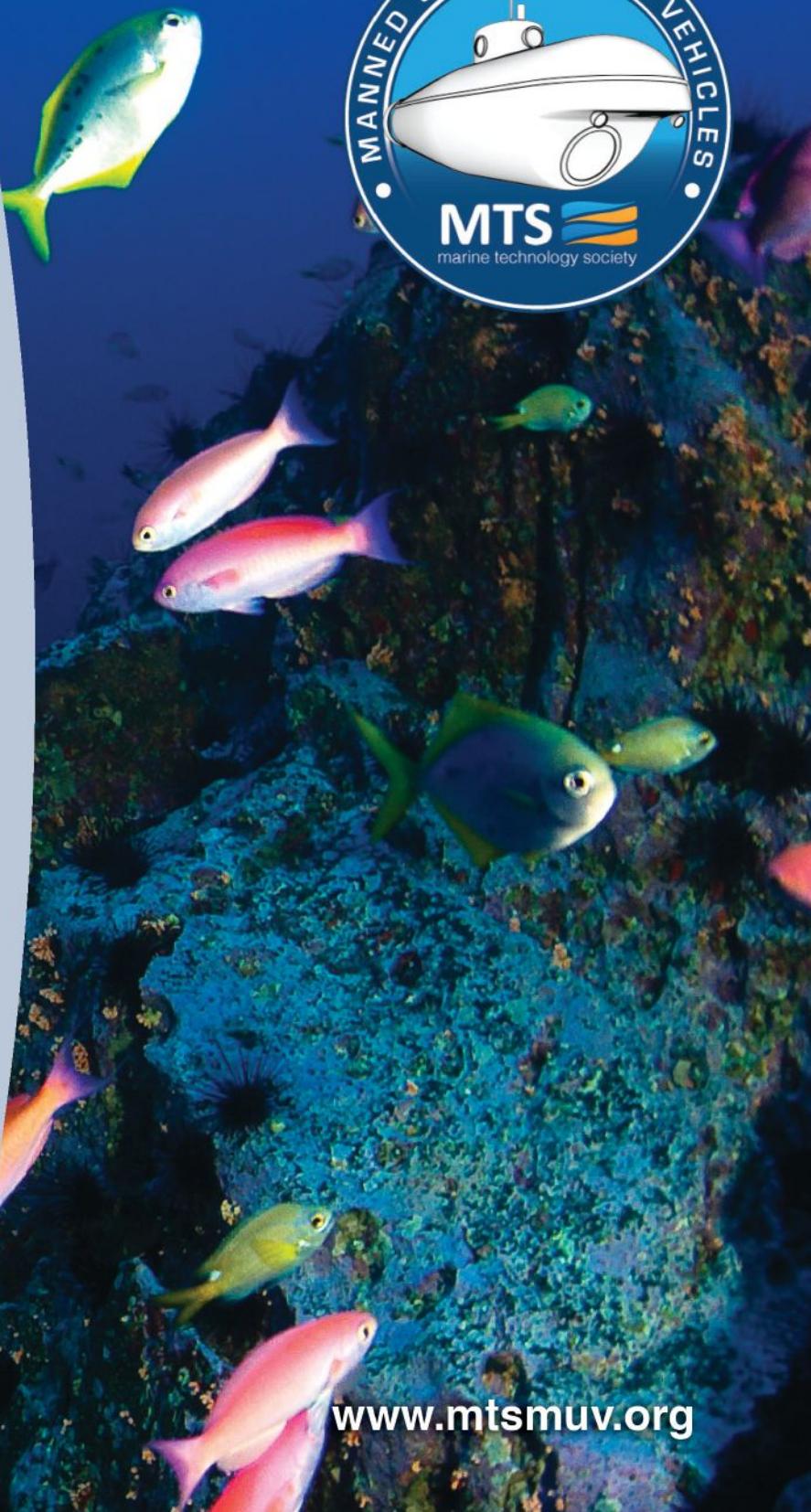
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# Manned Ocean Exploration

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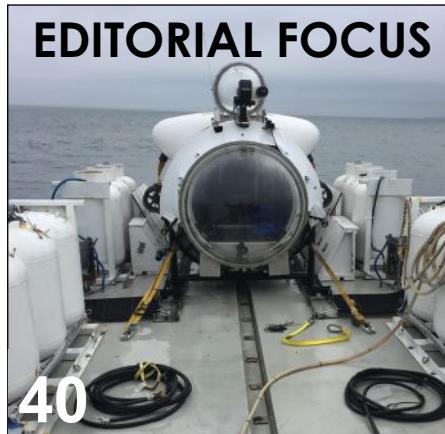
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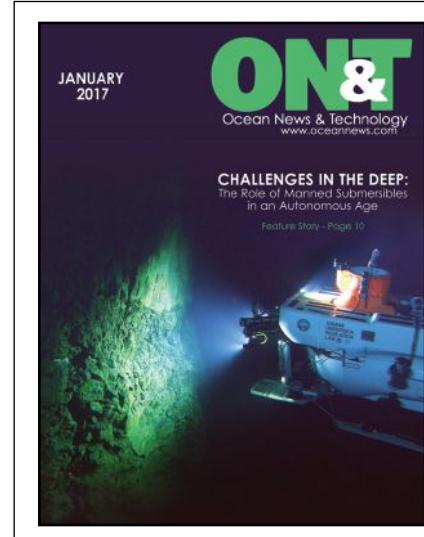
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Photo of the Pisces IV manned submersible taken through Pisces V's pilot's viewport during a National Geographic dive to the Loihi volcano in 2011. Photo credit: Terry Kerby.

# EDITORIAL

# ON&T

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Rhonda J. Moniz



## Taking the Helm

Having worked in the subsea industry for over 20 years, I have worn many hats and quite a few diving helmets. Now, as we head into 2017, I am the new Editor for Ocean News & Technology.

As a young child, I found Jacques Yves Cousteau's book collection tucked under the bookcase in my grandmother's house. I was hooked. A few years later, the movie Jaws came out and instead of doing what the rest of the country was doing (staying far away from the water), I became obsessed with sharks and diving. Around the same time, my father suggested that I take lessons of some sort. I know Dad thought I would choose guitar, maybe piano. Nope. Much to the surprise of both my parents, I wanted to SCUBA dive. So the journey began.

I became a diving instructor, scientific diver, and dive safety officer (DSO). I worked as an underwater cinematographer and producer on multiple documentaries for broadcast television and was introduced to marine technology. After starting a career as an ROV pilot over 10 years ago, I worked as Dr. Robert Ballard's first female ROV pilot. I have been fortunate enough to study ancient shipwrecks in Turkey and underwater volcanoes off the coast of Greece. And I have worked with sea lions, Beluga Whales, dolphins, sea turtles and, of course, my beloved sharks.

Over my career, I have worked with many amazing people and numerous subsea vehicles. I have been published in several marine technology and diving magazines, both print and digital. And I am still learning. I had my first dive in a manned submersible this past June while working with the amazing crew at OceanGate for the Andria Doria expedition (I hope you enjoy reading more about that in this month's issue). Of course, I am extremely excited that my first assignment as ON&T Editor is our manned submersible issue. And I look forward to working with this amazing team to bring you news and information on what I think is the most exciting industry on the planet. Along with a new editor, we have a new look and feel that brings with it information on the most cutting edge and innovative technology for the subsea industry. We hope you enjoy the read and the adventures that await us.

Fair Winds and Following Seas,

*Rhonda J. Moniz*

Editor, ON&T

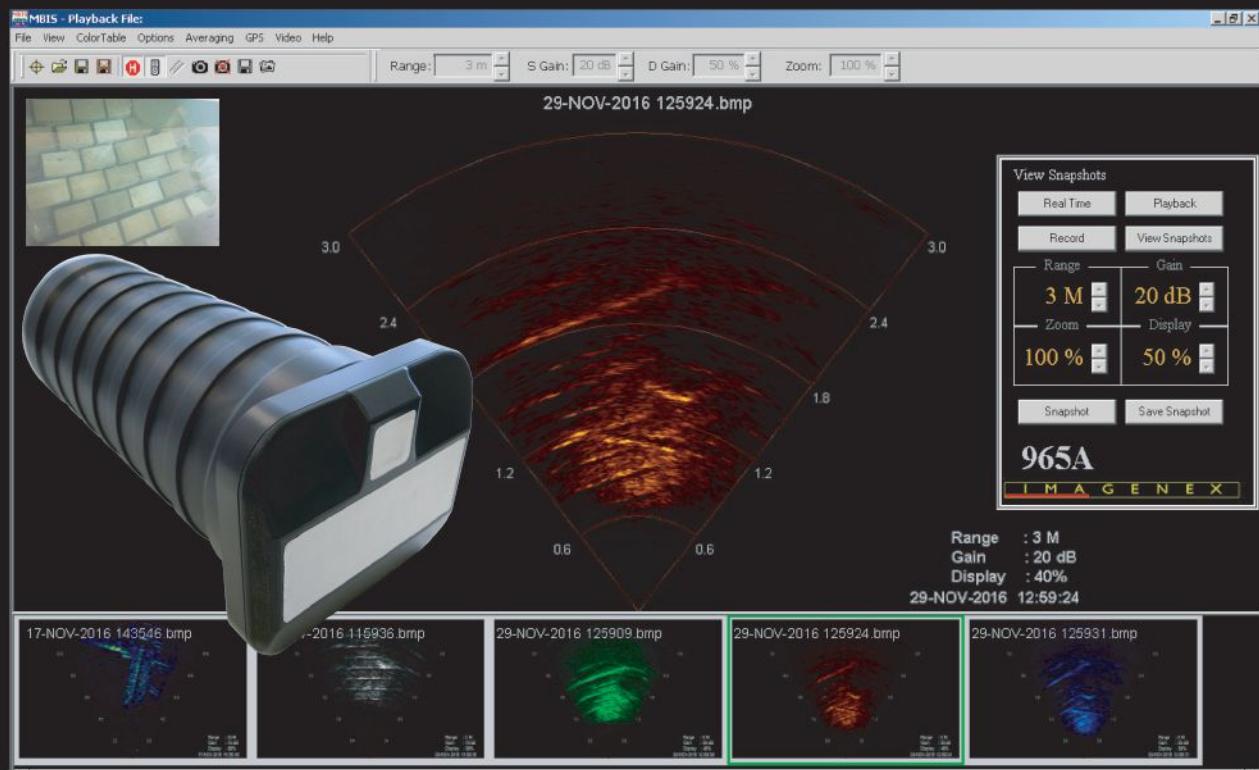
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I M A G E N E X

# FEATURE STORY

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# CHALLENGES IN THE DEEP:

## The Role of Manned Submersibles in an Autonomous Age

By: Rhonda Moniz and Kira Coley

The world's oceans are hectic with advanced underwater technology striving to uncover its long-retained secrets. Yet, 60 years ago Denise was the only one of her kind. Developed by Jacques-Yves Cousteau and engineer Jean Mollard in 1959 at the French Centre for Undersea Research, Denise, or SP-350, was the first manned underwater vehicle designed expressly for scientific exploration. In 1965, the advancement of technology allowed Denise, along with Cousteau's team on board Calypso, to explore depths down to 500 m and complete over 1,500 dives. Six decades later, some question if there is still a place for manned underwater systems in scientific exploration and what the future holds for this technology.

*Ictineu 3 crew and inspector during first certification dive at sea in Villefranche sur Mer, near Nice, April 2015.  
Photo credit: David Luquet.*

# FEATURE STORY

**A**utonomous technology now dominates ocean science due to the recent boom in advanced capabilities, which has opened new applications not possible in the past, such as exploring the waters beneath the Arctic and Antarctic ice, as well as the adoption of Remotely Operated Vehicles (ROVs) in the offshore oil and gas industry. As a result, many manned submersible programs have lost funding, but experts say human-operated vehicles still have a place in ocean science.

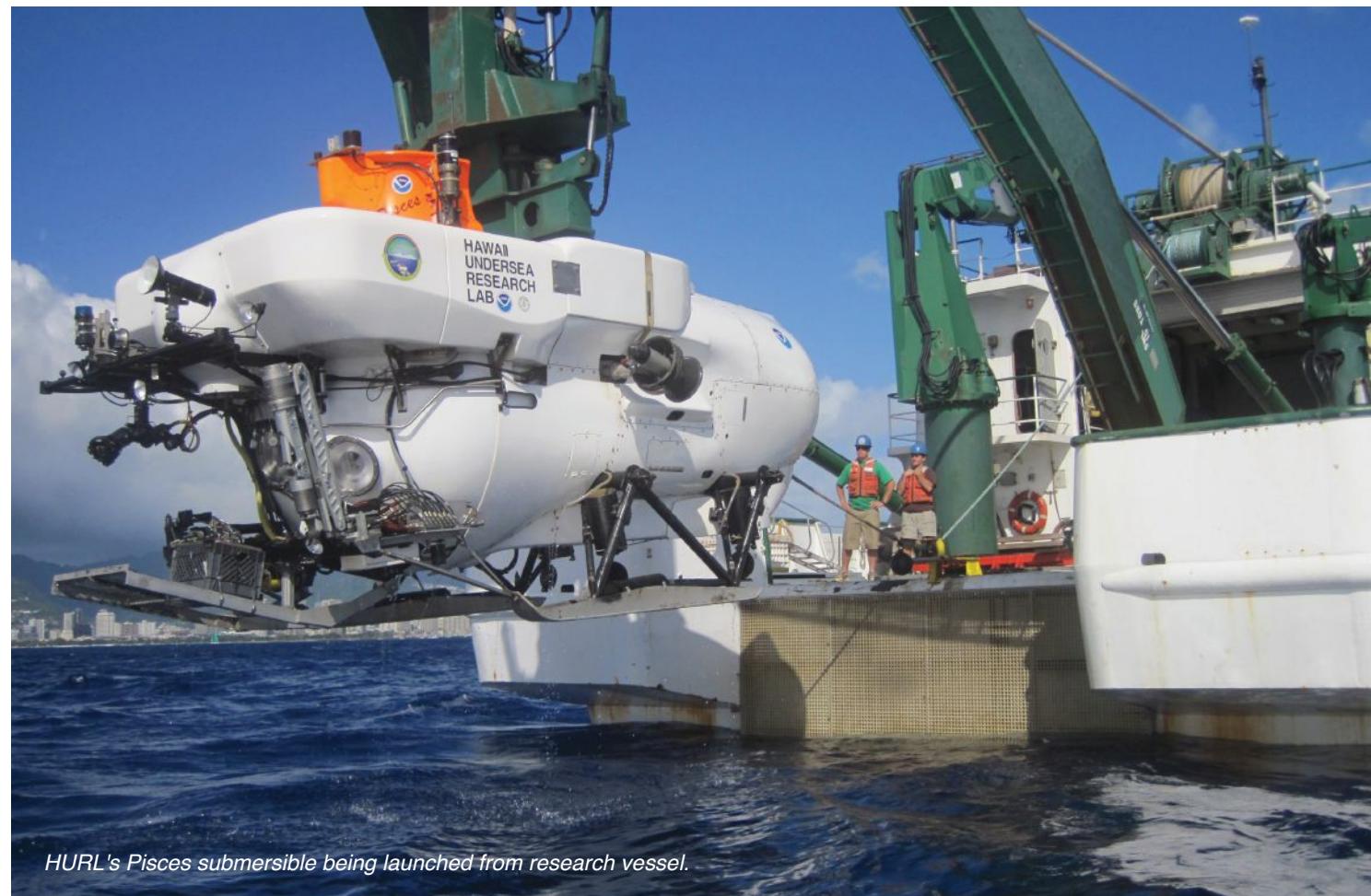
Carme Parareda, co-founder, administrator, and chief operating officer at ICTINEU Submarine SL, says that while unmanned vehicles are trending, manned subs still do a good job, "Not only the big systems such as Alvin and Shinkai 6500, but also Curasub, Undersea Hunter, Pisces IV and V, Deep Rover, and Jago have been involved in much science over recent years, to mention only some. But as operators, we see that many researchers are still skeptical about manned submersibles and regard these vehicles as something from the past—old fashioned with few capabilities. That is, until they try them and get enthusiastic about them."

Parareda says that the first scientific community to use

manned submersibles were geologists. With the discovery of hydrothermal vents, the number of biologists in submersibles increased. In the last few decades, archaeologists have been some of the most active.

"Archaeologists appreciated the accuracy of manned submersibles in their delicate work," Parareda says. "Biologists are aware that they will be able to see much more from a submersible than through a camera attached to an ROV. Geologists know that even with a few dives down to the seafloor, the 3D vision and perception they will have offers a clearer and faster understanding of the geological structures, including the seafloor, seamounts, and chimneys."

Dr. Adam Soule, chief scientist for Deep Submergence at the Woods Hole Oceanographic Institution (WHOI) agrees, "Having a human presence in the deep sea is irreplaceable. The ability for humans to quickly and efficiently process the inherently 3D world around them allows for really efficient operations and excellent sampling potential. Besides, there is no better experience for inspiring young scientists and for ensuring that any scientist can get the most out of unmanned systems than immersing themselves in the environment."



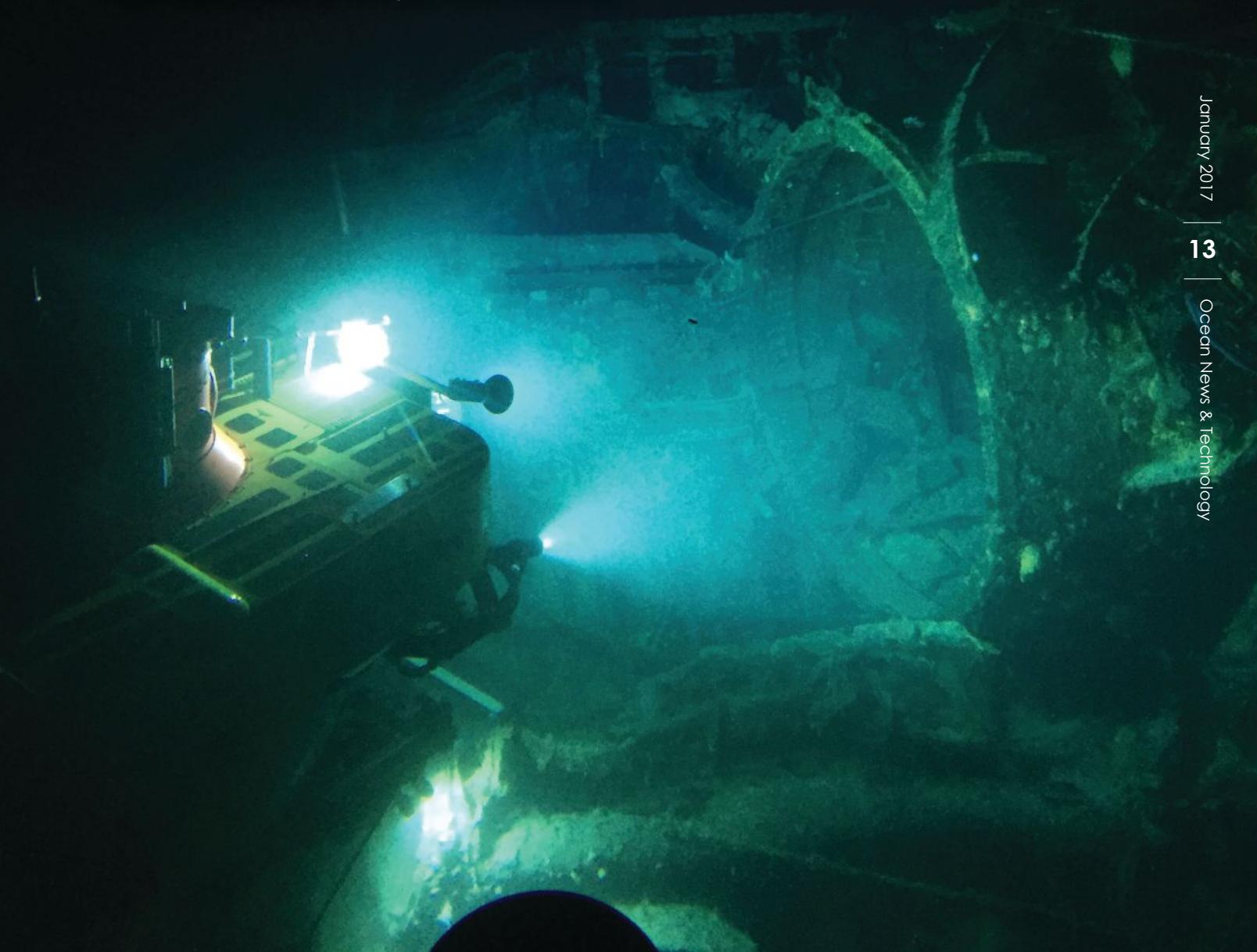
*HURL's Pisces submersible being launched from research vessel.*

## HURL's Story

One organization whose history illustrates this evolution from manned to unmanned submersibles is the Hawaii Undersea Research Laboratory (HURL). Beginning in 1981, the program utilized the manned submersible Makali'i, which made the first dive to conduct studies in the crater made by the first hydrogen bomb tested: the Oak Crater in Eniwetok Atoll. HURL conducted three months of diving operations at Eniwetok Atoll, and the expedition launched HURL as a science diving program.

In 1986, HURL acquired the manned submersible Pisces V and in 2000, the Pisces IV was acquired from the Canadian Navy. The two Pisces submersibles have worked in tandem and are considered shallow water subs with a maximum depth of 2,000 m. They were designed for the oil and gas industry and originally used for communications cable surveys and cable burial works, each sub was built with skids that keep the belly pan off the bottom. When doing cable burial work, the subs would straddle the cable and move over the cable with a water jet to form a trench to bury the cable.

*HURL's Pisces submersible investigates wreck off Pacific atoll.*



# FEATURE STORY

In 2005, the team conducted a five-month expedition to explore 13 active volcanoes from Samoa to New Zealand. In total, 56 dives were planned and the HURL team was able to get in 63 dives despite some challenging weather.

"We encounter more entanglement issues in a dive season than most deep diving subs will encounter in a whole career. So, having two submersibles not only gives us immediate backup capabilities, but it really doubles the productivity. We are really diving the buddy system with two subs on the bottom. They are both really unique in operations. There are some areas where certain assets are more suitable than others," said Terry Kerby, director of submersible operations at HURL.

In an industry that has seen a trend toward more autonomy and remotely operated systems, manned submersibles face challenges. NOAA announced the discontinuation of funding for Pisces operation in 2012. The crew turned to a smaller footprint for operations.

"We reactivated the LRT-30a and by the end of 2012 it was re-certified by ABS and a new crew of divers and pilots were trained. We chartered a 75-ft tugboat, the American Emerald, to support LRT-30a and Pisces V sci-

ence dives. We were able to pull off a flawless three-month science dive season. There are some areas where certain assets are more suitable than others. You can dive on an atoll that may come up hundreds of meters right up to a breaking fringe reef. So if you are trying to dive with a tethered vehicle you practically have to park your support ship on the reef to get a vehicle down in this really rugged terrain. With the Pisces, we can come right up to SCUBA diving depths. You can come up as shallow as you want until you start to feel the surge."

The roller coaster ride continued when in 2014 all science proposal requests to NOAA for Pisces operations were rejected. The team managed to pull together several film documentary dives, but in 2015 operations were scheduled to be discontinued once again, until the Chinese came through with a prospect for a two-month expedition in the South China Sea scheduled for early 2016. In preparation for the expedition, the submersible completed recertification and test dives. Prior to departure for the South China Sea, the project was canceled due to political tensions between the U.S. and China over some of the regions where the Pisces submersible would be diving. The University of Hawaii had incurred considerable costs to prepare the ship and submersibles and the expedition



Bruce Strickrott and Susan Humphris inside the Alvin sphere. Photo credit: Chris Linder, Copyright © Woods Hole Oceanographic Institution.

was lost without compensation for the costly upgrades. Once again, the program was in danger of being shut down. Thankfully, the reactivation of the LRT-30a in 2013 had caught the attention of the U.S. Navy's Special Operations Command, which led to a contract with the Navy to train SOCOM divers to pilot the LRT and kept the HURL operations team intact for a few more months.

The Navy work gave the team time to put together some dives with Dr. Sylvia Earle and National Geographic. Several NOAA coral dives followed with three days of seamount exploration and Loihi dives with Greg Stone and Conservation International, during which HURL/KOK operations conducted 18 dives in 10 days in spite of two passing hurricanes.

The team was a day away from moving the submersibles back to Makai Pier when the Pisces were contracted to conduct National Science Foundation (NSF)-funded deep coral research dives in the Northwestern Hawaiian Islands and beyond. The KOK and Pisces submersibles went out in late October for 30 days of dives on five different seamounts and were able to complete 12 days of 14 scheduled dive days before the team was chased out of the area by a typhoon. As of now, the Pisces subs are scheduled to complete the Northwestern Hawaiian Islands deep coral dives in 2017, which will keep the capability intact a little longer.

*“Many researchers are still skeptical about manned submersibles and regard these vehicles as something from the past . . . That is, until they try them.”*

— Carme Parareda

## A New Generation

“Concern about daily operating cost is far greater than in the past, and engineers search for alternatives to the big ROVs systems,” says ICTINEU’s Parareda. “The alternative is vehicles without umbilicals, but if you don’t put a human inside—in most cases to date—you still have the risk of losing the vehicle. As a result, the manned submersible is the safest technology available at the moment. In terms of time underwater, ROVs and AUVs are unbeatable. But with the ICTINEU 3, for example, you may run two 10-hr dives, charge batteries for 4 hrs, and go back to sea, which approaches to an ROV’s productivity.”

Manned submersibles have a safety advantage over tethered vehicles when working around complex submerged platforms where entanglement issues can be a problem.

In 2004, ICTINEU Submarine sought to develop a new generation of manned submersibles. Since that time, the technology has advanced enormously, creating a significant gap in depth rating and a need for numerous modifications to meet the demands of 21st-century science. According to Parareda, “Research submersibles used to be heavy machines weighing between 10 and 20 Tm for depths deeper than 1,000 m. This meant they need large oceanographic vessels and cranes to be deployed—similar to larger ROVs. There was a need for weight reduction if we wanted to make a manned submersible easy to operate, easy to deploy, and affordable for the scientific community. The ICTINEU 3 weighs only 5.5 Tm, carrying three people in a 1,200-m rated vehicle.”

“There was also a huge gap in energy technologies. We have seen an evolution of batteries from lead-acid to nickel-cadmium to the latest generation high-density lithium batteries, with many others in between—and, in parallel, energy systems such as fuel cell appeared as alternatives. Only some teams had risked with lithium-polymer batteries in experimental vehicles, but nobody had thought about a high density-high power system, pressure-compensated in a manned vehicle. So, after many years of engineering and testing, we came across a system that has five times more energy than most submersibles with same or even less volume and weight.”

The ICTINEU team has also worked on vehicle hydrodynamics, resulting in improved safety, better underwater navigation and piloting, and low energy consumption. A development they want to implement on submersibles is a smart piloting assisted system, similar to the ones used in aerospace.

“We have seen the WHOI Alvin having been completely refitted and given new capabilities recently. The Chinese submersible Jiaolong is a newly built vehicle and they are working on a new full-ocean depth vehicle and several 2,000-m vehicles. Thanks to a robust battery system, our ICTINEU 3 can run up to 40 km underwater or upload as many equipment and tools as needed without reducing the mission time,” states Parareda.

## Alvin

The Woods Hole Oceanographic Institution’s (WHOI) Human Occupied Vehicle (HOV) program faces challenges as well, in spite of the fame of its flagship. Commissioned by the Navy in 1964, Alvin was one of the world’s first deep-ocean submersibles. In the mid to late 1960s, Alvin was selected to attempt the recovery of an H-bomb that dropped when an Air Force B52 collided with a tanker in the Mediterranean. The following year, Alvin returned to the Bahamas to collect biological and geological data. In the 1970s, the sub worked off Martha’s Vineyard, the Mid-Atlantic Ridge, and many other locations in the U.S. and abroad.

# FEATURE STORY

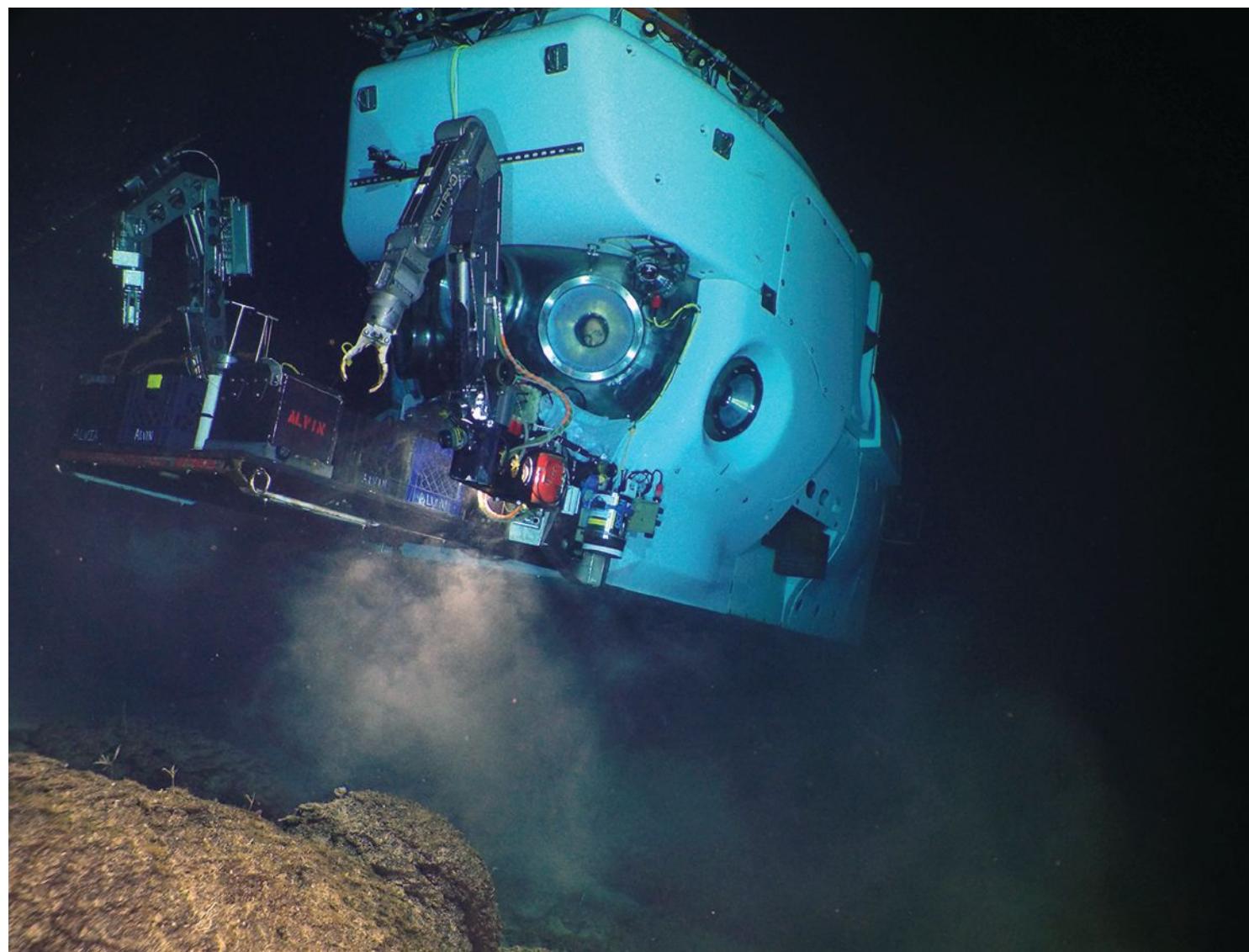
In 1986, the Alvin group, along with WHOI's Deep Submergence Lab (DSL), set their sights on the famous wreck found by Dr. Robert Ballard: the RMS Titanic. The shipwreck had not been seen in 75 years. The team made several dives collecting video footage, the same footage that audiences would see 12 years later in the opening scene of the blockbuster hit movie *Titanic*.

Alvin has had many overhauls over its lifetime and, as a result, it has remained state-of-the-art. Currently, Alvin is rated to 4,500 m, giving scientists access to two thirds of the ocean floor, and plans are in place to increase the vehicle's maximum depth to 6,500 m, making it one of less than a dozen vehicles on earth currently being used outside of the military that can reach the deepest depths of the Hadal zone.

## Manned Submersibles and Citizen Science

The rise of citizen science has fueled an increased interest in manned submersibles, but there is some debate about the use of manned systems for this purpose.

"Manned submersibles, as currently constituted, are not ideal tools for citizen science given that they are designed to get experts into the environment they are studying," suggests WHOI's Soule. "However, there is progress towards democratizing that experience by, for example, enabling acoustic communications of text and images from sub to ship and the reverse. Alvin has recently implemented an acoustic comms package for this purpose. As this technology develops, the notion of bringing more citizens into the submarine 'virtually' becomes viable."



*Photo courtesy of P. Gregg (U. Illinois), D. Fornari (WHOI), M. Perfit (U. Florida)/NSF/WHOI-MISO Facility ©2016 Woods Hole Oceanographic Institution. Cochief scientists of OASIS cruise AT37-05 on RV Atlantis funded by the National Science Foundation. Images and video taken from DSV Alvin on Dive 4850 (Nov. 17, 2016) on Matthew Seamount in the 8° 20'N Seamount Chain in the eastern equatorial Pacific using WHOI MISO Facility deep-sea camera systems (<http://www.whoi.edu/miso/>). P. Hickey was the Alvin pilot on Dive 4850. © Woods Hole Oceanographic Institution (WHOI).*



*Stern view of Alvin being deployed on dive AL4685. Photo credit: Chris Linder, © Woods Hole Oceanographic Institution (WHOI).*

## The Human Element

The director and senior pilot of the WHOI's HOV program, Bruce Strickrott, believes manned vehicles still have a role to play: "I think they work well with other tools. It's just like the push to go to Mars. We have plenty of tools roaming around Mars that are giving us data, but it is also clear to me that there is this great desire to go there. I think it is for the same reason. We will never truly know a place until we visit it. You can get to know a place through study and through various means and various tools, but until you actually go there, your full understanding is not there. Your perspective is not complete. Manned vehicles provide that opportunity. A manned vehicle allows you to take your imagination down to a place and see it and bring it back with you. It provides that extra piece to the puzzle of understanding."

Parareda suggests that the human element of the manned submersible is key. "Why isn't the public as motivated about Mars exploration as they were during the mission to the moon? Maybe it's due to human presence. Take people to Mars and, once again, you'll have millions of people staring at the TV. The same happens with the sea: children, but also adults, get extremely excited about subs. There is an evocation to adventure, to the unknown,

and this must be used to raise awareness. ROVs do not have such power."

Soule adds, "There is no replacement for bringing humans into the environment they are studying. Rather than pitting manned and unmanned technologies against each other, scientific fields should recognize the powerful synergies created when these technologies are used together."

"I believe that keeping manned submersibles in our arsenal of tools to investigate the deep ocean —alongside autonomous and unmanned vehicles —gives us the greatest opportunity to learn as much as possible about the deep ocean. Having access to manned systems has been central to the development of my understanding of the deep ocean. As a geologist, I learned my craft by immersing myself in the environment, standing on the outcrop, walking over the terrain, handling the rocks. To be denied that in the deep ocean makes it nearly impossible to gain the same depth of understanding. Manned submersibles restore that ability to deep sea scientists—be they geologists, biologists, chemists—and enables them to develop richer interpretations of the data generated by unmanned systems," concludes Soule.

## Easier Visual Mapping of Biodiversity

In a collaboration with Nortek, researchers at the Norwegian University of Science and Technology (NTNU) have found that a horizontally facing DVL is key to solving mapping challenges and reduces the need for highly skilled manual ROV operators.

Steep underwater walls are often important to investigate for multiple scientific end users such as biologists and geologists as well as professionals in industrial sectors. However, surveying and mapping of such walls has been challenging due to technical limitations.

Using a Nortek 1MHz DVL, researchers at the Centre for Autonomous Marine Operations and Systems (NTNU AMOS) have developed an ROV-based system for efficient, high-quality visual mapping of a steep underwater surface. This is of significant benefit for the research community in general.

"Most ROV operations today are heavily reliant on experienced pilots. Being able to automate the control can increase both the efficiency and quality of data collecting, while freeing up time and resources," explains Stein M. Nornes, research fellow at NTNU AMOS.

Results from a test survey done by researchers at NTNU AMOS have demonstrated how the DVL measurements enabled the Dynamic Positioning (DP) system to efficiently map a vertical underwater wall with still imagery while maintaining a constant distance to the face of the wall for ideal image quality and coverage.

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Why did researchers at NTNU choose the Nortek DVL for this project? Nornes explains that the compact size of the Nortek DVL was of vital importance.



"For the project, we needed to mount a DVL facing forward on our ROV. With the comparatively tiny Nortek 1 MHz DVL, we only needed a simple mount and could place the instrument exactly where we wanted it. In comparison, the DVL we already had on the vehicle is large and heavy, which would have required very robust mounting and limited our options with regards to where the instrument could be mounted on the ROV."

Helping biologists map biodiversity quickly and efficiently, Geir Johnsen is a professor in marine biology at the Department of Biology (NTNU) and is one of the founding partners in Ecotone, a NTNU spin-off company using new optical techniques for mapping and monitoring the marine environment.

He emphasizes that the work that has been done to integrate the DVL in the operation is important for biologists as it helps to improve control of the ROVs that are used in the visual mapping of steep underwater walls.

For more information, visit [www.nortek-as.com](http://www.nortek-as.com).



# POWER TO THE DEPTHS

SOSI winches. Only from Okeanus.

An advertisement for SOSI Ocean Solutions. The top half features the text "POWER TO THE DEPTHS" and "SOSI winches. Only from Okeanus.". Below the text are two images of industrial winches: a smaller white unit on the right and a larger blue unit with a red wheel and a large brown spool on the left. The SOSI logo, consisting of a stylized fish icon and the text "SOSI OCEAN SOLUTIONS", is located in the bottom right corner.

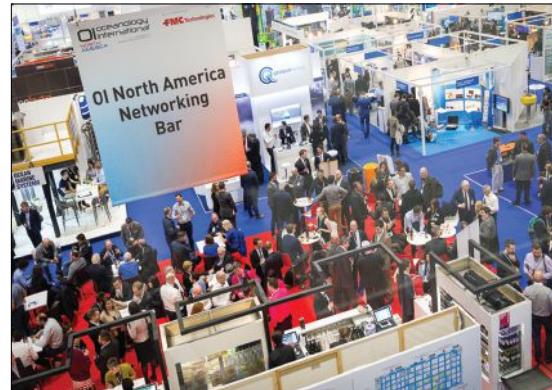
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## Oceanology International Finally Comes to North America: February 2017

The global ocean science and marine technology communities will gather in San Diego, California when Oceanology International makes its U.S. debut in February 2017. OINA 2017 will feature a multi-track conference with an opening plenary and three keynote sessions: Ocean Resources, Transportation and Security, and Climate and Environment.

Five topical technical sessions across three days will explore the latest developments in ocean science and technology: Big Data, Visualization & Modeling; Hydrography and Geophysics & Geotechnics; Sensors & Instrumentation; Unmanned Vehicles and Vessels; & Communications & Navigation. Also in the main conference program, topical sessions will delve into opportunities in aquaculture, biomarine, biomimicry, maritime security, and port and maritime operations. The final day brings the Catch the Next Wave (CTNW) conference track, delivered in association with the world-renowned Scripps Institution of Oceanography.



Exhibitors, including major players from the U.S. and Europe will present the latest technology. Booths from the biggest names in ocean science and marine technology present the next generation of products and solutions designed to support both research and industry. Additional features include a Careers Day; an Investment, Trade and Innovation Theater; and networking events. OINA takes place at the San Diego Convention Center, February 14-16, 2017. To register, visit the OINA website at [www.oceanologyinternationalnorthamerica.com](http://www.oceanologyinternationalnorthamerica.com).

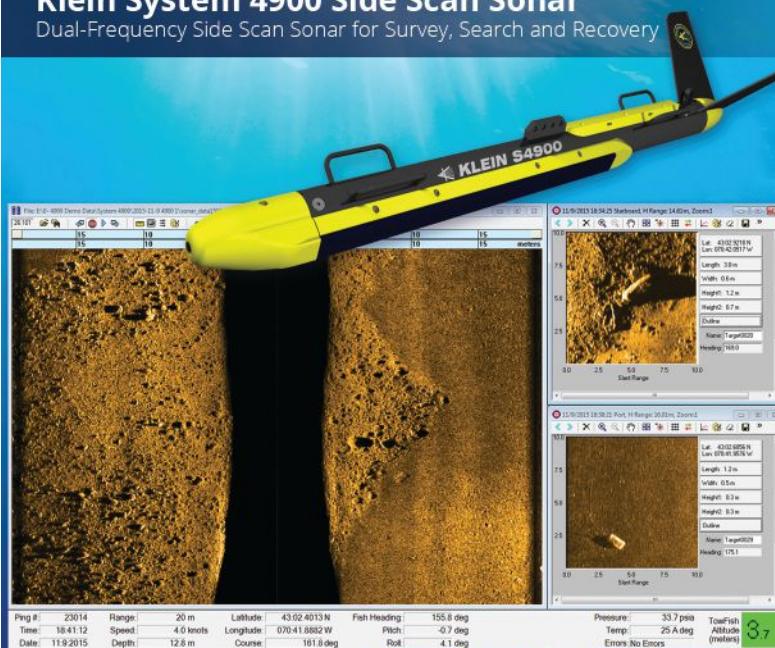
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Bottom line... the System 4900 provides "best-in-class" performance, operation and reliability which is what you would expect from Klein's nearly 50 years of side scan sonar design experience.

Call (603) 893-6131 or visit us at [KleinMarineSystems.com](http://KleinMarineSystems.com)



## RockBLOCK – Scaling Down Satcom for Research & Commercial Applications

By enabling a plug-and-play satellite communication link from literally anywhere on the planet, the innovative RockBLOCK system has become the unsung hero of countless marine research and commercial applications. Developed by the UK's Rock Seven, the RockBLOCK concept is beautifully simple—provide an open platform to enable data communication in a small and low-cost form factor.



*RockBLOCK can be used with a wide range of platforms from Windows, Mac and Linux to Intel Arduino and Raspberry Pi.*

### Low-cost Satcom

RockBLOCK costs just \$200—and with data as little as \$0.04 per message, it offers the lowest-cost satcom air-time available today. It integrates with almost any platform, including Windows, Mac, and Linux, in addition to “miniature computing systems” such as Intel’s Arduino and the Raspberry Pi. RockBLOCK features an open API so data can be delivered by e-mail or injected directly to the user’s own web service.

RockBLOCK is a proven, reliable, and low-cost way to integrate two-way communication into sensor and measurement-based research projects. It sends messages up to 340 bytes in size and receives messages up to 270 bytes using Iridium Short Burst Data (SBD), which offers global, pole-to-pole coverage. At just 76.0 x 51.5 x 19.0 mm, the system can be integrated into any sensor station, vessel equipment, or offshore platform. RockBLOCK is available as a PCB or encapsulated product and features an integrated antenna and power conditioning with the option to use external antennas for greater flexibility.

RockBLOCK is application agnostic and can be used for anything that requires an Internet connection. It embraces the emerging concept of Small Data, where the goal is to achieve more with less. RockBLOCK’s low cost, small size, and ease of use make it far more accessible than other types of satcom in the market.



*RockBLOCK has been integrated on specially developed wave buoys deployed onto sea ice floes in the Arctic and Antarctic by NIWA.*

### Small Data Applications

RockBLOCK’s inherent flexibility is reflected by a diverse user-base. It has been used to deliver data from near-space aircraft and balloons, oil wells on land, and countless maritime solutions. In the commercial arena, one innovative application already tested is environmental monitoring in diver rescue chambers and hyperbaric lifeboat cabins.

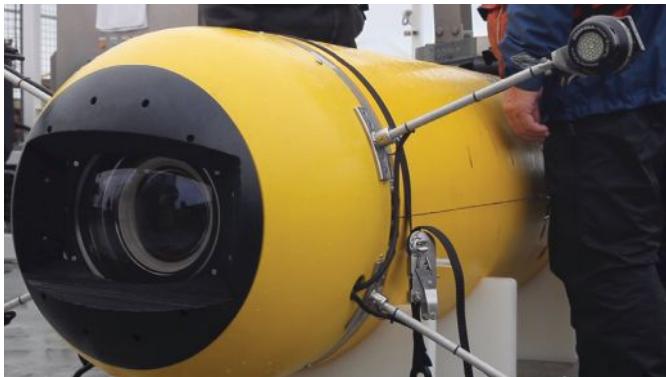
RockBLOCK’s ability to deliver a reliable data link is also being leveraged by environmental researchers worldwide. In the Antarctic, it’s used by a team from the National Institute of Water and Atmospheric Research – New Zealand (NIWA) to measure effects of storm waves on sea ice. RockBLOCK is integrated on wave buoys deployed onto sea ice floes where it transmits GPS position and signal strength data every hour, enabling movement of the ice to be plotted against wave data.

In the Northern hemisphere, RockBLOCK is used by the Laboratory for Cryospheric Research as part of Rock Seven’s RockFLEET system (which also offers vessel tracking functionality) to support measurement of glacier and ice cap dynamics across the Canadian Arctic Archipelago.

### Satcom Innovations

The common theme across the research and commercial applications enabled by RockBLOCK is that unlike traditional maritime satcom uses, projects don’t require a high bandwidth VSAT link to connect to the web and social media, millions of dollars of sensing technology, or access to a corporate LAN. What is needed is a flexible, hard-wearing, and low-cost way to transmit data. In this area of satcom innovation, RockBLOCK’s low-cost, compact design, and open architecture prove that small is most definitely best.

Visit [www.rock7.com/rockblock](http://www.rock7.com/rockblock) to learn more. Rock Seven is offering 10% off the cost of RockBLOCK until February 2017. Use code ONT10.



## MBARI Robot Automating a 20-year Survey of Deep-Sea Animals

A new MBARI robot that can traverse the deep sea, collecting data all on its own, is providing a boost to one of MBARI's longest running research projects – the midwater-time series project. The robot carries a new video system called "i2MAP" (Investigations of Imaging for Midwater Autonomous Platforms). This new tool will add to the scientific observations MBARI researchers have been making with remotely operated vehicles (ROVs) for nearly two decades.

<http://ont.news/MBARI>

## CSA and NOAA Case Study on Oil Spill Effects on Seagrass

CSA Ocean Sciences Inc. (CSA) announces the recent online publication in Marine Pollution Bulletin senior authored by Dr. Mark Fonseca, CSA Vice President—Science. Dr. Fonseca worked in collaboration with NOAA staff from both the NOAA National Centers for Coastal Ocean Science and the NOAA Fisheries Restoration Center/Damage Assessment, SW Region to research and draft the article "Susceptibility of seagrass to oil spills: A case study with eelgrass, *Zostera marina* in San Francisco Bay, USA."

<http://ont.news/CSA-NOAA>



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## BOEM Announces Environmental Study Reports

The Environmental Studies Program (ESP) announces the availability of new findings from six research studies posted online to the Environmental Studies Program Information System (ESPIS) from July-September 2016. Two were managed by BOEM's Alaska regional office, one by the Gulf of Mexico regional office, two by the Pacific regional office, and one broadly applicable national study that was managed by headquarters. Four reports—The Alaska Fault Tree Methodology report, the Pacific Power Cable Observation report, the Hawaiian Biogeographic Assessment report, and the Geophysical Surveys report—contain links to other peer-reviewed articles or data citing BOEM-funded studies.

[http://ont.news/BOEM\\_ESP](http://ont.news/BOEM_ESP)

## Scientists Triple Known Types of Viruses in World's Oceans

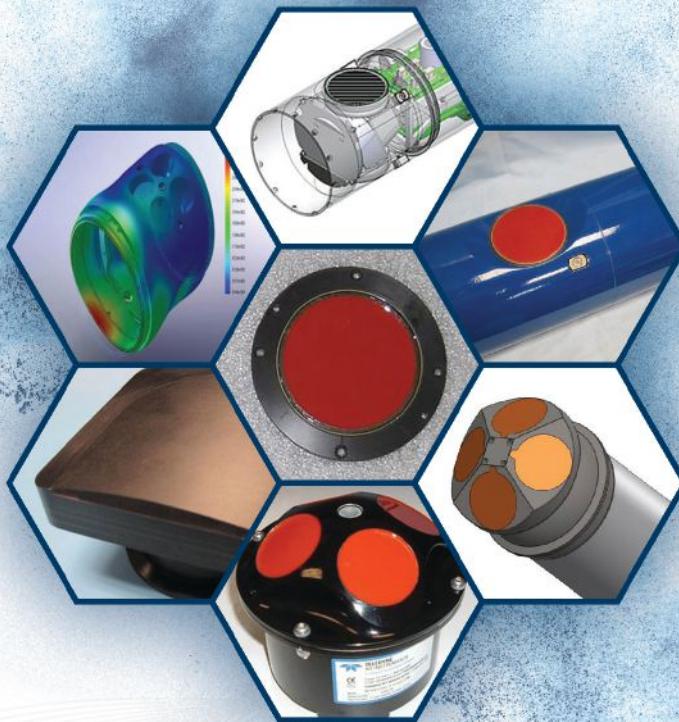
The world's oceans teem with scientific mystery, unknowns that could prove to be tools that will one day protect the planet from global warming. An international research team now reports they've tripled the known types of viruses living in waters around the globe and have a better idea what role they play in nature. Led by Ohio State University scientists, the team includes University of Michigan biologist Melissa Duhaime. Team members said their work will likely have far-reaching implications, including ultimately helping to preserve the environment through reducing excess carbon humans put into the atmosphere.

[http://ont.news/ocean\\_virus](http://ont.news/ocean_virus)



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# MANNED UNDERWATER VEHICLES:

## Pushing the Next Frontier

The design, manufacture, and operation of human-occupied vessels to meet the challenges of extreme ocean environments is led by the Marine Technology Society's elite Manned Underwater Vehicles (MUV) group. Across several decades, advancements by these companies have impacted space, defense, airborne and other subsea initiatives. New engineering designs leverage the physics of underwater propulsion, new material fabrication (i.e., titanium and carbon fiber), and energy storage, and there have been advances in optical cameras for subsea filming and data capture as well as underwater navigation systems. In 2016, the companies below had significant success in MUV exploration, engineering, design, and technological innovations.

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### 2016 MUV OVERVIEW BY COMPANY:

Ocean News &amp; Technology



#### Aquatica Submarines, Canada

Sub: Stingray 500



Aquatica entered the market in 2013 as an operator and manufacturer. Their three-person Stingray 500 is the first in a series of models that has completed a "live drop" to 690 ft for its sea trial with leading classification society DNV-GL in September 2016. Stingray 500 has a small footprint and weighs 8,300 lbs, making it versatile for a wide range of crane types over 4.5 tons. Aquatica submersibles feature a top hatch ingress/egress with a high freeboard and good surface stability to avoid the need for a "man-rated" crane. Two weeks after the sea trial testing, the company completed its first commercial expedition off the coast of Vancouver. The expedition was contracted by the Artificial Reef Society of British Columbia to collect data and imagery while observing artificial reef biomass of the sunken vessel HMCS Annapolis. Aquatica recently completed the design of the Stingray X, a 3,300-ft submersible for the commercial market.

## China Ship Scientific Research Center (CSSRC), P.R. China

Sub: Jiaolong, Huan Dao Jiao Long



CSSRC is China's largest ship and ocean engineering research institute with more than 500 research engineers and 22 large-scale test facilities. Founded in 1951, CSSRC's main focus is in the research of ship design, underwater engineering, vibration and noise reduction, and marine and offshore structures. CSSRC's 7,000-m depth rated Jiaolong submersible is the deepest operating manned submersible in the world today. Currently, CSSRC is developing a number of new vehicles, including a 4,500-m rated research MUV for the China Academy of Sciences. In 2016, the shipyard delivered its acrylic-hulled tourism submersibles, the Huan Dao Jiao Long 1 and 2, for operation on Hainan Island.

## DeepFlight

Sub: Super Falcon, Dragon, Falcon 3S



DeepFlight vehicles are an entirely new class of submersibles that are positively buoyant. The all-electric

vehicles apply the principles and dynamics of flight to underwater craft. Considered fast, light, easy to maneuver, and safe, DeepFlight's designs have been compared to futuristic airplanes and Formula 1 racecars. Founded in 1996, DeepFlight has developed five generations of personal submarines focused on the commercial markets of super yachts, luxury resorts, and private ownership.

In September, at the Monaco Yacht Show, DeepFlight introduced the DeepFlight Super Falcon 3S. The new design adds a third cockpit to its flagship vehicle that allows the pilot to take two passengers on underwater flights to 120 m. The submarine will have Lloyds Register classification and be U.S. Coast Guard certified. DeepFlight also announced a new partnership with Shanghai-based Rainbowfish Ocean Technology called DeepFlight Adventures. The partnership will provide piloted submarine excursions from resort locations starting in 2017. DeepFlight, in conjunction with RainbowFish, recently completed a significant expedition in Papua New Guinea where guests were treated to submarine dives on the wreck of the Yokohama Maru.

## GEOMAR Helmholtz Centre for Ocean Research, Germany

Sub: JAGO



GEOMAR's JAGO is a 400-m depth rated DNVGL classed two-person submersible. The vehicle is primarily dedicated to exploration and research. The submersible's relatively lightweight (3 tons) and compact size (3 x 2 x 2.5 m) enable worldwide operations from a wide variety of support ships that have sufficient crane capacity as well as logically simple transportation in a single 20-ft sea freight container. First built in 1989 by the Max Planck Institute, JAGO is stationed at the GEOMAR Helmholtz Centre for Ocean Research. The sub has made over 1,300 dives, taking more than 600 scientists, engineers, and observers to the seafloor.

# EDITORIAL FOCUS

JAGO was involved in an expedition with the German research vessel POSEIDON to El Hierro, the youngest and most geologically active volcanoes of the Canary Islands. A team of scientists from GEOMAR, the University of Las Palmas de Gran Canaria, and the Instituto Español de Oceanografía used JAGO to inspect a subsea volcano that erupted offshore at a distance of 2 km from the southern tip of the island. The team documented the present stage of the eruption site where warm water is still discharged. They were able to sample hydrothermal fluids, bacteria, and other volcanic products. A second expedition was conducted in the Norwegian Archipelago of Svalbard in the Arctic Ocean to investigate the role of polar carbonate factories mainly composed of coralline red algae and carbonate-producing invertebrates.

## GlobalSubDive, USA

Sub: Nemo and Nomad  
(Triton 1000/2 models)



GlobalSubDive provides turnkey underwater exploration solutions with access to advanced technical diving teams in over 54 countries. Founded in 2014, GlobalSubDive completed three significant missions in 2016 to support global conservation efforts for Project Baseline. The first, with Miami Waterkeepers, increases the understanding and awareness of coral reef conditions near Port Everglades in advance of a dredging to expand the port. SCUBA divers collected valuable baseline data from 3 km of the Florida Reef Tract surrounding the Port Everglades shipping channel. Renowned explorer and environmental advocate Philippe Cousteau was part of the project and brought international attention to the initiative.

The second expedition teamed with Nekton and a group of leading scientists to execute the first mission of the

XL Catlin Deep Ocean Survey in Bermuda. Two submersibles and 10 technical divers explored and documented five sites at depths between 15 and 300 m with nearly 100 dives conducted in 24 days. The team produced 138 baseline video transects and identified nearly 300 species of coral, sponge, and algae. Along with the participation of scientists, journalists, and media personalities, a UNESCO representative announced the world's first High Seas World Heritage Site, the Sargasso Sea, from inside the MUV.

For GlobalSubDive's third expedition, they partnered with NOAA's National Marine Sanctuaries and Office of Exploration and Research and BOEM to conduct laser and photogrammetry surveys of wrecks that sank in battle off of North Carolina in WWI. Submersibles explored the U-576 and Bluefields both at ~240 m depth while technical divers explored the wreck of the YP-389 at 90 m. The work advances NOAA's goal of expanding the Monitor National Marine Sanctuary and fosters ongoing collaborations between NOAA and Project Baseline.

## ICTINEU Submarins SL, Spain

Sub: ICTINEU3



Founded in 2008, CTINEU designed and built the first research submersible ICTINEU3 in Barcelona, Spain. Rated to 1,200 m, the submersible carries one pilot and two passengers for dive durations of 10 hrs. Main features include the largest acrylic viewport dome in operation, a highly efficient hydrodynamic design, and lightweight, powerful lithium battery modules designed by the company. The ICTINEU 3 was classed by DNVGL, is registered by French Maritime Affairs for operation in European waters, and has completed more than 80 dives between 30 and 1,000 m.

ICTINEU3 completed several nautical archaeology expeditions in the Aegean Sea and the Mediterranean. The Baix Empordà mission led by the Subaquatic Archaeological Centre of Catalonia, CASC, and the Catalan Government agency for underwater archaeology documented, surveyed, and identified new shipwrecks at 100 to 200 m. During the mission, archaeologists discovered three new shipwrecks from the Roman Imperial era. ICTINUE's battery system is a rare reversal where a very specific technology developed for a manned submersible is being transferred to the AUV and offshore industry. The ICTINEU LiPo battery pack is a compact pressure-compensated battery module offering great weight and volume to power ratios and is rated to 6,000 m. ICTINEU has sold multiple packages to vehicles in Asia and North America.

## SEAmagine Hydrospace Corporation, USA

Subs: Ocean Pearl, Triumph, Aurora 3/200, Aurora 3/1500, Aurora 3C, Aurora 4/330, Aurora 5/330, Aurora 5/1000, Aurora 6/1000

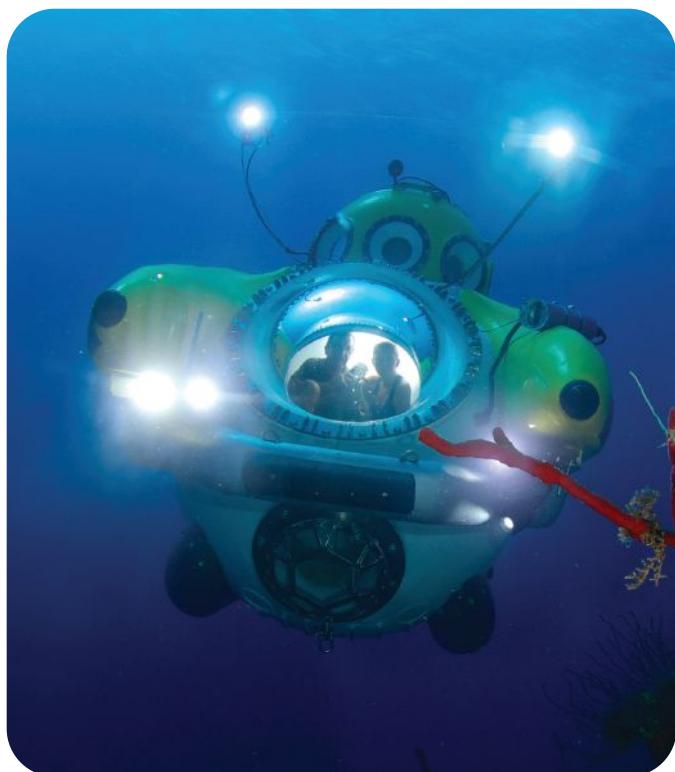


Founded in 1995, SEAmagine Hydrospace Corporation manufactures and designs two- to six-person manned submersibles with depth rates from 150 to 1,500 m. SEAmagine's submersibles are used for defense, commercial, and scientific research applications. The company's existing fleet has over 12,000 dives accumulated and been featured in National Geographic, BBC, and other film and media projects. The company has a number of patents focused on underwater vehicle technology and has established a series of industry firsts, including flexible buoyancy and flotation systems, a novel clam shell cabin design, a high surface freeboard design, the first three-person spherical acrylic hull, and reliable external controls for surface handling. SEAmagine submersibles are American Bureau of Shipping (ABS) certified.

This year, SEAmagine delivered the first manned submersible to South America for the Argentine Coast Guard. The two-person Ocean Pearl submersible will be used for law enforcement both at sea and for many remote inland lakes. The custom trailer-compatible design allows great flexibility to easily transport the vehicle from coastal regions to deep remote lakes in the Andes Mountains.

## Stanley Submarines, Honduras

Sub: IDABEL



Founded by Karl Stanley in 1998, Stanley Submarines currently operates IDABEL, a 915-m depth-rated three-person submersible focused on scientific research, tourism, and film and media expeditions. Owner operator, Karl Stanley has logged over 2,000 dives, totaling over 5,000 hours.

In 2016, Stanley Submarines conducted over 80 dives, including the filming of six-gill sharks with ZDF German TV and Animal Planet's River Monsters. Filming was also conducted with the Ukrainian travel TV show, Heads and Tails. Dives for science and research were conducted with staff from the University of Michigan in an ongoing project to study Crinoids and with scientists from the Smithsonian to study deepwater fish. One of the farthest tows of the sub to date was a 25-mi round-trip steam at 3 to 4 knots to investigate the site of a plane crash reported to have over 4,000 kilos of cocaine and the co-pilot still aboard.

# EDITORIAL FOCUS

## Submergence Group, LLC, USA & MSUBS Ltd., UK

Sub: S201, S301, S351, MASTT



Founded in 2007, Submergence Group and MSubs Ltd. provide manned and unmanned submarines and vehicles for defense, research, and commercial sectors. The company's capabilities include pressure vessel design and construction, control and navigation system integration, HP gas and hydraulics, life support systems, and GRP tooling. Their expertise encompasses mechanical, composites, electrical, and electronic and software design. The worldwide network of engineering and material science resources allows both companies to scale quickly based on project delivery cycles. MSubs recently produced the largest unmanned underwater vehicle in the world, weighing in at 63 tons. At 80 ft (24 m) long, it is used as a submarine tracking target.

Last summer, Lockheed Martin and Submergence Group announced a partnership to build, integrate, test, and deliver up to three dry combat submersibles (DCS) to U.S. Special Operations Command (USSOCOM). The partnership focuses on a US\$166 million awarded contract to supply a new class of combat submersibles that operate at greater depths and with longer endurance. The DSC will support two operators (pilot and navigator) plus up to six swimmers with the ability to lock them out and in.

## Triton Submarines, LLC, USA

Subs: TRITON 3300/3, TRITON 1650/3 LP, TRITON 1000/7, TRITON 3300/1 MD, TRITON 1000/2, TRITON 6600/2



Founded in 2008, Triton expanded design and manufacturing operations for 2016 with construction on five new submersibles, including two new models. The Triton 3300/1 MD (minimum displacement) was built for a European client who already owns a Triton 3300/3 and wanted a second submersible to complement their film and documentary capabilities. This one-man vessel can dive to 1,000 m. The new Triton 3300/3 MKII is the sixth in the product line and is a three-man vessel.

The completed Triton 3300/3 MKII was delivered to the client and used in the Sea of Cortez in July. The vessels feature the new single point lifting system, enabling launch and retrieval in a greater variety of sea states. The first of the new compact Triton 1650/3 LP (low profile) submersibles was launched at Monaco and sent to the Fort Lauderdale Yacht Shows and the Blue Ocean Film Festival in St. Petersburg to highlight its flexibility and capability as a film platform. Triton has also begun construction on a second submersible in this model line and will be using this vessel for charter in 2017.

Triton submersibles have been used in numerous research and scientific discovery missions around the world, ranging from Florida surveys to expedition work in the most remote corners of the Pacific. Highlights of these missions include filming the Britannic (sister ship to the Titanic) in the Mediterranean, the first ever manned submersible dives in Antarctica, and the first live footage captured of a giant squid off the coast of Japan.

## UBoat Worx, Netherlands

Subs: Super Yacht Sub 3, C-Explorer 3, Cruise Sub, HiPer Sub, C-Researcher



U-Boat Worx, founded by Bert Houtman in 2005, is one of the largest builders of private submarines. The company's models accommodate one to nine people and operate to depths up to 1,700 m. Each U-Boat Worx submersible is designed, engineered, and built to the highest possible safety and engineering standards and registered with DNV-GL.

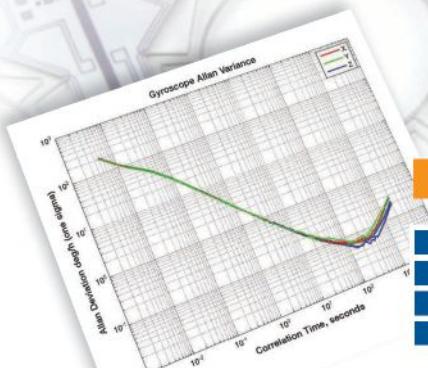
In 2016, Uboat Worx launched the unique Cruise Sub designed with two large acrylic spheres on either ends. The aerodynamic design of the revolving interior provides passengers the best view possible. The Cruise Sub series can hold five, seven, or nine occupants. Both the Cruise Sub 5 and the Cruise Sub 7 can dive to a depth of 1,140 m. The large passenger capacity makes this sub perfect for tourism or research applications. For deeper applications, U-Boat Worx developed the C-Researcher 3; it is designed for research and can be equipped with a wide array of tools and measurement equipment.

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## DONG Energy Becomes First Company to Reach 1,000 Wind Turbines at Sea

DONG Energy has reached the 1,000-offshore-turbine mark and by 2020 will build more offshore wind capacity than it built altogether in the preceding 25 years

DONG Energy is the first company worldwide to have installed 1,000 offshore wind turbines, and its offshore wind power venture will continue unabated: From 2016 to 2020, DONG Energy is set to build more offshore wind capacity than it built altogether in the preceding 25 years. Today, every single one of the biggest wind turbines delivers almost twice as much energy as the first offshore wind farm.

Offshore wind capacity recently marked a milestone when DONG Energy commissioned offshore wind turbine number 1,000. It happened at the German offshore wind farm Gode Wind 2, which is one of the many wind farms that DONG Energy fully or partly owns and operates in Denmark, the UK, and Germany.

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Developments have been moving forward at a rapid pace since the first Danish offshore wind turbine with a capacity of 0.45 MW started producing power 25 years ago at the offshore wind farm Vindeby. Today, each of the largest wind turbines in the market—with a rotor span of 164 m and a capacity of 8 MW—can produce almost twice as much energy as all 11 of the small wind turbines that make up the Vindeby Offshore Wind Farm. In fact, just one rotation of the largest wind turbines produces electricity to cover one household's power consumption for over 29 hours.

"In the space of only a few years, offshore wind has evolved from being a niche technology to being recognized as a reliable and clean energy source supplying power on utility scale and playing an important role in the green transformation of the energy sector. With 1,000 offshore wind turbines, we have a unique level of experience and routine at constructing and operating 'power plants' at sea, and this is crucial to ensuring that we can continue to reduce the costs of green electricity from offshore wind," says senior vice president Anders Lindberg, who is responsible for the construction of offshore wind farms at DONG Energy.

At the end of 2015, DONG Energy had installed offshore wind farms with a total capacity of 3 GW (3,000 MW). And there is much more in the pipeline: Towards 2020, DONG Energy is building a number of large offshore wind



farms in the UK and Germany that will increase capacity to 6.7 GW, equaling the electricity consumption of 17 million Europeans. In other words, in just four years, DONG Energy is building more offshore wind capacity than in the previous 25 years altogether.

Developments really took off in 2007, when DONG Energy constructed the UK offshore wind farm Burbo Bank, which was the first to use the world's biggest offshore wind turbines at the time. With a capacity of 3.6 MW, the new turbine could deliver 56% more power than the previous generation of 2.3-MW offshore wind turbines.

The next breakthrough came in 2015, when DONG Energy built the UK offshore wind farm Westermost Rough with 6-MW wind turbines. And in September 2016, DONG Energy—as the first in the world—started to install the new 8-MW offshore turbines at the wind farm Burbo Bank Extension in UK waters. The capacity of the latest wind turbines is nearly 18 times as big as the 0.45-MW turbines that make up the first offshore wind farm at Vindeby.



## Measuring Doppler Profiles to New Depths

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# OFFSHORE ENERGY



## BP approves Mad Dog Phase 2 Project in the Deepwater Gulf of Mexico

BP has sanctioned the Mad Dog Phase 2 project in the United States, highlighting its long-term commitment to the country despite the current low oil price environment. Mad Dog Phase 2 will include a new floating production platform with the capacity to produce up to 140,000 gross barrels of crude oil per day from up to 14 production wells. Oil production is expected to begin in late 2021.

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

## Offshore Wind Advocacy Group Comments on U.S. Presidential Election

The director of the Business Network for Offshore Wind released an open letter on what a Trump presidency means for offshore wind. The following is an open letter from Liz Brudick, Executive Director, Business Network for Offshore Wind. "A lot has been written over the last few days about a Trump Administration and its possible impacts on renewable energy. The press reports about the Trump Administration range from devastating global climate change efforts to its inability to stop the energy revolution. I have been asked what I think will happen to offshore wind in the U.S. The simple answer is the U.S. offshore wind industry will continue to move to commercial scale development. Why? Because costs are dropping, U.S. energy decisions are local and OSW enjoys bi-partisan support."

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



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# MONTH IN REVIEW

## Atwood Changes Ultra-Deepwater Drillship Delivery Schedule

Atwood Oceanics has agreed with DSME to delay the requirement to take delivery of Atwood's two newbuild ultra-deepwater drillships.

<http://ont.news/2h1lhWh>

## Historically Low Bid Comes in for Danish Offshore Wind Farm

The winning bid in the Kriegers Flak tendering procedure came from Vattenfall Vindkraft at a world record for offshore wind turbines.

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

## Falling Costs, Tech Innovations Will Drive Offshore Wind Power Boom

Offshore wind power has the potential to grow from just 13 gw in 2015 to 100 GW in 2030.

<http://ont.news/2hx4w76>

## Deepwater Wind Plans to Serve Maryland

Deepwater Wind plans to build the Skipjack Wind Farm, a 120-mw wind farm off the Maryland coast that will generate \$100 million in economic development.

<http://ont.news/2h1N3mx>

## Cape Sharp Tidal's OpenHydro Turbine Lighting up Nova Scotia

The most powerful tidal turbine in North America, Cape Sharp Tidal's 2-MW machine, has been successfully connected to the grid.

<http://ont.news/2gC6Don>

## Production Drilling Starts on the Statoil Operated Mariner Field in the UK

Up to five wells will be drilled before the Mariner A platform hook up and commissioning activity starts next summer.

<http://ont.news/2h1KBwF>

## Interior Announces Offshore Oil and Gas Leasing Plan for 2017-2022

Dol and BOEM released the final plan to guide future energy development for the nation's OCS for 2017-2022.

<http://ont.news/2gMo6hz>

## BP Announces Start of Drilling on Prospect

BP said drilling has commenced on a carboniferous gas play in Block 43/26a that could open up a new phase of development in the region.

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

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# Muddy Days & Nights

Crew members from CSA Ocean Sciences Inc. (CSA) at work in the deep waters of the Mediterranean, collecting seafloor sediment samples for an environmental assessment prior to offshore drilling operations. CSA specializes in designing and conducting studies to document the physical, chemical, and biological properties of water and sediment as part of offshore permitting, exploration, and development. CSA's Environmental Data and Geospatial Services (EDGS) team then plays a crucial role in the management and visualization of data, imagery, and documents, using web-based applications to unlock data trapped in maps and transcend regulatory requirements.



*Photo credit: Christopher Kelly, CSA Ocean Sciences Inc.*

## Boeing to Acquire Liquid Robotics

Boeing will acquire Liquid Robotics, a market leader in autonomous maritime systems and developer of the Wave Glider ocean surface robot.

Boeing has entered into an agreement to acquire Liquid Robotics, a market leader in autonomous maritime systems and developer of the Wave Glider ocean surface robot, to grow its seabed-to-space autonomous capabilities.

"With Liquid Robotics' innovative technology and Boeing's leading intelligence, surveillance, and reconnaissance solutions, we are helping our customers address maritime challenges in ways that make existing platforms smarter, missions safer, and operations more efficient," said Leanne Caret, president and CEO of Boeing Defense, Space & Security.

In September 2014, Boeing and Liquid Robotics entered into a teaming agreement resulting in extensive integration on the Sensor Hosting Autonomous Remote Craft (SHARC®), a version of the Wave Glider. The SHARC, integrat-



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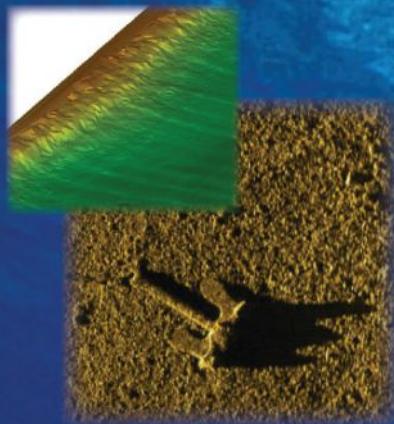


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ed with Boeing's advanced sensors, connects intelligence, surveillance, and reconnaissance capabilities ranging from satellites to manned and unmanned aircraft to sub-surface crafts.

Liquid Robotics has designed and manufactured the Wave Glider, the first wave and solar-powered autonomous ocean robot, since its founding in 2007. With more than 1 million nautical miles traveled, the Wave Glider's capabilities address the challenges facing defense, commercial, and science customers by making ocean data collection and communications easier, safer, and immediate.

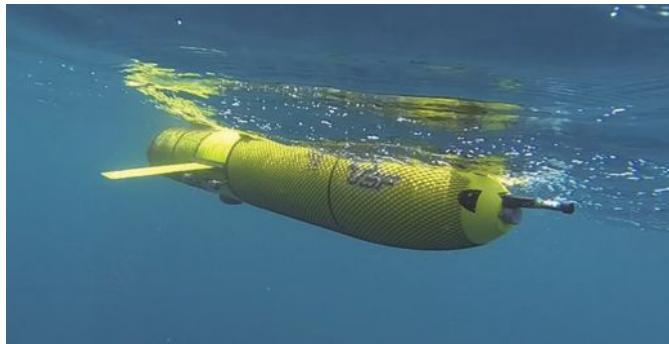
"I am proud of our team, culture, and relentless commitment to designing the best ocean surface robot in the maritime industry," said Gary Gysin, president and CEO of Liquid Robotics. "This acquisition allows us to leverage the strengths of one of the world's leading global companies while continuing to push our innovation to new levels."

Liquid Robotics has approximately 100 employees in California and Hawaii. The company will become a subsidiary of Boeing operating under its current business model and reporting to Kory Mathews, vice president of Autonomous Systems for Defense, Space & Security. The terms of the agreement were not disclosed. Completion of the transaction is subject to satisfaction of customary closing conditions.

For more information, visit [www.boeing.com](http://www.boeing.com).



# SUBSEA INTERVENTION & SURVEY



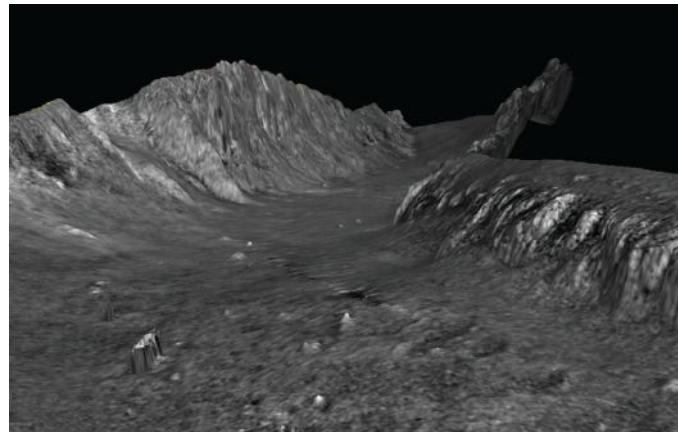
## Instrumenting and Testing a New Fishery Echosounder in an Ocean Glider

NOAA's Beaufort Laboratory (National Centers for Coastal Ocean Science and Southeast Fisheries Science Center) collaborated with the Center for Ocean Technology and College of Marine Science of the University of South Florida to instrument an echosounder into an ocean glider to extend surveys of pelagic and demersal fishes associated with rocky reefs in the Gulf of Mexico and Southeast U.S. Atlantic. <http://ont.news/2hu2Ewu>

## CARIS Onboard Brings Real-Time Data Processing to Autonomous Operations

Teledyne CARIS™ has released a new product that enables the processing of data in near real-time and minimizes data conversion and processing times. Designed with autonomous operations in mind, CARIS Onboard requires less interaction for automated survey activities, which will save valuable time. This release introduces several new processes, including the incorporation of the SIPS™ Backscatter engine. Backscatter mosaics can now be generated alongside surfaces in near real-time. This version also presents the ability to compute GPS tide and apply observed depth and attitude filters.

<http://ont.news/2h0C9O2>



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

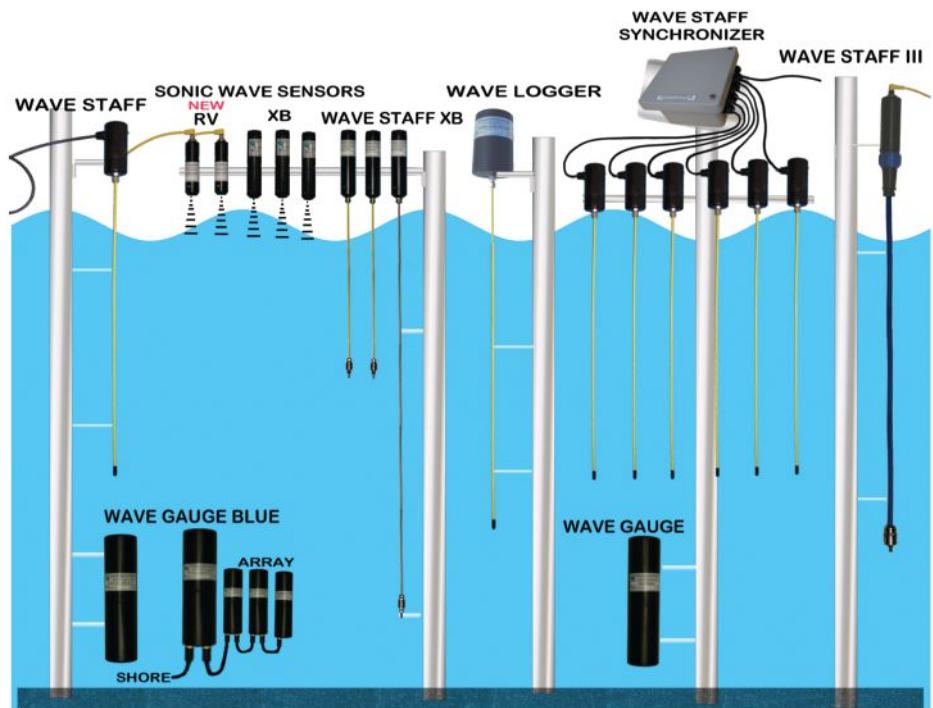
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# MONTH IN REVIEW

## Ecoscope Deploys Subsea Glider in the Gulf of Papua

Ecoscope is using cutting edge technology to acquire valuable environmental baseline data in the Gulf of Papua.

<http://ont.news/Ecoscope>

## Leopard Rules the Waves

Saab Seaeye Leopard ROV system recently delivered an active heave compensator to Japan's Kaiyo Engineering.

<http://ont.news/2hC1WzU>

## The Canadian Underwater Conference & Exhibition

The CUCE is the only show of its kind in Canada for those who work in the underwater industry.

<http://ont.news/2hvrv27>

## Teledyne RESON HydroSweep Now Supports Industry Standard Data Format RESON

Teledyne RESON A/S releases a major software update for the HydroSweep deep water multibeam echosounders.

<http://ont.news/2hEUB2R>

## SMD Launches Sentio™, a New Innovative Virtualization Tool for Offshore Operations

SMD announces the launch of Sentio™, a highly advanced synthetic environment and virtualization platform.

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

## Saab Seaeye Panther is Diving Support Vessel Resource

Flash Tekk Engineering has chosen the Saab Seaeye Panther XT Plus ROV as a key diving support vessel resource.

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

## JFD Secures Multi-Million Pound Saturation Diving System Contract

JFD has been awarded a major contract with Shanghai.

<http://ont.news/2h0i9ek>

## Phoenix Conducts ROV Operations in the Continuing Search for Malaysia Airlines Flight 370

Phoenix International Holdings, Inc. is conducting deepwater ROV operations in the search for Malaysia Airlines Flight 370.

<http://ont.news/2hEYdl4>

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Image Credit: NOAA  
<http://tinyurl.com/p596wtk>

# Diving Deeper in OceanGate's Cyclops Submersibles

With close ties to the aerospace and technology industries, Stockton Rush and Guillermo Sohnlein founded OceanGate, Inc. in Everett, Washington in 2009. OceanGate provides manned submersible solutions that enable researchers to reach the oceans' vast resources. They currently own and operate two five-man submersibles that provide deep-sea access for underwater site survey and inspection, scientific research, technology testing, and film production.

In June 2013, OceanGate committed its flagship submersible Antipodes to a series of dives to showcase the company's ability to operate efficiently through successive cycles of mobilization and deployment. In less than 30 days, OceanGate completed expeditions in three separate bodies of water across the contiguous United States. Each location had specific dive objectives, such as equipment testing, oil platform surveys, and invasive species and habitat monitoring.

The Cyclops 1 was the next submersible built in the series. Its features include an enhanced automated control system to monitor life support, power management, navigation, and other critical system diagnostics. Using a combination of Commercial Off the Shelf (COTS) technology and innovative system architecture designed by the Applied Physics Lab at the University of Washington and OceanGate's internal engineering group, the Cyclops 1 is a fully functional prototype with depth capabilities to 500 m. Cyclops 1 functions as a test platform for software, technology, and equipment to be deployed on the 3,000-m Cyclops 2 submersible, expected to debut commercially in 2017.

In 2016, Cyclops 1 made a historical dive on the famous shipwreck, the Andrea Doria. The Andrea Doria wreckage has been hailed as the Mt. Everest of SCUBA diving due to dangerous conditions, including lines, nets, and strong currents. There have been 16 divers killed on the wreck due to the harsh environment. Sixty years after it sank, OceanGate captured detailed sonar images of the legendary shipwreck for the first time. The company was contracted by Argus Expeditions to provide a manned submersible and a marine operations team on an expedi-

tion to survey the iconic wreck. The objective was to capture sonar images of the shipwreck to document its current condition to establish accurate and reliable baseline data so explorers and scientists can better assess the decay of the wreck over time.

Divers have explored the legendary shipwreck for decades, with the first dive occurring within hours of the sinking. These dives have resulted in limited views of the wreck due to the short bottom time available to divers (approx. 20 minutes per dive) and limited visibility.

Since divers can only spend a few minutes at depths of 250 ft and because water turbidity limits visibility to a few dozen feet, it is nearly impossible for divers to capture images of the full scope of this 697-ft long shipwreck. And, as the ship decays, the familiar landmarks that divers once used to navigate around the vessel are changing or disappearing. As a result, there are no images that fully illustrate the scope of the wreck in its current state.

"Five times more people have been to the top of Mt. Everest than have seen the Andrea Doria wreck site, so this expedition was a rare opportunity for our crew—all while expanding our knowledge of the ocean," said Stockton Rush, OceanGate's chief executive officer.

OceanGate has now started the construction of Cyclops 2, with an order for two titanium hemispheres and two matching titanium to carbon fiber interface rings from Titanium Fabrication Corp. (TiFab), the world's largest fabricator of reactive metals, and an order for a 56-in. diameter, 100-in. long carbon fiber main cylinder from Spencer Composites Corporation.

*“Using our five-person submersible, we were able to view the Andrea Doria area for nearly 4 hrs, which is more than 10 times longer than SCUBA divers can.”*

The two titanium hemispheres form the ends of the submersible's cylindrical pressure hull that protects five crew members during dives to depths of 4,000 m. The forward hemisphere houses a 21-in. diameter acrylic viewport—the largest viewport of any submersible capable of these depths. Design and engineering of Cyclops 2 began in 2013.

These two orders begin the construction phase of the project. In parallel, the team is also developing a mobile sub-sea launch and recovery system for the submersible.

“Construction of Cyclops 2 is a significant milestone in human exploration of the ocean. When completed, it

will be the only privately owned submersible in the world that can take five people to these depths. TiFab and Spencer Composites are the ideal choices to fabricate these vital components of our new submersible.

Their depth of experience, quality of work, and ability to produce these large custom shapes with exceptional precision are critical to constructing a manned submersible that can safely dive 2.5 mi deep,” said Rush.

Fabrication of the titanium and carbon fiber components are planned to begin immediately, with delivery scheduled for Spring 2017. When delivered, the hemispheres will be mated to each end of the filament-wound carbon fiber main cylinder that forms the center section of the submersible's pressure hull.

Following assembly of the three main components, the pressure hull will be independently tested to ensure vessel integrity before the final installation of electronics, navigation, and life support systems. Most of these systems to be used on Cyclops 2 are currently in use on Cyclops 1. The first in-water dives for Cyclops 2 are planned for late 2017.



## TE Subcom, Ciena to Deliver Enhanced Open Submarine Cable Networks

TE SubCom, a TE Connectivity Ltd. company, and Ciena have agreed to an alliance that furthers the advancement of open submarine cable networking solutions. Customers seeking a single point of contact for both wet plant and dry plant will have the option to combine TE SubCom's advanced wet plant designs and marine installation with Ciena's industry-leading 6500 Packet-Optical Platform, powered by WaveLogic™ coherent optics, to create a powerful and flexible next-generation undersea cable system.

The combination of Ciena's leadership and innovation in high-speed optics, underpinned by its OPn network philosophy, including GeoMesh submarine solutions, and TE SubCom's leading position in wet plant cable solutions will accelerate the transition toward software-defined submarine networks that offer ultimate capacity and reach, maximum resilience, greater programmability, and lower operating costs. Introduced in 2015, TE SubCom's Open Cables business model continues to enable a greater degree of choice, allowing customers the flexibility to select their preferred submarine transceiver equipment vendor. Since its launch, TE SubCom has seen an increasing number of cable operators take advantage of its Open Cables approach and elect to utilize Ciena equipment.

Recognizing the benefits of this enhanced customer choice, TE SubCom's Open Cables model will now also provide customers the option of buying a combined solution using fully qualified Ciena equipment on TE SubCom-designed wet plant. Customers can purchase this solution from TE SubCom, benefitting from a single point of contact and guaranteeing the performance of an end-to-end, turnkey lit system, or, alternatively, customers can contract independently with TE SubCom for wet plant and Ciena for transmission equipment.

"Having manufactured our own submarine line termination equipment for decades, we are well aware which technologies are required to efficiently utilize our wet plant system. Ciena produces innovative, flexible and responsive technology that will provide for a fully optimized undersea cable network," said Aaron Stucki, president of TE SubCom.



*Photo courtesy TE SubCom.*

"The Open Cables model has enabled us to offer our customers options that have never before been available in the undersea cable industry. That model is now further enhanced through this agreement with Ciena, as cable operators wishing to deploy Ciena's equipment on TE SubCom networks will be able to do so efficiently, with the full support of our engineering team and our commitment to on-time delivery of an end-to-end solution."

"As customers increasingly choose to consume network technology in different ways to address evolving network requirements for today's web-scale world, this alliance with TE SubCom helps us continue meeting their needs for open, programmable, multi-vendor networks to create powerful and flexible next-generation undersea systems," said Gary Smith, president and CEO of Ciena. "Collaborating with TE SubCom will provide Ciena greater reach into submarine network operators and give customers a more diverse range of options for network configuration."

For more information, visit [www.subcom.com](http://www.subcom.com) or [www.ciena.com](http://www.ciena.com).



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The logo for OSI Ocean Specialists, Inc. It features a stylized graphic of two dolphins leaping out of the water. Below the graphic, the letters "OSI" are written in a large, bold, blue font. Underneath "OSI", the words "Ocean Specialists, Inc." are written in a smaller, sans-serif font.

# COMMUNICATION & SUBSEA CABLES



## NTT Com, NTTWEM, and NTT Finance Announce Launch of New Cable Ship

NTT Communications, NTT World Engineering Marine Corporation, and NTT Finance Corporation have launched the Kizuna, the world's newest cable ship. NTT Communications Corporation (NTT Com), the ICT solutions and international communications business within the NTT Group; NTT World Engineering Marine Corporation (NTTWEM); and NTT Finance Corporation jointly held a launch ceremony on 16 November for their new submarine cable-laying vessel "Kizuna" at Kanrei shipyard in Tokushima, Japan. Construction of the 8,500-ton ship, which measures 109 m in length and 20 m in width and will have a planned average cruising speed of 13 knots and a capacity of up to 60 crew, will be completed by the end of fiscal year 2016.

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

## Siem Offshore Wins Installation Contract for German Offshore Wind Farm

Siem Offshore Contractors will conduct the turnkey installation and supply for Trianel Windpark Borkum Phase II array cables. Siem Offshore Contractors GmbH (SOC), a wholly owned subsidiary of Siem Offshore Inc., has been awarded the contract for the turnkey supply and installation of the inner array grid cable system for the Trianel Windpark Borkum Phase II (TWB-II) offshore wind farm by Trianel Windkraftwerk Borkum II GmbH & Co. KG. This contract award further demonstrates the Siem Offshore group's commitment to expansion into the offshore renewable energy market.

<http://ont.news/2gB2fWP>



## International Support for the North-East Passage Cable

Constructing a telecommunications cable between Europe and Asia via the North-East Passage would be politically and technologically feasible, says a report presented to Finland's Minister of Transport and Communications Anne Berner by Paavo Lipponen and Reijo Svento. If the project was carried out, the cable would significantly speed up telecommunications between Europe and Asia and respond to the increasing capacity needs. It would also benefit the national economies in Europe, Russia, and Asia.

According to the report, the key countries, among them Russia, China, Japan and Norway, would be interested in being involved in the project. A number of businesses were contacted during the course of the report's preparation.

<http://ont.news/2htP7as>



# MONTH IN REVIEW

## NEC Finishes APG Submarine Cable System for International Consortium

The 10,900-km APG submarine fiber optic cable was completed by NEC. APG was developed by a consortium of 13 large international carriers.

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

## GTT to Acquire Transatlantic Cable Operator Hibernia Networks

GTT announced plans to buy Hibernia Networks for US\$590 million. Hibernia owns transatlantic cable systems Hibernia Atlantic and Express.

<http://ont.news/2hu4pME>

## Numerous Global Fleets Turn to KVH's IP-MobileCast

KVH Industries, Inc. announced that numerous global fleets have subscribed to or expanded their deployments of its IP-MobileCast™ service.

<http://ont.news/2hFJZ3L>

## PCCW Global Selects DDC as Critical Element for Pan-African Expansion

PCCW Global has selected the Djibouti Data Center (DDC) to help facilitate undersea fiber cable access services in East Africa.

<http://ont.news/2hmho2q>

## VBMS Shows New Method for Offshore Wind Export Cable Shore Landings

VBMS used a new method to land export cables on the Galloper wind farm by lowering the cable onto the seabed without divers or other traditional means.

<http://ont.news/2gLE0sl>

## Marlink Secures Global Intelsat EpicNG Coverage on Horizons 3e

Intelsat S.A. and Marlink have signed an agreement for high-throughput connectivity from Intelsat's Horizons 3e satellite.

<http://ont.news/2hx8bCs>

## VBMS to Handle Cable Installation for Dutch Offshore Wind Farm

VBMS has received a contract to conduct the installation of the Borssele Alpha project export cables. TenneT awarded the EUR 70 million contract.

<http://ont.news/2gLOI25>

## SpeedCast, Axxess Marine Join to Develop Superyacht Data Management

SpeedCast International Limited and Axxess Marine are joining forces to revolutionize the way superyacht customers manage their data usage.

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

## Phoenix International's ROVs Work on First U.S. Offshore Wind Farm

Phoenix International and Ocean Tech Services teamed to provide ROV support for the Block Island Wind Farm, the first U.S. offshore wind farm.

<http://ont.news/2hx9n8N>

## Indoi to Build Indian Ocean Exchange Cable System

The Indian Ocean Exchange System will be the third submarine cable for Mauritius. It will accelerate technological innovation in the region.

<http://ont.news/2hFF3vA>

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**AUV Batteries**

**Battery Systems**

# Future USS Gabrielle Giffords Completes Acceptance Trials

Future Independence-class littoral combat ship USS Gabrielle Giffords (LCS 10) successfully completed its acceptance trials 18 November. The trials consisted of a series of in-port and underway demonstrations for the Navy's Board of Inspection and Survey (INSURV).



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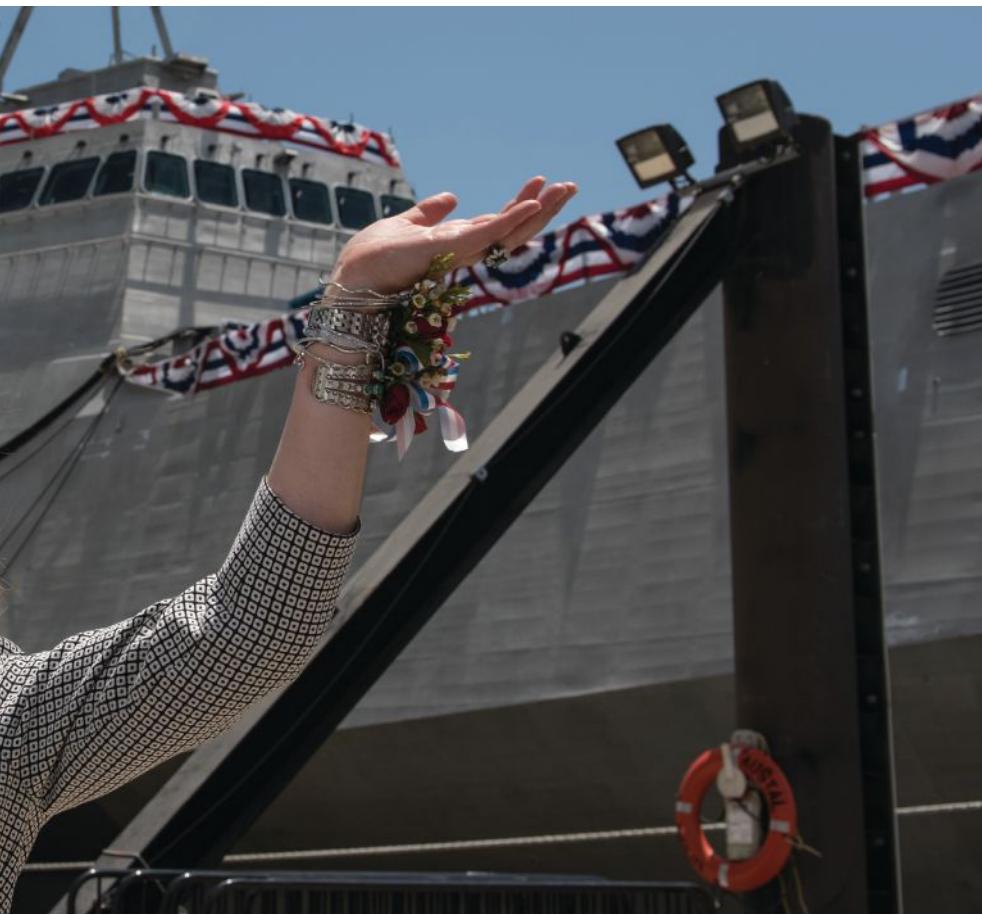
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Following delivery and commissioning in Galveston, Texas, LCS 10 will sail to California to be homeported in San Diego with sister ships USS Independence (LCS 2), USS Coronado (LCS 4), USS Jackson (LCS 6), and USS Montgomery (LCS 8).

Several more Independence variants are under construction at Austal USA in Mobile, Alabama. Future USS Omaha (LCS 12) and future USS Manchester (LCS 14) are preparing for builders trials in 2017. Future USS Tulsa (LCS 16) is scheduled to be christened in early 2017. Other sister ships, future USS Charleston (LCS 18), future USS Cincinnati (LCS 20), future USS Kansas City (LCS 22), future USS Oakland (LCS 24), and future USS Mobile (LCS 26) are all in varying stages of construction.

The LCS class consists of two variants—the Freedom variant and the Independence variant—designed and built by two industry teams. The Freedom variant team is led by Lockheed Martin for the odd-numbered hulls (e.g., LCS 1). The Independence variant team is led by Austal USA for LCS 6 and the subsequent even-numbered hulls.

Each LCS will be outfitted with a single mission package made up of mission modules containing warfighting systems and support equipment. A dedicated ship crew will combine with aviation assets to deploy manned and unmanned vehicles and sensors in support of mine countermeasures, anti-submarine warfare, or surface warfare missions.

For more information, visit [www.navy.mil](http://www.navy.mil).

## Ultra-Compact Dual Frequency Echosounders

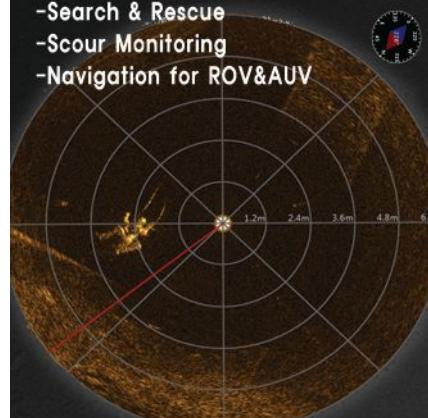


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## Kraken Receives Financial Contribution From Government of Canada

The National Research Council of Canada has made a financial contribution to Kraken Sonar Systems under the Industrial Research Assistance Program. Kraken Sonar Inc. announced that its wholly owned subsidiary, Kraken Sonar Systems Inc., will receive a non-refundable financial contribution of up to \$485,000 from the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP).

<http://ont.news/2htR2Mt>

## Unmanned Vehicles Figure Prominently In Mine Countermeasures Exercise

U.K.-U.S. Mine Countermeasures (MCM) Exercise 17-1 concluded in the Arabian Gulf, 17 November. The 38-day bilateral exercise between the U.S. Navy and U.K. Royal Navy was designed to provide an opportunity for both nations to share knowledge of MCM techniques. U.S. Navy exercise participants included USS Devastator (MCM 6), USS Gladiator (MCM 11), USS Dextrous (MCM 13), and Explosive Ordnance Disposal Mobile Unit (EODMU) 1. U.K. Royal Navy exercise participants include MCM ships HMS Bangor (M 109), HMS Chiddingfold (M 37), HMS Penzance (M 106), HMS Middleton (M 34), and auxiliary landing ship dock RFA Lyme Bay (L 3007).

<http://ont.news/2h0EVmA>



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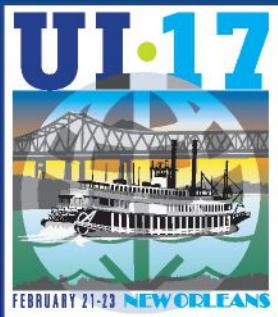
## A wide range of ROVs & electric manipulators for deep water operations

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## EXHIBIT AT UNDERWATER INTERVENTION 2017

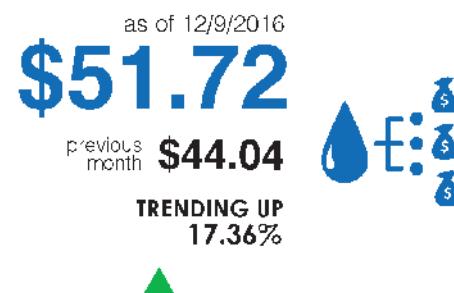
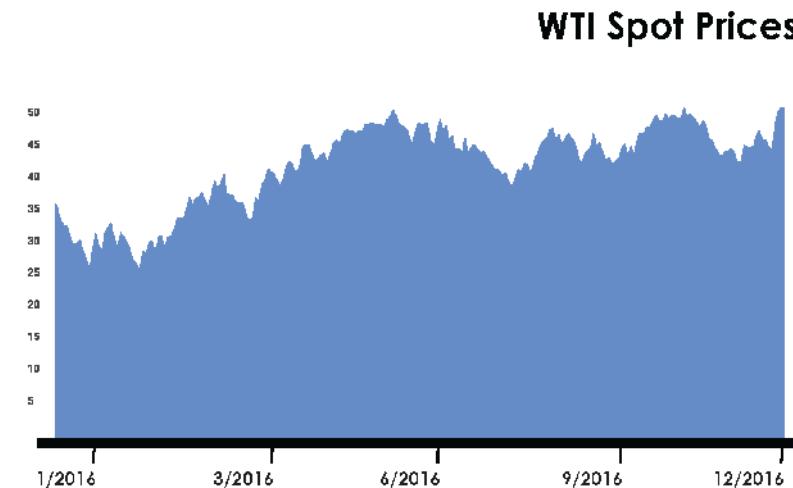
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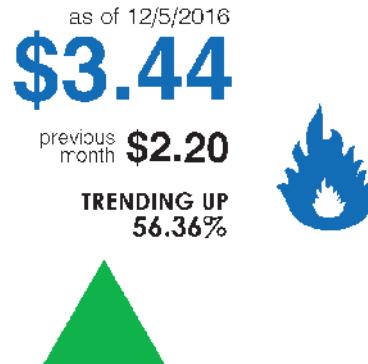
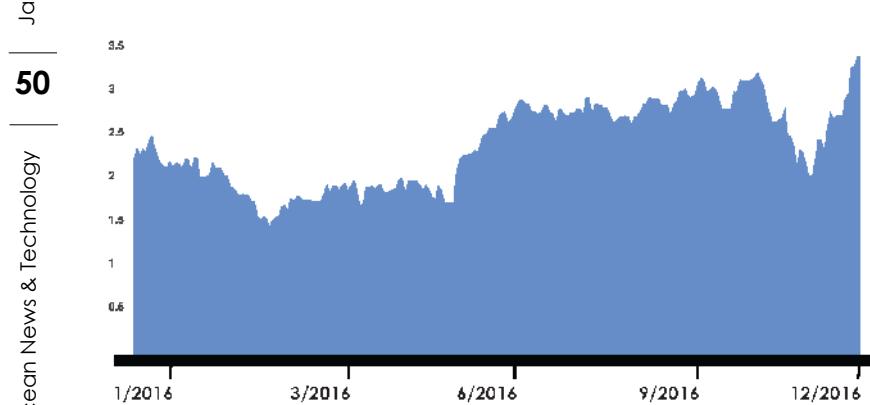
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# OFFSHORE STATS & DATA

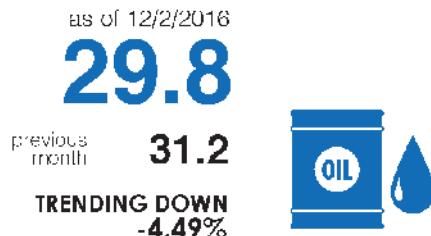
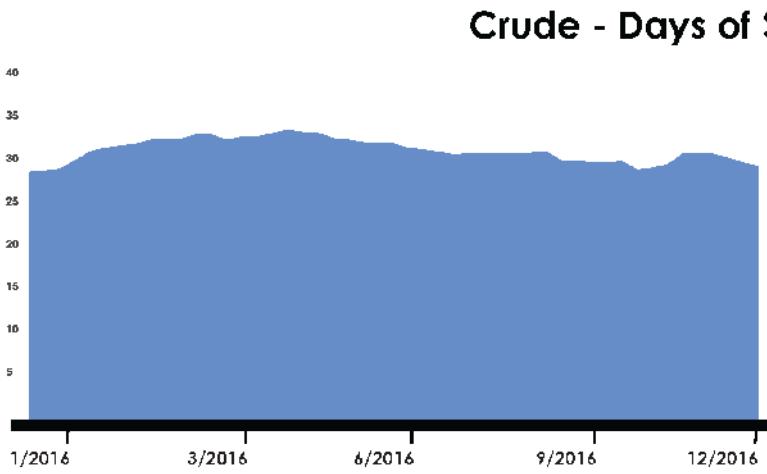
## Oil & Gas Industry Trends



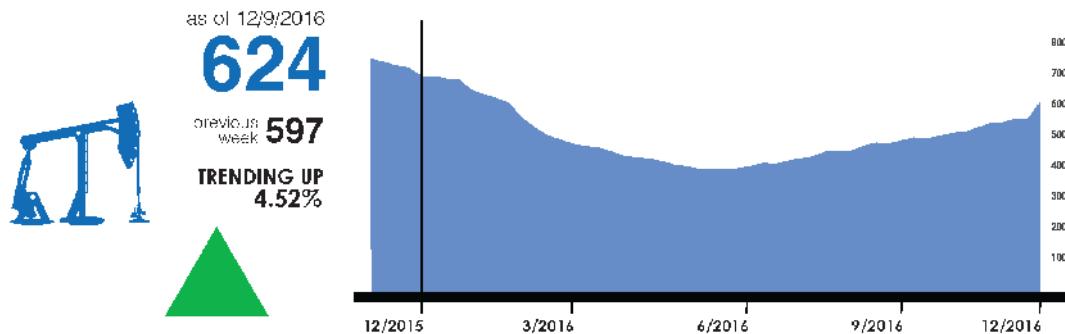
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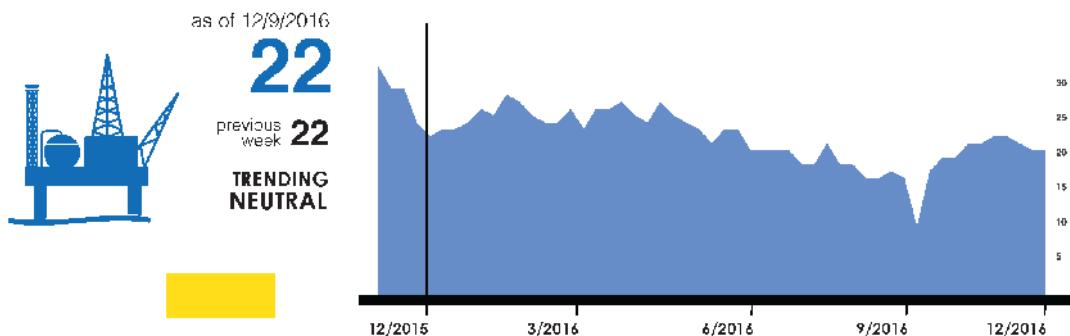
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## US Total Rig Count



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**Aberdeen, UK****Subsea Expo**

February 1-3

[www.subseaexpo.com](http://www.subseaexpo.com)**Southampton, UK****Ocean Business**

April 4-6

[www.oceanbusiness.com](http://www.oceanbusiness.com)**Seawork Int'l**

June 13-15

[www.seawork.com](http://www.seawork.com)**London, UK****Offshore Wind Energy**

June 6-8

<http://offshorewind2017.com>**Amsterdam****MCEDD**

April 3-5

<http://mcedd.com>**Offshore Energy**

October 9-11

<http://offshore-energy.biz>**Wind Europe**

November 28-30

<https://windeurope.org/confex2017>**Bremen, Germany****UDT**

May 30 - June 1

[www.udt-global.com/welcome](http://www.udt-global.com/welcome)**Marathon Bay, Greece****UASUV**

May 17-19

[www.unmanned-v.com](http://www.unmanned-v.com)**Paris, France****Euromaritime**

January 31 - February 2

[www.euromaritime.fr](http://www.euromaritime.fr)**Dubai, UAE****Marine Data Infrastructure GCC**

January 30-31

[www.marinedatainfrastructuregcc.com](http://www.marinedatainfrastructuregcc.com)**Singapore****UDT Asia**

January 17-18

[www.udt-asia.com](http://www.udt-asia.com)**Asia Pacific Deep Sea Mining**

November 9-10

[www.asia.deepsea-mining-summit.com](http://www.asia.deepsea-mining-summit.com)

# 2017 EDITORIAL CALENDAR

ON&T

## CALENDAR

### JANUARY

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

### FEBRUARY

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

### MARCH

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

### APRIL

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

### MAY

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

### JUNE

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

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### JULY – Digital Distribution Only

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

### AUGUST

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

### 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  
**Product & Services Focus:** Acoustic Modems, Releases & Transponders; Marine Communications; Survey & Exploration Services

### NOVEMBER – Digital Distribution Only

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

### DECEMBER

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

## SHOW DISTRIBUTION

### JANUARY

UDT Asia – January 17-18\*  
Marine Data Infrastructure GCC – January 30-31\*  
Euromaritime January 31– February 2  
GoM Oilspill/Ecosystems – February 6-9  
Oil North America – February 14-16

### FEBRUARY

Underwater Intervention – February 21-23  
Decomm & Abandonment Summit – March 14-16  
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

### APRIL

OTC – May 1-4  
AUVSI XPONENTIAL – May 8-11  
IOSC – May 15-18  
Canadian Hydrographic Conference – TBD  
Deepwater Decomm Workshop – TBD

### MAY

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

### JUNE

TBD

### JULY – Digital Distribution Only

TBD

### AUGUST

TBD

### SEPTEMBER

Oceans 17 – September 17-21  
Int'l Offshore Wind Forum – TBD  
AWEA Offshore Wind – October 24-25

### OCTOBER

Oilcomm – October 3-5  
MTS Dynamic Positioning – October 9-11  
Offshore Energy – October 9-11  
Offshore Well Intervention GoM – TBD  
Clean Gulf – December 5-7

### NOVEMBER – Digital Distribution Only

International Workboat – November 29 – December 1  
Offshore & Deep Sea Mining – TBD

### DECEMBER

TBD

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Ocean News & Technology

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# MILESTONES



## AquaHarmonics Wins the Energy Department's Wave Energy Prize

AquaHarmonics wins the \$1.5 million first place prize. CalWave Power Technologies and Waveswing America are runners-up. An 18-month design-build-test competition, the Wave Energy Prize focuses on catalyzing the development of game-changing wave energy converters that will ultimately reduce the cost of wave energy. Wave energy technology could one day provide clean, cost-competitive, reliable energy for homeowners, communities, businesses, and government in geographically suited parts of the United States.

<http://ont.news/2gJ3FDu>

## New Science and Technology Director at NOC

Professor Angela Hatton has begun her new role as Director of Science & Technology at the National Oceanography Centre. Hatton said, "These are interesting and exciting times for the NOC: addressing globally significant challenges, driving forward technology development, and conducting science that has a positive impact on society and the economy. I'm delighted to take up the challenge of helping the NOC achieve this and to strengthen partnerships with the marine science community in the UK and around the world."

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



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Image courtesy of Kongsberg Maritime © Roy Edgar Hansen, Norwegian Coastal Administration and Norwegian Defence Research Establishment (FFI)

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## DONG Energy Inaugurates Taiwan Office, Signals Expansion In Asia

DONG Energy inaugurated its office in Taipei and plans to develop four offshore wind farms in Taiwan with a capacity of at least 2 GW. Among the 36 offshore wind farm sites planned by Taiwan's Ministry of Economic Affairs (MOEA), 21 sites are located in the Changhua County. DONG Energy is currently carrying out a comprehensive environmental impact assessment (EIA) on four of these sites.

<http://ont.news/2gJeZj0>

## Hydroid Opens New Headquarters in Massachusetts

Hydroid Inc., a subsidiary of Kongsberg Maritime and the leading manufacturer of marine robotics, has announced it has opened a new headquarters building in Pocasset, Massachusetts. The new environmentally friendly building, located at 1 Henry Drive, houses the company's corporate and administrative offices, and is on the same campus as Hydroid's existing manufacturing and research facility.

<http://ont.news/2gL6eDI>



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## Introducing the New 2017 Ocean Industry Directory

Scheduled for release in January 2017, the updated Ocean Industry Directory provides a dedicated solution for finding product and service providers. Avoid searching multiple, incomplete directories that fail to consolidate ocean industry companies in one place. The comprehensive, easy-to-use Ocean Industry Directory takes the mystery out of corporate listings by distinguishing between manufacturers, sellers, rental agents, and service providers.

### Get Listed!

The Ocean Industry Directory is featured in every issue of Ocean News & Technology's print and digital magazines, providing exposure across multiple media channels that is important in a competitive marketplace. In addition, the Ocean Industry Directory is a key component of [www.oceannews.com](http://www.oceannews.com) and updated on a monthly basis.

### Key Features

If you're interested in becoming a part of the Ocean Industry Directory, consider the benefits of adding your own corporate listing. Key features include:



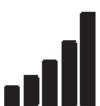
#### Company Listing

Offers companies the opportunity to list their company name, address, phone number, and website. All listings submitted through the website will be screened by a moderator to ensure that they align with the mission of the Ocean Industry Directory.



#### Search by Product or Service

Each listing will be categorized according to the product and or service offered by the company. The directory lists over 200 different oceanographic categories. Users will be able to search the categories listed within the directory to easily find information regarding companies associated with the products and services they are researching.



#### Sales Contacts

Upgraded listings include additional marketing content as well as sales contacts and emails. Let potential customers know who to reach and how to reach them.

### Multiple Participation Levels

The directory offers three tiers of corporate participation. Ranging from free to upgraded, our listings are tailored to fit your company's marketing budget. These directory participation levels include:

	Free Plan Digital Only Listing	Silver Plan \$500 Digital Only Listing	Gold Plan \$950 Digital & Print Listing
Company name, address, phone number, and website	●	●	●
Link to chosen categories for products and services	●	●	●
Corporate Logo		●	●
100-word company introduction		●	●
Sales contact name and email		●	●
One corporate document upload		●	●
Print listing for one category			●

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Website: www.rowetechinc.com  
Contact: Ray Mahr



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 electronics suite is superior to others due to a powerful compact single-unit configuration which allows simultaneous current profiling and bottom tracking.

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E-mail: ross@a2sea.co.uk  
Website: www.a2sea.co.uk  
Contact: Ross Taylor



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Fax: (951) 659-3958  
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Contact: Gary Brown, Sales Manager

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

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



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# UNDERWATER COMMUNICATION AND POSITIONING SOLUTIONS

# EvoLogics®



## S2C TECHNOLOGY: COMMUNICATION AND TRACKING COMBINED

- time, space and cost-saving solutions
- low power consumption for autonomous operations
- advanced data delivery algorithms, addressing and networking, remotely configurable settings
- extendable platform with multiple configuration options: power-saving Wake Up module, acoustic releaser, additional sensors, custom solutions, OEM versions available

## USBL POSITIONING SYSTEMS

**simultaneous** positioning and communication - no need to switch between positioning mode and modem mode

- flexible SiNAPS positioning software
- reliable data transmissions
- range: up to 8000 m
- accuracy: up to 0.04 degrees

## UNDERWATER ACOUSTIC MODEMS

reliable data transmissions even in adverse conditions, customizable R-series modems, light and compact M-series "mini" modems, **new S2CM-HS high-speed modem**, special editions for developers, S2C communication and positioning emulator - remote access or standalone device

- range: up to 8000 m
- depth: up to 6000 m
- data rate: up to 62.5 kbps

## LBL POSITIONING SYSTEMS

highly accurate, precise and stable performance, simultaneous positioning and data transmissions

- flexible SiNAPS positioning software
- reliable data transmissions
- range: up to 8000 m
- accuracy: better than 0.01m

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# SeapHOx™

## Ocean pH CTD & Oxygen Sensor



The new Sea-Bird Scientific SeapHOx™ combines the SeaFET™ Ocean pH sensor with the SBE 37-SMP-ODO MicroCAT CTD+DO sensor.

SeapHOx™ utilizes onboard measurements of conductivity, temperature, and pressure to optimize the measurement of ocean pH in real-time.

- pH - shallow and deep configurations
- Conductivity
- Temperature
- Pressure
- Optical Dissolved Oxygen
- Integrated into a long-term deployment mooring package

[seabird.com/SeapHOx](http://seabird.com/SeapHOx)



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