

**FEBRUARY  
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## **Advances in Unmanned Surface Vehicles for Long-Duration METOC Missions**

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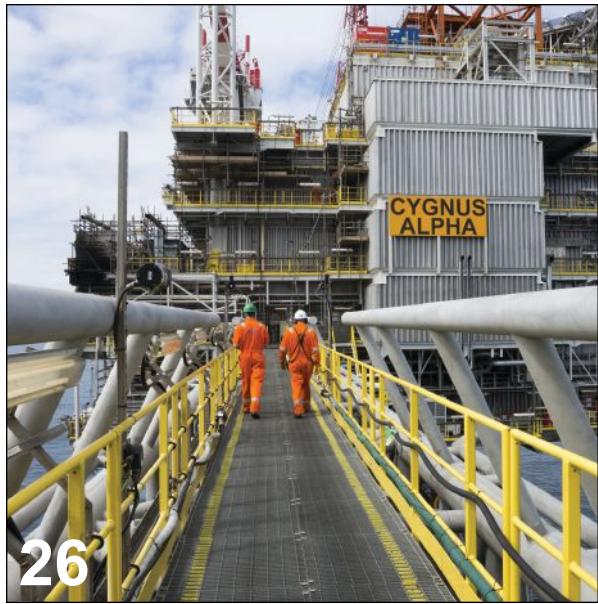
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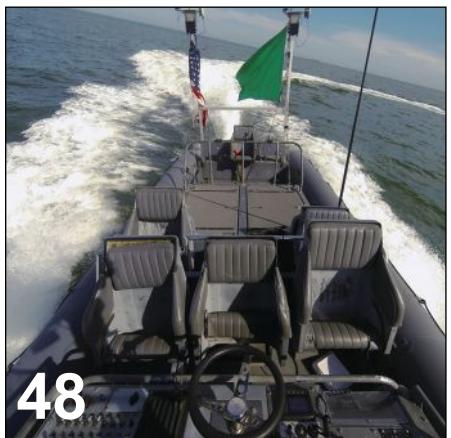
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## About the Cover

Measuring and monitoring the Arctic. The Wave Glider® configured with weather and environmental sensors on mission in the Arctic.

Photo Credit: Liquid Robotics

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Kevin Traver  
Executive Director,  
Marine Technology Society

## Opportunity Runs Deep

### Marine Technology Society to Collaborate on Technology Incubation

As the new Executive Director for the Marine Technology Society (MTS), I'd like to share my vision of where MTS is headed. First and foremost, MTS must support our members. For example, we are looking at ways to expand our influence well-beyond our Washington, DC headquarters. The ocean's importance is global and our organization must grow to fully support our members.

We also plan to evolve our promotion of marine technology to include incubation. Under the direction of our talented and experienced Board of Directors, I envision MTS becoming the premier technology and business incubator for the marine technology industry, and the future of the Blue Economy.

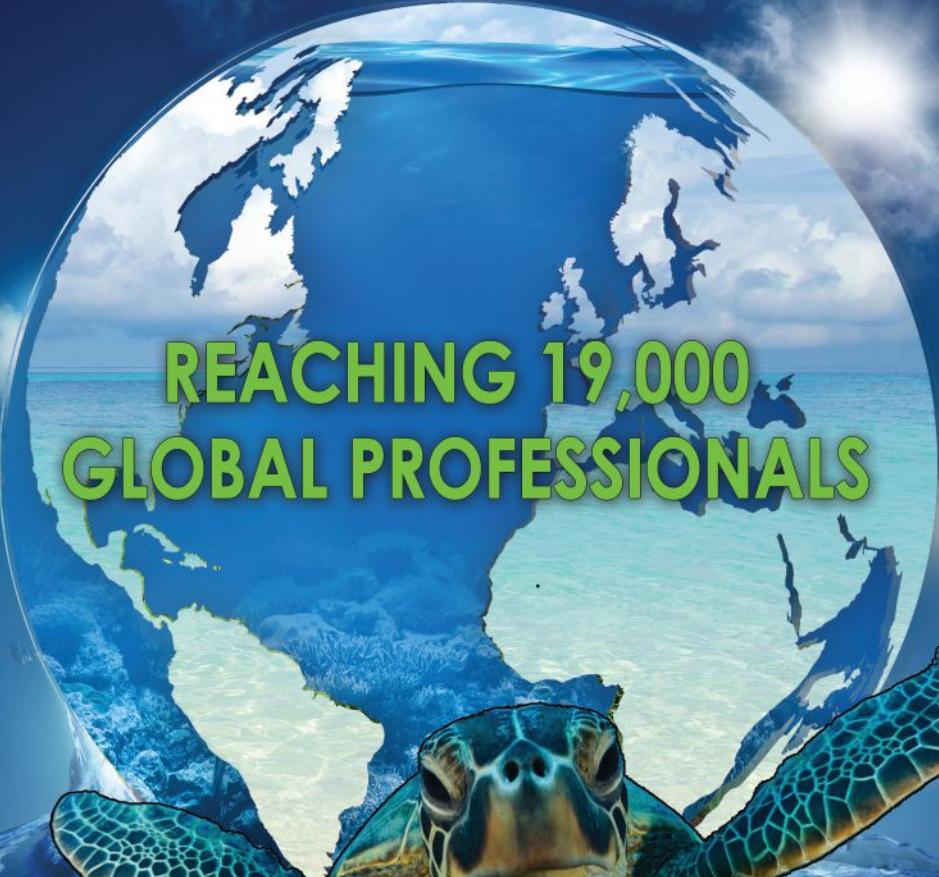
In this expanded role, our organization will become the convening authority for entrepreneurs, government, industry and investors. Our collaborators will be innovative companies (our industry members,) organizations (our corporate partners) and ocean critical government agencies that are driving change, not only in the marine technology sector, but also globally.

Under my leadership, MTS will always be thinking about how to improve access to information, networking opportunities, event platforms, and communications to better serve our members. The last of these points might be the most important: We need to connect to, explain, and promote all those within the Marine Technology Sector.

In addition, we must engage those that are one step away from our sector. MTS needs to be the "go to organization" for its members, and partners of state, federal and international government. We must also become the "go to organization" for non-governmental agencies and corporate partners who support our industry. MTS must be the place where they are turning for information, and participation in world class events that allow them to gather information, meet with customers and partners and to drive innovation.

MTS is pleased to announce a partnership with Ocean News & Technology that will bring exciting new benefits for MTS members

Our motto is: Opportunity Runs Deep, it is time for MTS to start leading the way and live up to its name and history.



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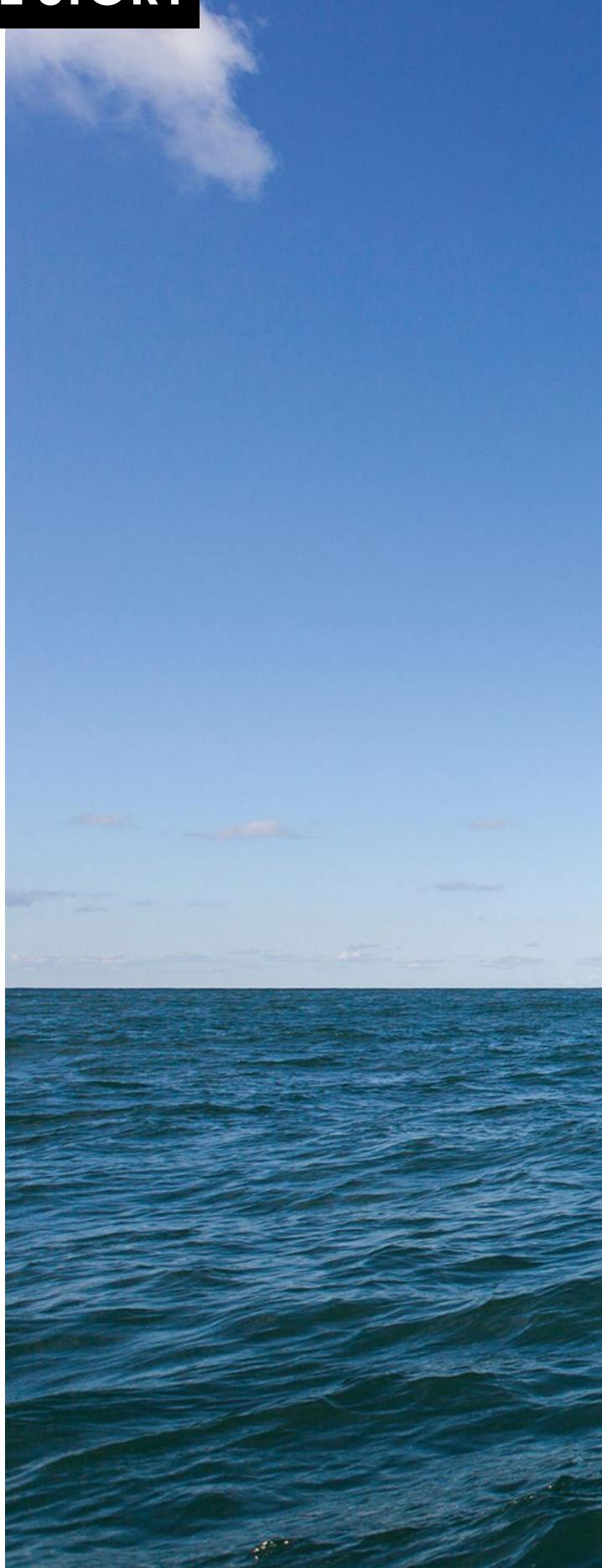
# Advances in Unmanned Surface Vehicles for Long-Duration METOC Missions

February 2017

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Ocean News &amp; Technology

**T**hink back 25 years when autonomous maritime systems were futuristic and found only in the most prestigious academic U.S. institutions and Navy R&D laboratories. Due to the state of technology, they were designed for single, special-purpose applications. Mission durations were measured in hours or days, not months or years and data were retrieved only once the systems were recovered, if they were recovered at all. Meteorology, oceanography, and defense organizations were the early pioneers leading the charge to use unmanned systems to advance research and surveillance capabilities.



Today, unmanned maritime systems have matured from prototypes and proofs-of-concept to workhorse systems relied upon to handle the dangerous, remote, and repetitive observation and monitoring missions. Unmanned Surface Vehicles (USVs) are now multi-purpose and able to support multiple sophisticated sensor payloads and real-time communications. Advancements in system endurance, reliability, power systems, and autonomy make possible longer missions that are now measured in months vs. days/weeks. These advancements enable meteorologists and oceanographers to collect data over longer time periods (seasons), in harsher environments, and from more remote geographic areas.

An excellent example is the recent Arctic mission conducted by Woods Hole Oceanographic Institute and the University of Michigan. The research team deployed Wave Gliders®, unmanned surface vehicles, to gather measurements for weather, climate change, biological, and other environmental monitoring. Their task was to measure the Arctic waves in the Beaufort Sea. Cumulatively, these USVs spent 900 days at sea surveying over 36,000 nautical miles. An accomplishment, that less than a decade ago, would not have been possible.



# FEATURE STORY

## Dual-use METOC Missions Across Industries

Across the defense, oil and gas, and commercial markets, there is an increasing demand for unmanned systems capable of supporting METOC data collection in conjunction with their primary mission. The ability to collect and communicate accurate, in-situ weather data for real-time situational awareness is vital to ensure safe operations and mission success.

Additionally, by adding weather or other biological sensors to these long, unmanned missions, researchers

can gain weather, climate, and other biological data in sparsely sampled portions of the world's ocean. This data can provide valuable insight to ocean conditions rarely observed.

Below are several mission examples of how Liquid Robotics' Wave Gliders® have been deployed for dual-use METOC missions. In each case, they successfully supported a mixed payload of METOC and acoustic sensors, cameras, GPS, and communications on long duration, mobile platforms.

*Fleet of Wave Gliders deploying for Unmanned Warrior 2016.*



- **Unmanned Warrior 2016:** A semiannual defense training exercise hosted by United Kingdom's Royal Navy and designed to demonstrate the use and networking of autonomous maritime systems. During this exercise, Liquid Robotics and Boeing demonstrated, for the first time, the use of a network of persistent USVs to detect, report, and track a live submarine in a naval demonstration. Equally valuable, the USVs from Liquid Robotics were equipped with meteorological and oceanographic sensors and were deployed to the North Atlantic to gather data that ultimately contributed to sensor prediction models for the entire Unmanned Warrior and Joint Warrior exercise. These systems operated 24/7 in harsh conditions unfavorable for manned operations—waves in excess of 6.6 m and winds of more than 60 knots—to autonomously provide real-time data on the weather and ocean conditions critical to the safe operation of the Unmanned Warrior systems.
- **Illegal, Unregulated and Unreported Fishing:** USVs are beginning to be used to combat the escalating threats of Illegal, Unregulated and Unreported (IUU) fishing. Working in concert with other manned and unmanned systems, Wave Gliders® have patrolled remote, vast areas of the ocean to detect the presence of surface vessels around Marine Protected Areas (MPAs) or Exclusive Economic Zones (EEZs).

A Wave Glider® patrolled the UK's Foreign & Commonwealth Office (FCO) MPA in the Pitcairn Islands. Image below is an image of a vessel detected by the Wave Glider® while on patrol around the Pitcairn Islands. After successfully completing its mission around the Pitcairn Islands, the Wave Glider® was remotely piloted more than 2,808 nautical miles (5,200 km)—through strong equatorial currents, doldrums, and challenging sea states—back to port in Hawaii. Along the way, it collected 9,516 measurements of meteo-

*Wave Glider providing real-time METOC data.*



# FEATURE STORY

logical, oceanographic, and marine biodiversity data and was continuously at sea, untouched, for 213 days while traveling a total of 7,205 nautical miles (13,344 km) through seas rarely sampled.

- **Seismic Surveys and Weather Condition Surveys:** USVs, specifically Wave Gliders®, have been used to monitor ocean currents for activities such as seismic surveys as well as the weather conditions around offshore oilrigs. Having the capability to support mixed payloads of METOC sensors, current sensors, acoustic receivers, and communications devices on one platform provides operators with a way to enhance situational awareness and ensure safe maritime operations around multi-billion dollar oil operations.

## Changing Climate and Forecast Capabilities with New Systems

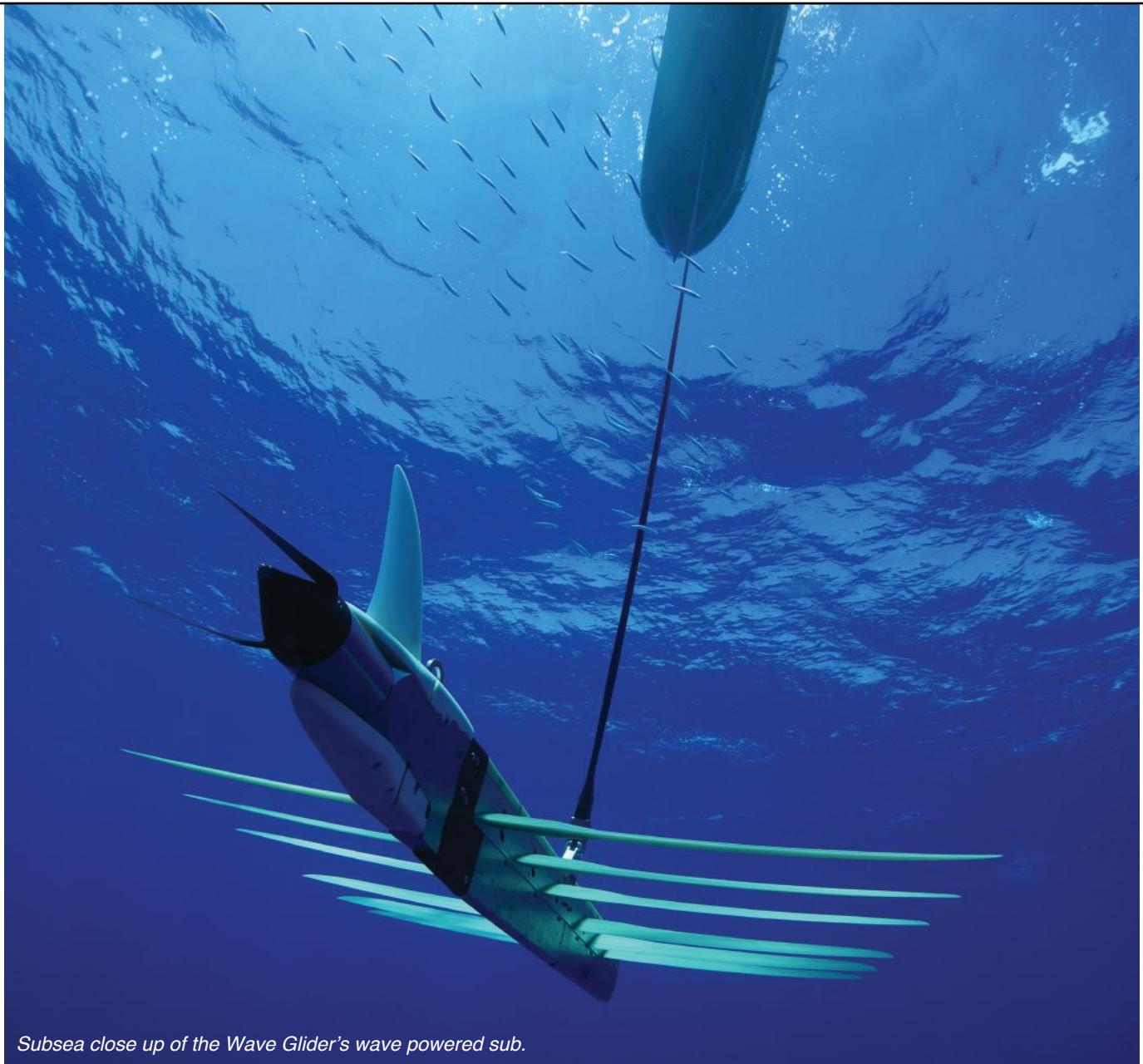
Autonomous, unmanned systems provide meteorologists, oceanographers, and scientists with a new and more efficient platform for gathering measurements. While buoys, ships of opportunity, and satellites will continue to play roles in data collection, vehicles like the Wave Glider provide the foundation for cost-efficient systems for long-duration data collection.

They are being used in multiple ways:

- Extended duration sampling with other platforms for climate research – The Council for Scientific and Industrial Research (CSIR)-led Southern Ocean Carbon Climate Observatory (SOCCO) program in South Africa has been using Wave Gliders and buoyancy gliders on multi-month missions to advance climate research in the Southern Ocean.
- Existing long-duration sampling program – Researchers at the Monterey Bay Aquarium Research Institute (MBARI) recently published a paper on the use of Wave Gliders for pCO<sub>2</sub> and pH observations (i.e., temperature, salinity, oxygen, pCO<sub>2</sub>, pH, wind speed, and direction). They demonstrated how USVs can provide quality datasets that compared favorably to traditional moored and shipboard systems already in use since 1993, offering lower cost data acquisition and greater spatio-temporal coverage<sup>1</sup>.
- Long-term observation networks – Today, when a buoy or buoy-based system breaks, the effort to repair it is typically expensive and time consuming, resulting in long periods without measurements. Even when the budget exists, getting boat availability and fixing a buoy



Liquid Robotics' Pitcairn Google Journey Map.



*Subsea close up of the Wave Glider's wave powered sub.*

can be hampered by weather and resource availability. Unmanned systems that are both mobile and capable of holding station provide a flexible way to increase system uptime. When a system or node has problems, another one can swim out to replace it, which typically allows one showing problems to swim home for inspection or repair.

#### **On the Horizon, the Digital Ocean**

The use of autonomous systems has proven invaluable as a way to lower the costs and risks of collecting data needed to advance weather modeling and forecasting. The latest technological advancements that provide intelligent, long-duration, dual-use systems will further help researchers better understand the complex weather conditions driven by the ocean.

As we look to the future, unmanned systems will further transform the way we interact and learn about

ocean and, in turn, our planet. Over the next decade, systems will continue to advance in levels of endurance, power, intelligence, and autonomy. However, the scientific breakthroughs required to address weather and global climate change, ocean preservation, maritime security, and other grand challenges will be different. Systems and data will be more interconnected, making the ocean more digital and instant access to ocean data a reality. Imagine the breakthroughs in forecasting for climatologists and meteorologists. With collaboration and continued innovation, it's possible and just over the horizon.

<sup>1</sup> Chavez, F.P., J. Sevadjian, C. Wahl, J. Friederich, and G.E. Friederich. 2017. Measurements of pCO<sub>2</sub> and pH from an autonomous surface vehicle in a coastal upwelling system. *Deep Sea Research Part II: Topical Studies in Oceanography*.

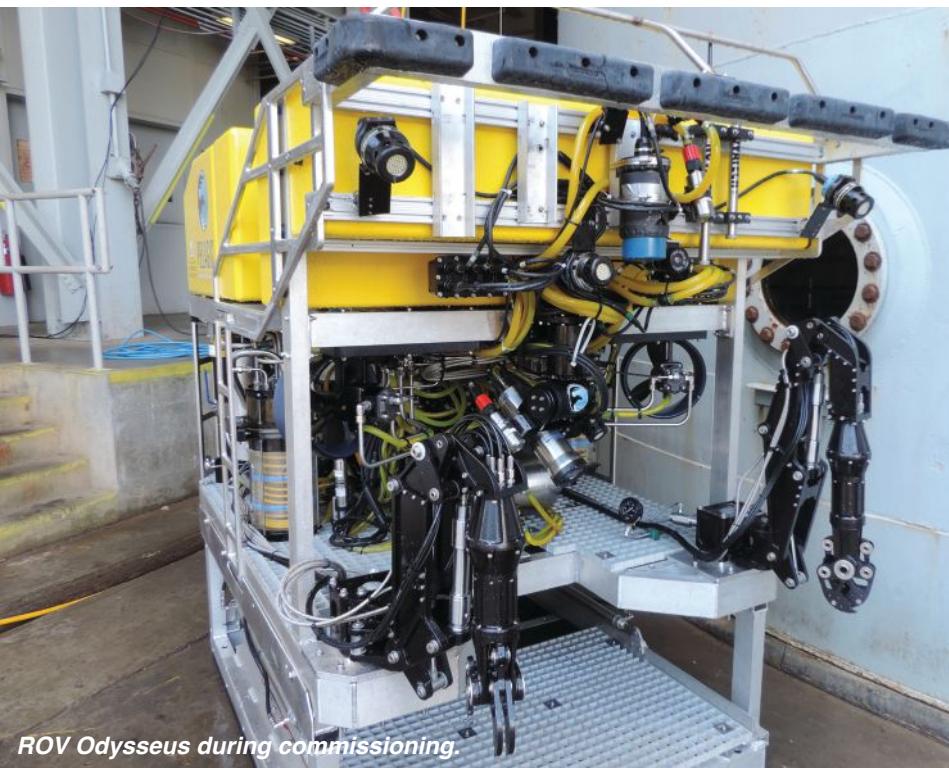
## Redesign of Odysseus ROV has Global Implications

Pelagic Research Services (PRS) recently completed an extensive redesign of its 6,000-m ROV System Odysseus, which included in-water commissioning and verification of all ROV systems, including endurance and full power tests. Completed by MPH Engineering, the new system is designed to serve the offshore industry as well as ocean research and exploration communities around the world.

The Odysseus ROV System is a 6,000-m, science-/medium-work class hydraulic ROV with a heavy lift capability and small footprint. It is mobile and flexible, accommodating new and legacy sensors in addition to science sampling systems. Odysseus' umbilical is standard UNOLS .681 fiber optic cable. The vehicle has spare hydraulic functions, two spare fibers and available AC/DC power supply. A new welded aluminum frame provides a thru-frame lift capacity of over 4,000 lbs along with two hydraulically controlled load releases. The frame accommodates existing tool skids, cable reels, etc., as well as myriad science payloads through a customizable frame interface.

The Odysseus ROV System includes a payload skid with a hydraulic activated tray measuring 47 3/4"(W) x 32 "(L) x 15" (H). This tray can be fully extended beyond the ROV and, as an example, can easily accommodate over 18 push cores, insulated tubes for coral genetics and separate bio boxes for other samples like sponges and rocks. To ensure every dive is efficient and successful, PRS provides two five-function manipulators or can easily provide one or two seven-function manipulators if required by the project.

Odysseus is equipped with a SubC 1Cam Alpha (MK5) HD fiber optic camera equipped with a 10x optical zoom mounted on a hydraulic pan and tilt. Six SD cameras are also provided. These DeepSea Power and Light cameras include Multi-SeaCams, Wide-i SeaCams and a Super Wide-i SeaCam. A data overlay system providing germane ship and ROV navigational information is provided on the main HD video stream. Raw and processed full-resolution HD video is available in the control room where four separate video streams may be recorded on both solid state drives and other digital media. The video viewing and recording suite utilizes a master time clock to synchronize all of the image streams and navigational data collected. The HD camera comes equipped with 512 gigabytes of internal memory, which serves as a functional back-up to the primary video data recorders. The ROV main HD camera also takes 4 to 24 megapixel native digital stills. Lighting is provided by 6 to 9 DeepSea Power and Light 5000-lumen, individually-dimmable LED lights. These lights can be placed anywhere on the ROV to provide illumination to complement the full suite of cameras.



The Odysseus has seven hydraulic thrusters, four horizontal and three vertical. The thrusters are individually controlled by RPM, providing outstanding maneuverability, station-keeping and operations in high current. The control system has a complete autopilot system, featuring auto hover, auto depth, auto altitude, and waypoint navigation. As a science-class ROV system, Odysseus has pre-populated bulkheads for various sensors, spare power and hydraulic functions to easily integrate wired USBL beacons, multi-beam SONARS, survey systems and additional cameras, including HD, 3D and 4K cameras.

Odysseus uses a Greensea Inertial Navigation System coupled with the following aiding sensors: Tritech Altimeter,



*Odysseus mobilized aboard the USM Research Vessel Point Sur.*

TRD Workhorse DVL and Paroscientific depth sensor. Odysseus also utilizes the Greensea Balefire Workspace, which allows for discrete monitoring of all ROV navigational sensors, ship navigational data, USBL data and additional sensors as requested. Navigation solutions for the ROV as determined by the INS are presented along with critical ROV and ship data in this workspace. This Balefire Workspace serves as a tracking and navigation interface as well as serial data management system. Unique to Balefire, the Odysseus Tritech SeaKing SONAR is seamlessly overlaid on the tracking data providing a critical visualization of the subsea environment. The Balefire Workspace with all of the navigation and SONAR data used to populate the interface record every dive as a unique event. These logs, coupled with video from each dive, can be replayed to provide an excellent tool for post-expedition analysis.

Odysseus is housed at Stennis Space Center in Mississippi and is in proximity to the University of Southern Mississippi's Research Vessel Point Sur. PRS has also been selected as a prequalified ROV service provider for the Ocean Networks Canada (ONC) and recently completed a major project for ONC that involved recovering and replacing one of the primary nodes of the Neptune Ocean Observing System. PRS was also selected by the U.S. Government to complete a survey of critical fisheries habitat off the southeast coast of Alaska. PRS provided the ship as well the ROV for these projects.

The current Odysseus ROV System is transported via ground on two flatbed trailers and in three 20-ft ISO container for overseas shipment. Odysseus is easily integrated on ships of opportunity and is ready to meet the ocean communities' subsea needs anywhere in the world. For more information, visit [www.pelagic-services.com](http://www.pelagic-services.com).

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## Florida Corals Tell of Weather Past, Foretell Weather to Come

Scientists seeking an oceanic counterpart to the tree rings that document past weather patterns on land have found one in the subtropical waters of Dry Tortugas National Park near the Florida Keys, where long-lived boulder corals contain the chemical signals of past water temperatures. By analyzing coral samples, USGS researchers and their colleagues have found evidence that an important 60- to 85-year-long cycle of ocean warming and cooling has been taking place in the region as far back as the 1730s.

The cycle, called the Atlantic Multidecadal Oscillation or (AMO), is linked to rainfall over most of the US, Midwestern droughts, hurricane intensification and landfalls, and the transfer of ocean heat from the tropical Caribbean Sea to the North Atlantic Ocean by way of the Gulf Stream. It interacts with ongoing climate change in poorly understood ways, and it is very hard to spot in pre-20th century records.

"The AMO has a huge impact on human populations and the economy, mainly through its influence on rainfall patterns," said geochemist Jennifer Flannery of the USGS Coastal and Marine Science Center in St. Petersburg, Florida, who led the study. "Climatologists suspect the AMO is a natural climate cycle that has existed for more than 1,000 years. But until recently most of the evidence came from ships at sea, and only went back 150 years or so."



"The record we obtained from the Dry Tortugas coral cores captures several complete AMO cycles stretching back 278 years. That gives climate modelers a lot of new evidence to work with as they try to understand past AMOs and predict future ones."

The Dry Tortugas samples precisely track major climate phenomena like the Little Ice Age that ended in the early 1800s, and the lethal Dust Bowl drought of the 1930s. A research paper about the study appeared January 15 in the journal *Palaeogeography, Palaeoclimatology, Palaeoecology*.

Dry Tortugas National Park is a cluster of small, isolated islands at an important marine crossroads, the Florida Straits, where the Gulf of Mexico and the Caribbean Sea flow into the Atlantic Ocean. The islands are within a large zone of seawater called the Atlantic Warm Pool, which typically heats up in spring to 83°F (28.5°C) or more. The heat stored in the Atlantic Warm Pool appears to influence rainfall in the Caribbean and parts of North America and the formation and intensity of hurricanes.

The Dry Tortugas also lie near the origin of the Gulf Stream, the current that carries warm seawater north to Greenland, where it chills, plunges deeper into the sea, and heads back towards the equator. Together, the northbound warm flow at the surface and the deep,

cold southbound flow are known as the Atlantic Meridional Overturning Circulation (AMOC), which affects weather in the entire North Atlantic, including the U.S. Atlantic seaboard and much of Europe.

Some parts of this circulation system have been known for centuries, but others, like the AMO, are relatively recent discoveries. Climatologists are eager to learn more about the AMO from a longer record of sea surface temperatures in this region where ocean-wide patterns take shape.



That's where the Dry Tortugas coral cores come in. Coral skeletons, like tree rings, have growth rings that preserve evidence of past weather conditions. While they are alive, corals take up strontium and calcium from seawater, depositing the two minerals in their skeletons in a ratio that varies with water temperature.

By measuring the strontium-to-calcium ratio in corals, scientists can reconstruct past sea surface temperatures. Working with two boulder corals cored by divers in 2008 and 2012, Flannery's team used a dentist's drill to collect and analyze samples at intervals as short as one month, going back as far as 1837. Combining these two corals' records with three other Dry Tortugas coral cores that stretch back to 1733, the team was able to track 278 years' worth of sea surface temperatures.

The Dry Tortugas corals show that after a cold spell during the 1960s, sea surface temperatures in the region have warmed by about 1.5°F (0.8°C) between 1970 and 2012. They also show two sets of oscillations in sea surface temperatures: a shorter cycle lasting 28 to 30 years, and a longer cycle of 80 to 90 years, consistent with the Atlantic Multidecadal Oscillation.

The coral cores reliably track these longer cycles of warming and cooling, providing confirmation that the Atlantic Multidecadal Oscillation has existed for the past three centuries, Flannery said. This suggests that there is a close connection between sea temperatures in the area around the Dry Tortugas and the larger AMO.

"By looking at sea surface temperatures in the Dry Tortugas, climatologists may be able to predict imminent changes that will affect the entire North Atlantic basin," Flannery said.

The study is available at [www.sciencedirect.com/science/article/pii/S0031018216306289](http://www.sciencedirect.com/science/article/pii/S0031018216306289).

For more information, visit [www.usgs.gov](http://www.usgs.gov).

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## Ocean Acidification to Hit West Coast Crab Fishery

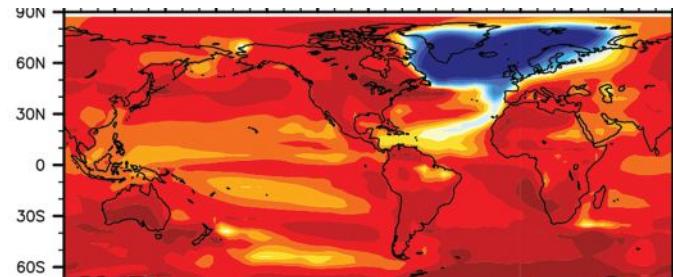
The acidification of the ocean as seawater absorbs increasing amounts of carbon dioxide from the atmosphere will reverberate through the West Coast's marine food web, but not necessarily in the ways you might expect, new research shows. Dungeness crabs, for example, will likely suffer as their food sources decline. Dungeness crab fisheries valued at about \$220 million annually may face a strong downturn over the next 50 years, according to the research published January 12 in the journal *Global Change Biology*.

<http://ont.news/2k9Ncqt>

## Climate Model Suggests Collapse of Atlantic Circulation is Possible

The idea of climate change causing a major ocean circulation pattern in the Atlantic Ocean to collapse with catastrophic effects has been the subject of doomsday thrillers in the movies, but in climate forecasts, it is mostly regarded as an extreme longshot.

<http://ont.news/2kkn4vE>.



## NASA Ocean Color Mapping Project Features FlowCam® Analyzer

Columbus thought he'd sailed the ocean blue but according to satellite imagery from NASA and the FlowCam® particle imaging and analysis system, it's closer to 50 shades of green. NASA Goddard Space Flight Center's Ocean Ecology Laboratory Field Group is mapping and monitoring the world's oceans using satellite-based ocean color imagery, and several of its research scientists turned to the FlowCam® from global aquatics instrumentation manufacturer Fluid Imaging Technologies, Scarborough, Maine to ground-truth satellite data and identify phytoplankton communities.

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

## Scripps Institution of Oceanography and the Western Australian Museum Led a Scientific Expedition off the Coast of Western Australia to Find Ruby Seadragons in the Wild

In hopes of getting a rare glimpse of the newly discovered third species of seadragon, researchers at Scripps Institution of Oceanography at the University of California San Diego and the Western Australian Museum led a scientific expedition off the coast of Western Australia to find Ruby Seadragons in the wild. After several days of searching with a mini-remotely operated vehicle in waters over 50-meters (164-feet) deep, the researchers got what they came for—the first-ever field sightings of the fish near Western Australia's Recherche Archipelago. As they observed two Ruby Seadragons on video for nearly 30 minutes, the scientists uncovered new details about their anatomy, habitat, and behavior.

<http://ont.news/2jOJPV4>





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## EXPERTS IN **SUBSEA DATA COMMUNICATIONS**

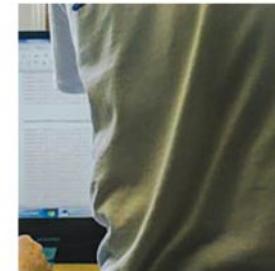
CSnet International provides broadband oceanographic, meteorological, seismological and hydrographic data services worldwide through the use of Ocean Observing Systems.



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## **TYPICAL PROJECTS SERVED**

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# GO BIG OR GO HOME: INSTRUMENTING THE NEARSHORE

Leaning over the side of the 22-ft boat and pulling up the first line of temperature sensors, oceanographer Jamie MacMahan described the state of the line as the worst bio-fouling he had ever seen. It was slimy and smelly. One down, 34 more to go.

This was only a pilot project, but MacMahan's mantra of 'go big or go home' meant that more than 300 instruments were attached to the arrays of moorings his team deployed offshore California's Point Sal State Park.

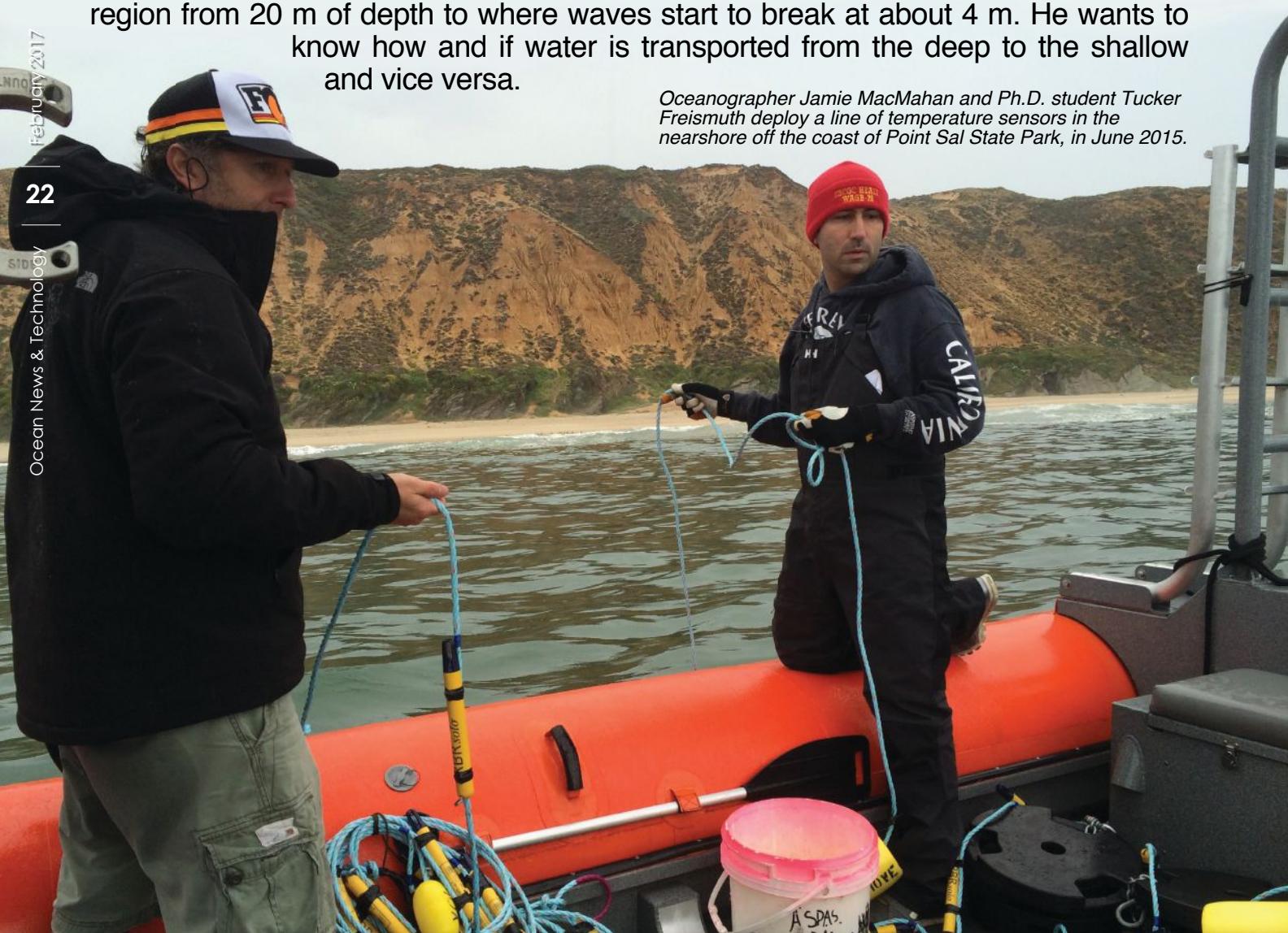
MacMahan, an associate professor of oceanography at the Naval Postgraduate School in Monterey, California, is studying how water moves in the nearshore, the region from 20 m of depth to where waves start to break at about 4 m. He wants to know how and if water is transported from the deep to the shallow and vice versa.

*Oceanographer Jamie MacMahan and Ph.D. student Tucker Freismuth deploy a line of temperature sensors in the nearshore off the coast of Point Sal State Park, in June 2015.*

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## Temperature as a Tracer

To track water movement, MacMahan identifies volumes of water by temperature. With data like those collected at Point Sal, MacMahan can identify physical ocean dynamics, such as rip currents, upwelling, and internal waves (enormous slow-moving waves that ride a density boundary below the ocean's surface).

"From a processes point of view, temperature's a great tracer. It's not perfect though," says MacMahan. If a volume's temperature only changed through direct contact and mixing with water of a different temperature, the team could account for all changes. Instead, the sun heats the water during the day, and it cools at night, so sampling must be done at a relatively high frequency in this case 1Hz so that the mass of water being followed isn't lost in other changes in temperature.

## Challenges Instrumenting the Nearshore

Beyond choice of tracer, there are several inherent difficulties studying this shallow and energetic ocean region. Waves, heavy currents, and the motion of sand on the bottom make the area ideal for deployment using a large vessel, one equipped with a winch. But, big vessels can not safely travel into the shallow areas, where MacMahan was headed. "The idea was, how are we going to deploy 30 stations from a small RHIB (rigid-hulled inflatable boat) and ensure that they will survive for two months, and at the same time, if something went wrong, what checks would we have in place to determine if the system failed?"

It came down to design. The common solution is for scuba divers to jet poles into the sand as anchors to which lines would then be attached. "That is almost 100% return on your data, but then that's logically expensive," MacMahan says. "It would probably take five days, maybe more. Based on the weather patterns, we felt we only had a two-day window to deploy or recover." Instead, they used 35-lbs barbell weights as anchors (one in shallow water and two where it was deep), attached their lines to crab buoys for buoyancy, and dropped the moorings off the side of the boat.

## Mooring Design

Usually an oceanographer who wants to measure temperature at a number of depths would use a t-string, a line with integrated temperature sensors at preset positions along its length. MacMahan did something different.

"I wanted to attach temperature sensors to lines so I had flexibility. You're always designing something. If you would buy the t-strings ahead of time and then the project changes, or you go, 'oh, there's this cool rocky outcrop. Wait, we're all set up for this standard system,' you can't adjust to that. As scientists doing fieldwork,

you're always re-evaluating your design, even to the last minute. You want to optimize it. So I wanted to go with independent temperature sensors."

Attached to each of the 35 lines were six to 12 RBRsolo T temperature loggers, which sample at up to 2Hz for up to six months. The lines also had a tilt sensor mid-line, which would indicate if the line remained vertical in the water, and a pressure sensor at the bottom to indicate movement of the mooring. Using "regular key rings," MacMahan and his team attached the temperature sensors to the lines by feeding the key rings through the hole on the top of the RBRsolo Ts and through the line. "Then we taped the RBRs to the line so they're basically part of the line."

The reason MacMahan wanted the sensors to be part of the line is simple: kelp. It's a constant hazard to instruments along the California coast. "If you have anything that can snag the kelp, it will get stuck on the line, and because the kelp is so massive, eventually it's going to start dragging your mooring."

On two consecutive days in early June 2015, MacMahan, Ph.D. candidate student Thomas (Tucker) Freismuth, a technician, and two volunteer graduate students took the hour-long trip from the nearest boat launch to Point Sal. There, they assembled some of the equipment in the boat and deployed their 35 moorings, in predetermined locations, including six ADCPs (Acoustic Doppler Current Profilers) to measure current velocities and directions.

"We designed various arrays to look at along-shore variability and cross-shore variability. Each mooring provided double duty as far as providing cross-shore and along-shore information."

At Point Sal State Park there is the eponymous rocky headland jutting into the sea, a sandy beach and rocky outcrop to its north, and a pocket beach and rocky bottom to its south, as well as submerged rocky outcrops off-shore. "It's a really cool, complex area," says MacMahan. "We're past the point, scientifically, of exploring stuff on straight and parallel beaches."

There was no beauty in recovery, however. On the first of the two days, the team tried to clean bio-fouled lines as they heaved them aboard, but they quickly gave up the effort and filled the boat with gunk. "It's a nice sunny day, and with the very first one, you're covered in slime and mud. For our moorings in shallow water, so about 12 to 15 meters or less, we used a 35 lb weight. The ones offshore were 70 lbs, so we had to haul in 70 lbs. And pulling those in with a slimy line was very tough. We were disgusting. It was wretched."

# EDITORIAL FOCUS

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*MacMahon handles a bio-fouled line of temperature sensors during recovery of his team's moorings, July 2015.*

Despite being slimy and stinky, the researchers were also thrilled. Their plan had worked—they had deployed their instruments in a new way that seemed dangerously simple. If they'd judged wrongfully, they could have lost their load of instruments, and the season's data. Instead, they found all moorings were intact, and all but three had stayed put against the waves, currents, and kelp.

## A Temperature-Rich Environment

On returning to Monterey, Freismuth downloaded the data, found he had a recovery rate of 99%, and began the analysis that will be the basis of his doctoral work. What Freismuth saw in the data, MacMahan describes as "a temperature-rich environment."

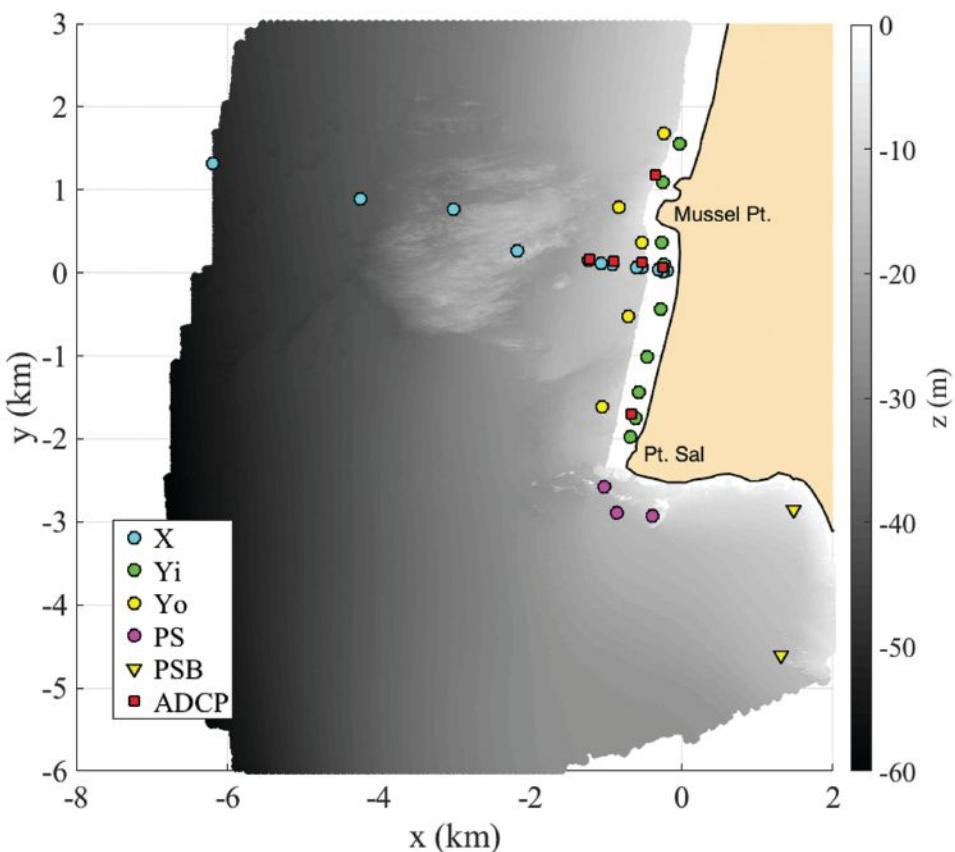
To Freismuth, the biggest driver of temperature variability was a surprise: "When we started analyzing the data, it looked like internal waves coming from offshore were overwhelming our signal. These internal waves are transporting warm water into the inner shelf and potentially into the surf zone."

Freismuth is working to complete his analysis quickly, because the results of this pilot project will be used to inform the main deployment of fall 2017. The larger study involves over 30 principal investigators. "What we're trying to do is get every measurement from 50 m to the beach," MacMahan says, "from measuring directly to measuring indirectly."

## Go Big or Go Home

Ever since MacMahan was a postdoctoral fellow under the supervision of Ed Thornton, he has worked alongside his mentor. MacMahan attributes his "go big or go home" mantra to Thornton, which led to success in this and past deployments. Thornton recalls, "I said, 'every pilot experiment you do, make sure it's almost as good or better than the real experiment because with nature, you don't always get a second chance.'"

Thornton, whose career as a nearshore oceanographer began in the 60s and hasn't ended (even though he's technically retired), adds: "I learned that the hard way."



*Locations and depths of oceanographer Jamie MacMahan's 35 temperature and ADCP moorings from 2015 deployment at Point Sal State Park, California. Circles mark locations of temperature line moorings; diamonds mark locations of bottom-mounted ADCPs.*

"If they hadn't done this comprehensive attempt you wouldn't know what scales to even look at and how those scales would tie into larger scales," Thornton says. In fact, the team had such success in recovering data, and with such an extensive set, that their 2017 plan involves extending their target area from 3 mi along the beach to 30 mi.

"I don't think we did anything crazy here," says MacMahan. "The only thing we did that I think was ingenious was to really make this a lightweight package that you can deploy overboard with humans." Of the systems the team deployed, he says, "I've learned that it's so easy, it's so simple, but it's very robust."

"I'm a little more of a risk taker in that I considered the risk and odds of doing this lightweight system," he says, "but the idea is that the return is much better if it's successful. I evaluated the risk versus the reward, and, you, gotta go for it." Go big or go home. Dr. MacMahan's work is funded by the Office of Naval Research.

# ENGIE E&P UK Limited Announces First Gas from Cygnus Field

ENGIE E&P UK Limited announced that first gas from the Cygnus development has been exported to the Bacton gas terminal in North Norfolk.

Cygnus, located in license areas P1055 & P1731, 150 km off the coast of Lincolnshire, is expected to contribute 5% of UK gas production—supplying sufficient gas to heat the equivalent of 1.5 million UK homes. The project added approximately £1.3 billion to the UK economy and supported nearly 5,000 jobs during its five-year development period.

Ruud Zoon, managing director of ENGIE E&P UK Limited, commented, "I'm very proud of the strong collaboration on Cygnus between partners ENGIE E&P, Centrica and Bayerngas. Together we have successfully achieved first gas production and export from the Cygnus field. Over 5,000 colleagues, contractors and suppliers have contributed to this landmark development and, most importantly, have maintained an excellent safety record since the project was approved in 2012."

"First gas from Cygnus represents a significant boost to the UK's long-term energy security, with an estimated production life exceeding 20 years. Furthermore, with over 80% of the contract work secured by British businesses—including fabrication yards in Hartlepool, Methil and Burntisland—it is a showcase for the technical and commercial excellence of the UK oil and gas supply chain."

The Cygnus complex, with four platforms, a total of 10 wells and two subsea structures, serves an estimated field size of 250 sq. km from which it is expected to achieve plateau production of 250 million cu. ft per day.

Bayerngas UK managing director, Gerry Harrison, added, "ENGIE E&P, Centrica and Bayerngas have worked closely together on this project since 2010. As you will hear from the partnership, most of the numbers related to this project are very large—for instance, investment, man hours, production levels, reserves, longevity. But perhaps the most important numbers are very small; our priority has always been



safety, and I am proud that Bayerngas has collaborated on a project with minimal Lost Time Incidents. We are looking forward to high levels of stable production and thank all those involved in Cygnus for their hard work and dedication."

Chris Cox, managing director of Centrica's Exploration & Production business, continued: "The Cygnus field is hugely important to the country's energy supply, so we are proud that gas is now flowing from the field and into homes and businesses across the UK. This milestone was only possible thanks to the hard work and collaboration of the teams across Centrica, ENGIE E&P, Bayerngas and our supply chain partners."

The partners are evaluating further opportunities in the Greater Cygnus area with the aim of bringing additional volumes through Cygnus when capacity becomes available.

Andy Samuel, chief executive of the Oil & Gas Authority, concluded, "ENGIE E&P, Centrica and Bayerngas have demonstrated an impressive collaborative effort in achieving first production from Cygnus. It represents a significant milestone for the Southern North Sea, delivering new volumes through existing infrastructure, utilizing the UK's skilled supply chain and helping create the right conditions for further developments. This is set to continue with the next phase of development from Cygnus Bravo, which will bring additional capacity on stream in the future to deliver MER1 UK."

Equity interests are operator ENGIE E&P UK Limited (38.75%) and partners Centrica (48.75%) and Bayerngas (12.5%).

For more information, visit [www.engie-ep.co.uk](http://www.engie-ep.co.uk).



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## Turbine Installation Completed at Burbo Bank Extension

On 14 December 2016, A2SEA's Sea Installer completed the installation of 32 MHI Vestas 8-MW turbines at DONG Energy's Burbo Bank Extension in the Irish Sea.

"The installation of the 32 MHI Vestas 8-MW turbines has progressed seamlessly. Again, A2SEA is first mover, this time by handling the currently largest offshore wind turbine in the market. The installation was completed safely and in accordance with the installation plan thanks to the well-planned and professional cooperation with our partners on the project, MHI Vestas and DONG Energy. Furthermore, I am very proud of the excellent work performed by all our dedicated employees both onshore and offshore. They make the differ-

ence," says Jens Frederik Hansen, CEO at A2SEA.

Claus Bølle Møller, project director at DONG Energy, said, "We are delighted at the completion of this major milestone in the project. It follows on from first power generation in November. This is the first time the 8-MW turbines have been installed offshore, so it is an exciting time for the entire industry. By using more powerful turbines, we are able to bring down the cost of providing clean, renewable energy to homes around the UK."

COO of MHI Vestas, Flemming Ougaard, acknowledged the importance of the first complete installation of a project: "The installation of the first V164 8-MW offshore



project, represents a major milestone in the history of MHI Vestas as well as our business partners." "I am proud of the commitment and excellent work of the entire installation team at MHI Vestas and the team from A2Sea and DONG Energy who worked with us on this project. Now, our focus turns to the commissioning of the turbines and bringing them into full operation prior to handing the project over to DONG Energy."

SEA INSTALLER's next project is turbine installation on the 580-MW Race Bank in the UK for DONG Energy. Installation is planned to start in early May 2017.

Burbo Bank Extension is owned by DONG Energy (50%) and its partners PKA (25%) and KIRKBI A/S (25%). The wind farm has a total capacity of 258-MW and is situated 7 km off the coast of Liverpool Bay. The wind farm is expected to be fully commissioned in Q1 2017 and will provide green energy for well over 230,000 homes in the UK.

For more information, visit [www.a2sea.com](http://www.a2sea.com).



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# OFFSHORE ENERGY



## BP Thunder Horse South Expansion Starts Up Ahead of Schedule

Deepwater Gulf of Mexico start-up expected to add 50,000 barrels of production, marking latest major investment in U.S. offshore region. BP announced that it has started up the Thunder Horse South Expansion project in the deepwater Gulf of Mexico 11 months ahead of schedule and \$150 million under budget. The project is expected to boost production at the facility by an estimated 50,000 gross barrels of oil equivalent per day, further increasing output at one of the largest oil-fields in the Gulf of Mexico.

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

## Danos Awarded Contract for Hess Stampede Platform

Danos has secured a contract to perform mechanical hook-up and commissioning (HUC) support services for the Hess Stampede tension leg platform (TLP) in the Gulf of Mexico. The Stampede deepwater oil and gas field (located approximately 115 mi south of Fourchon, Louisiana) is one of the largest undeveloped fields in the Gulf of Mexico, with estimated gross recoverable reserves in the range of 300 to 350 million barrels of oil equivalent.

<http://ont.news/2knz6nZ>



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# MONTH IN REVIEW

## Valhall and Hod Passes One Billion Barrels Oil Equivalents

Valhall and Hod have passed one billion barrels of oil equivalents (oil, gas and NGL) produced, more than three times the opening of the field in 1982.

<http://ont.news/2jzCzv5>

## Atlantis to Expand into Non-Tidal Stream Project Development

Atlantis Resources is establishing a new internal division as part of its diversification strategy to leverage its existing skill set.

<http://ont.news/2jRX07z>

## 122,000 Acres Offshore North Carolina for Wind Energy Development

The Interior Department and BOEM announce that 122,405 acres offshore Kitty Hawk.

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

## DTOcean to Optimize Wave & Tidal Arrays

A pioneering wave & tidal energy design tool that will assist project developers to design arrays was launched as an open source software package.

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

## Roxtec Secures Major Contract for Offshore Wind Farm Project

Roxtec has secured a major contract to deliver its innovative safety seal solutions to an ambitious offshore wind farm project in the North Sea.

<http://ont.news/2knN09H>

## Statoil Wins U.S. Government Offshore Wind Lease in New York

Statoil has been declared the provisional winner of the U.S. government's wind lease sale of 79,350 acres offshore New York.

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

## Minesto Orders Commercial-Scale Wing

Minesto has finished the procurement of another subsystem for the first commercial-scale Deep Green demonstrator with an order for the wing.

<http://ont.news/2jRlX4f>

## DOE Invests in Wave Energy Test Facility

Northwest National Marine Renewable Energy Center at Oregon State University will support innovation in wave energy technologies.

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

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# Heavy Iron

A New Industries crew loads a suction pile onto a barge at the company's Morgan City, Louisiana fabrication yard. The pile was installed as a foundation for a production manifold in the deep water Gulf of Mexico. New Industries is a specialty steel fabricator with a proven track record for large diameter steel piles and pressure vessels, and the capability to roll 25'+ diameters and 400+ tons in weight. The company also has complete suction piles in inventory for immediate sale or short- or long-term rental. Learn more at [www.newindustries.com](http://www.newindustries.com).



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## Bluefin SandShark Autonomous Underwater Vehicle is Ready to Order

General Dynamics Mission Systems announced its new Bluefin SandShark™ autonomous underwater vehicle (AUV) can now be ordered on the company's website by defense, commercial, and scientific customers worldwide. Weighing less than 11 pounds before adding a mission payload, the "micro" AUV fits in a backpack, can swim up to five knots and dive down to 200 meters (656 ft). The tail section of the Bluefin SandShark houses the battery and system electronics and is designed to leave most of the vehicle open for the user to customize with sensors and other mission critical payloads. The Bluefin SandShark™ joins the company's Bluefin Robotics family of autonomous underwater products.

"Compared to other small AUVs, the Bluefin SandShark™ offers customers the most flexibility and diverse mission capabilities at a very affordable cost," said Carlo Zaffanella, vice president and general manager of Maritime and Strategic Systems for General Dynamics Mission Systems.



"Depending on how it is configured, the Bluefin SandShark™ AUV can provide intelligence, surveillance and reconnaissance information for defense or harbor security missions, dive down to survey submerged structures, or become a floating communications network node at sea."

The Bluefin AUVs operating software is compatible with most underwater vehicle autonomy suites, the software languages AUV operators use to talk to the vehicle and program its mission instructions. This operating flexibility makes integration with existing underwater vehicle components and systems faster and more cost effective.

Changing, adding, and reconfiguring the payload section can be performed quickly, without specialized tools. This capability allows Bluefin SandShark™ customers to efficiently and cost-effectively create and test small, low-power sensors and other capabilities needed for underwater tasks. The Bluefin SandShark™ payload section can be dry or free-flooded, based on the customer's needs.

In addition to the Bluefin SandShark™ AUV, the vehicle's starter kit includes:

- 18-inch, flooded payload section with nose fairing
- 110-Volt AC shore power-charger
- Wireless router
- Maintenance and spares kits
- Durable, rolling case
- A pre-configured side-scan sonar payload will be available in June

The Bluefin SandShark™ AUV can be ordered on the General Dynamics Mission Systems website at <http://www.bluefinrobotics.com/vehicles-batteries-and-services/bluefin-sandshark/inquiry-form/>.

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

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## Electric Robotic Systems will Perform all Tasks in the Underwater Domain

Electric robotic systems will perform all tasks in the underwater domain, including those now undertaken by hydraulic systems, says Saab Seaeye.

They see a future where ROVs and AUVs in their present form will cease to exist and are replaced by transformative e-robotics that can roam, hover, reside, and perform all underwater tasks.

It is a future where task resolution is key, not class of vehicle, says the company.

Such tasks will include the heaviest in the subsea industry, tasks that electric systems and tools on the market today cannot yet undertake, but where the company sees rapidly advancing technology, innovative design and operational methods opening up an all-electric underwater world.

This will bring further significant savings, says director Matt Bates, savings that are already here today as electric technologies bring considerable through-life cost economies.

Electric is also more effective, he contends, as an all-electric robotic system is up to 50% more efficient, and typically has double the power density of an electro-hydraulic system.

Rapid advances in miniaturization—a key benefit of electric technology—are accelerating advances, says Bates, and are creating electric robotic systems that are smaller, lighter, smarter, more agile, and more powerful.

Electric actuators and tools have the added benefit of a simplified, reliable interface that, when complemented with an internal processor and suitable micro-sensors, extracts valuable data, enhances control options, and increases total system reliability through continuous internal monitoring. Having more data available from a device assists with pre-emptive maintenance planning and, coupled with an electric-only interface, allows for more remote long-term deployment underwater.

Bates says technology breakthroughs are already bringing savings, with reductions in vehicle size, weight, cable diameters, winch size, and other elements, leading to more compact systems that make considerable economies for operators.



*Sabertooth – pioneering transformative technology that has created a system that can roam autonomously, hover, perform light tasks, and remain resident.*

He points to the Leopard work vehicle as an example of how technology breakthroughs are opening up a lower cost future.

Compared to a 60-ton hydraulic equivalent, the Leopard's 30-ton complete package has a much smaller footprint, faster mobilisation time, lower maintenance costs, and needs fewer staff at the worksite. In addition, the Leopard's unprecedented ratio of thrust to volume and speed through water provides the payload, power, and control stability needed to carry the range of tooling and sensors usually associated with much larger systems.

A foretaste of transformative technology can be seen in the emergence of the hovering autonomous vehicle capable of being controlled remotely through low bandwidth links while accurately performing long excursion inspections, surveys, and environmental monitoring tasks. An example is the Sabertooth, which has merged AUV and ROV technology into a single system that can, through wireless communication, roam, hover, and perform tetherless light intervention tasks such as valve operations with an integrated electric torque tool.

Common to the future of all robotic systems is intelligent, behaviour-based control systems architecture, such as the iCON system, which comprises a set of hardware and software building blocks that allow harmonious migration of concepts across different systems and accelerates future development innovation.

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

# ASL's Ice Profilers Continue Sampling after Collision with Ice Island

Dr. Andreas Muenchow and his Ph.D. student Pat Ryan from the College of Earth, Ocean and Environment at the University of Delaware were involved in an international collaboration to measure the freshwater flux through Nares Strait from 2003 to 2012. Nares Strait and Fram Strait are two of the main pathways for fresh water to exit the Arctic. The fresh water flux into the North Atlantic controls the amount of vertical stratification and, in turn, the amount of deep water formation. This process has implications for ocean circulation, the transfer of heat from the tropics to the poles via ocean circulation, and, in turn, global climate.



To measure the freshwater flux due to ice, two IPS4 Ice Profilers were deployed in Nares Strait to obtain near-continuous measurements of ice draft from 2003 to 2012, with small periodic gaps for instrument maintenance. As Nares Strait remains ice infested through the summer, the IPS units had to run through every season. Of particular interest is the encounter these instruments had in 2010 with an ice island calved off of Petermann Glacier. The ice island was initially about 260 sq. km. The IPS units that had been nominally deployed at 75 m depth to reduce the risk of ice impact were struck on September 22, 2010, and were pushed down to about 90 m over a 3 hour interval. The ice island took approximately 11 hours in total to pass overhead of the instruments as it drifted by at an average speed of about 0.3 km/hour. During this passage, the IPS units sampled the range to the underside of the ice at 3-sec intervals, and depth (below the sea surface), pitch and roll at one minute intervals. Besides bent transducer guards, the IPS units, shown in the picture, survived the encounter, and continue to make ice measurements for this team on other projects.

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## Teledyne Gavia Releases New Klein Side-Scan/Bathymetry Module Gavia AUV

Teledyne Gavia, manufacturer of the Gavia Autonomous Underwater Vehicle (AUV), announces the release of a new Side-Scan/Bathymetry module that incorporates Klein Marine Systems' new UUV-3500 high-resolution side-scan sonar with optional bathymetry sonar. The system is another high-quality option for customers interested in utilizing the Gavia AUV for geophysical survey, cable and pipeline survey, environmental survey, and under ice survey, as well as Mine Countermeasures (MCM), Rapid Environmental Assessment (REA), and Intelligence, Surveillance, and Reconnaissance (ISR) surveys.

<http://ont.news/2kdysa6>

## JW Fishers Showcase New Underwater Metal Detector

JW Fishers Mfg., a company specializing in the design and manufacture of underwater search equipment for almost 50 years, is introducing a new underwater metal detector for 2017. The SAR-1 Search and Recovery metal detector was developed as a result of significant customer feedback and extensive product testing. This new detector was specially designed for use by public safety dive teams, law enforcement agencies, and military units that need to locate metal objects in poor visibility underwater environments.

<http://ont.news/2kN4WrA>

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## Riptide to Exhibit Latest Generation Micro-UUV at OINA 2017

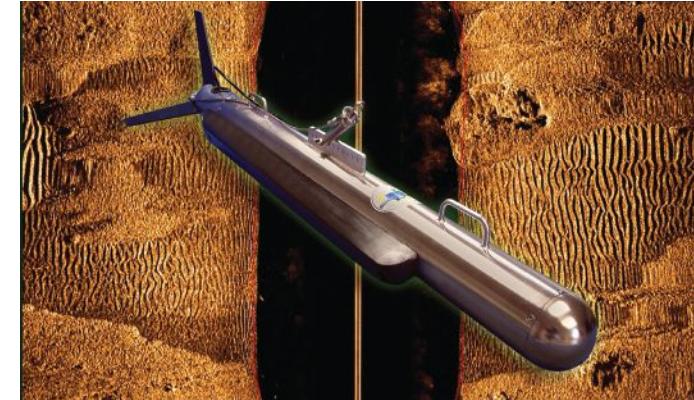
Riptide Autonomous Solutions, the leader in ultra-compact unmanned undersea vehicles (UUVs), will be exhibiting at Oceanology International North America in San Diego, February 14-16, 2017. At the exhibit, the latest upgrades to their micro-UUV will be on display. The micro-UUV is a flexible and affordable tool ideally suited for developers of autonomy and behaviors, power systems, subsea sensors, and new payloads.

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

## New High Performance Chirp Side Scan Sonar System from Falmouth Scientific

Falmouth Scientific, Inc. (FSI) has reached into its deep well of experience and knowledge to bring you the HMS-624 digital CHIRP Side-Scan Sonar System which offers dual simultaneous 100/400 KHz frequency operation. The new HMS-624 leverages these advanced technologies to provide superior imaging capabilities for deep and shallow water applications. The Tow Fish electronics incorporate FSI's CHIRPceiverTM 24-bit CHIRP signal processing, which results in very high resolution side-scan data at towing depths up to 2,000 m.

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



# MONTH IN REVIEW

## ECA Group to Develop Ultra-Deep Autonomous Underwater Vehicle (AUV)

Ifremer Chooses ECA Group to develop an innovative ultra-deep Autonomous Underwater Vehicle (AUV) for survey and inspection.

<http://ont.news/2kRoPx1>

## DeepSea Power & Light Introduces Two New Cameras

DeepSea Power & Light (DSP&L) has added two new products to its line of cameras for subsea use: the LED Micro SeaCam and the HD Zoom SeaCam.

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

## Coda Octopus Announces New XD Wide Angle Echoscope®

Coda Octopus has announced a new addition to its range of real time 3D sonar systems with a wide-angle 90° x 40° 240kHz option.

<http://ont.news/2jA84p6>

## Trelleborg and SubC Collaborate on First DBMs for Installation by ROVs

To meet customer demands, Trelleborg's offshore operation collaborated with SubC Partner to design, manufacture, and test a Distributed Buoyancy Module.

<http://ont.news/2jSpzC5>

## Fugro Awarded Major Contract from INPEX

Fugro has been awarded a contract from INPEX Operations Australia for subsea services to be executed across the Ichthys facilities in the Timor Sea.

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

## AccessESP Rigless System Successfully Enables ESP Pump Swap

AccessESP has showcased its rigless ESP conveyance system in the industry's first pump swap for an operator on the North Slope of Alaska.

<http://ont.news/2ke6MSF>

## CMRE Participates in Hunting Bombs in the Baltic Sea

A variety of chemical weapons and explosives left over from WW2 are still posing a potential threat to life surrounding the Baltic Sea.

<http://ont.news/2ke8p2B>

## Enpro Subsea Drives Plan Forward with New £1.5M Project

Enpro Subsea has announced a research and development grant from Scottish Enterprise, which will see the firm investing £1.5 million.

<http://ont.news/2jSCWo9>

## Schlumberger Acquires Peak Well Systems

Schlumberger announced the acquisition of Peak Well Systems, a specialist in downhole tools for flow control, well intervention, and well integrity.

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

## Subsea 7 Awarded Contract in the Norwegian North Sea

Subsea 7 S.A. has announced the awarding of a sizeable contract by Centrica for the Oda field in the Norwegian North Sea.

<http://ont.news/2kP00G0>

## Aquatec Launches Next Generation HYDRO 3000 Monitoring Equipment

Following the HYDROlog 2000 hydrotest logger, Aquatec Group has launched the next generation of hydrotest monitoring equipment.

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

## SapuraKencana Awarded New Contracts

SapuraKencana Petroleum Berhad's wholly owned subsidiaries have been awarded contracts with a combined value of approximately US\$300 million.

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

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# seanic

An Interview with Seanic  
President, Tom Ayars



February 2017

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Ocean News & Technology

Founded in 2007, Seanic Ocean Systems is currently headquartered in Katy, Texas. In 2016, the company completed a state-of-the-art facility located on 10.5 acres that includes a 55,000 sq. ft building and an in-ground wet test tank where Seanic recently completed their largest full-scale in-water test to date. The 3-day test was carried out on behalf of a major operator and engineering contractor and included equipment that was designed and built by Seanic in a full-scale System Integration Test (SIT) environment.

ON&T sat down with Tom Ayars, president of Seanic, to discuss the evolution of his company and its new partnership with Underwater Engineering Services (UES).

**Could you tell us a little bit about what Seanic does?**

**Tom Ayars:** We manufacture what is commonly called intervention tooling, though I am often somewhat hesitant to use that term because we do so many other things. Another way to put it is we build products that allow ROVs to complete tasks—pretty much everything that comes between the ROV and the existing subsea hardware. When we started out, our local competition was two very large companies, and tooling was not their primary focus. So we felt that we could start a business focused on the type of projects they didn't seem to be interested in—which, in the end, is basically what ended up happening. After we recruited our VP of Operations, Andy Guinn, he and I found a little building, purchased the hand tools, computers, and furniture, and hired a couple of engineers.

In the early days, there were five of us. By the fall of 2014, Seanic grew to 60 employees. As we went through the learning curve, we were asked to perform all kinds of other design/build projects. Since that time we've built a

diverse and robust product line and participated in a multitude of exciting bespoke engineering solutions. Our new facility has opened up new opportunities, and now, nearly a decade later, we've developed a whole set of competencies beyond intervention tooling.

**Can you talk about those expanded skills?**

**Tom Ayars:** Bespoke projects test you in so many ways and are often concepts that are being created for the first time. They typically include elements of deep water, high current, limited space, chemical compatibility, unique materials, a fast-paced schedule, and a host of other things that have to be considered when thinking through what the final product will look like. If you're going excel in this business your engineers have to be creative, fast, accurate, and constantly honing those skills. This is something our engineering team has excelled at, and it's reflected in the unique products we've built over the years. Examples would be our Flex Joint Inspection Tool (FJT) and a unique ROV, operated subsea water blasting system (ECB) that incorporates cavitation technology.

# FROM THE FIELD

## How does the flex joint inspection tool work?

**Tom Ayars:** Flex joints are subjected to extreme conditions, and any associated downtime can cost operators time and money, so it's important that they be inspected and maintained. Operators tell us that a planned maintenance to change out a flex joint can cost in the tens of millions.

To help operators manage future cost, Seanic developed a tool that has gained popularity as operators want to assess the status of their flex joint and determine the potential life of this very critical component. The FJT is attached by an ROV to a dynamic riser right under a flex joint; it provides a stable platform to safely and effectively clean the marine growth that covers the elastomer rubber. Once cleaning operations are complete we install the inspection package which gathers detailed images that can be used to produce 3D models that allow for future detailed analysis. If an anomaly is detected, this process allows operators to generate a baseline and then track that anomaly over time to evaluate if any further actions need to take place.

## How does the subsea water blasting tool work?

**Tom Ayars:** The ECB is based on cavitation water blasting. It was originally developed to clean marine growth off strakes and fairings, which are used on subsea risers and are often somewhat soft and made from a lightweight material. Over time, they become encrusted with marine growth and require cleaning. If you use a typical 5K water blaster, it won't effectively clean the material. If you use a 10K water blaster, the material has the potential to be damaged.

We came up with a concept that repackaged a proven technology that has been around for a long time. Divers have used cavitation blasting for years; it's basically a high volume of low pressure water flow. Coupled with a cavitation nozzle, this type of blasting has more of a pulsating effect vs. just sheer pounding with high pressure. Basically, we took standard triplex pumps and marinized them so they can be mounted directly to an ROV giving us an effective way to clean these soft materials. Over the years, our ECB has become the industry standard for projects of this type.





Your parent company, Centurion Group, recently merged with ATR Group to create a global player in the oil and gas rental equipment and services market. Underwater Engineering Services (UES) was a division of ATR Group specializing in the supply of marine and subsea support equipment within the offshore energy industries. Can you talk about that partnership with the Aberdeen-based company UES and what that can bring to the table?

**Tom Ayars:** Seanic and UES are joining forces. UES has always been more focused on deck equipment and standard tools in support of the diving industry, so they haven't typically participated in what you would call ultra deep water.

Seanic, on the other hand, has been all about deep water in support of ROVs, so working together seems to be a natural fit. The ability to share people, equipment, and capabilities to provide like services in both the Gulf of Mexico and Aberdeen is not only exciting, but I think it will be well received by our mutual clients.

**It sounds like you will now be able to offer services throughout the entire water column by bringing these two companies together, since UES is working in depths conducive to dive operations and Seanic works in much deeper depths.**

**Tom Ayars:** Absolutely. The two companies complement each other very well, and it really won't take much time to cross-pollinate our skills. Going forward, we will collectively market the reliable products and services we've been known for over the years. Aberdeen is a big hub for world-class vessels that sail all over the world to perform oil industry projects. So, between the Gulf of Mexico and Aberdeen, we can effectively serve two of the biggest markets in the world.

For more information about Seanic, visit [www.seanicusa.com](http://www.seanicusa.com).

## Environmental Impact of Basslink Cable is Minor and Temporary

A recently published study of the 290 km-long Basslink power cable shows that its impact on the seabed and associated organisms is "transient and minor."

Basslink plays a key role in the distribution of power between the Australian states of Victoria and Tasmania. To protect this infrastructure, the cable was placed in a trench cut into the seabed. However, near Tasmania the cable was placed in an iron pipe conduit in order to safely pass over a 500 m-wide zone of rocky reef and rubble.

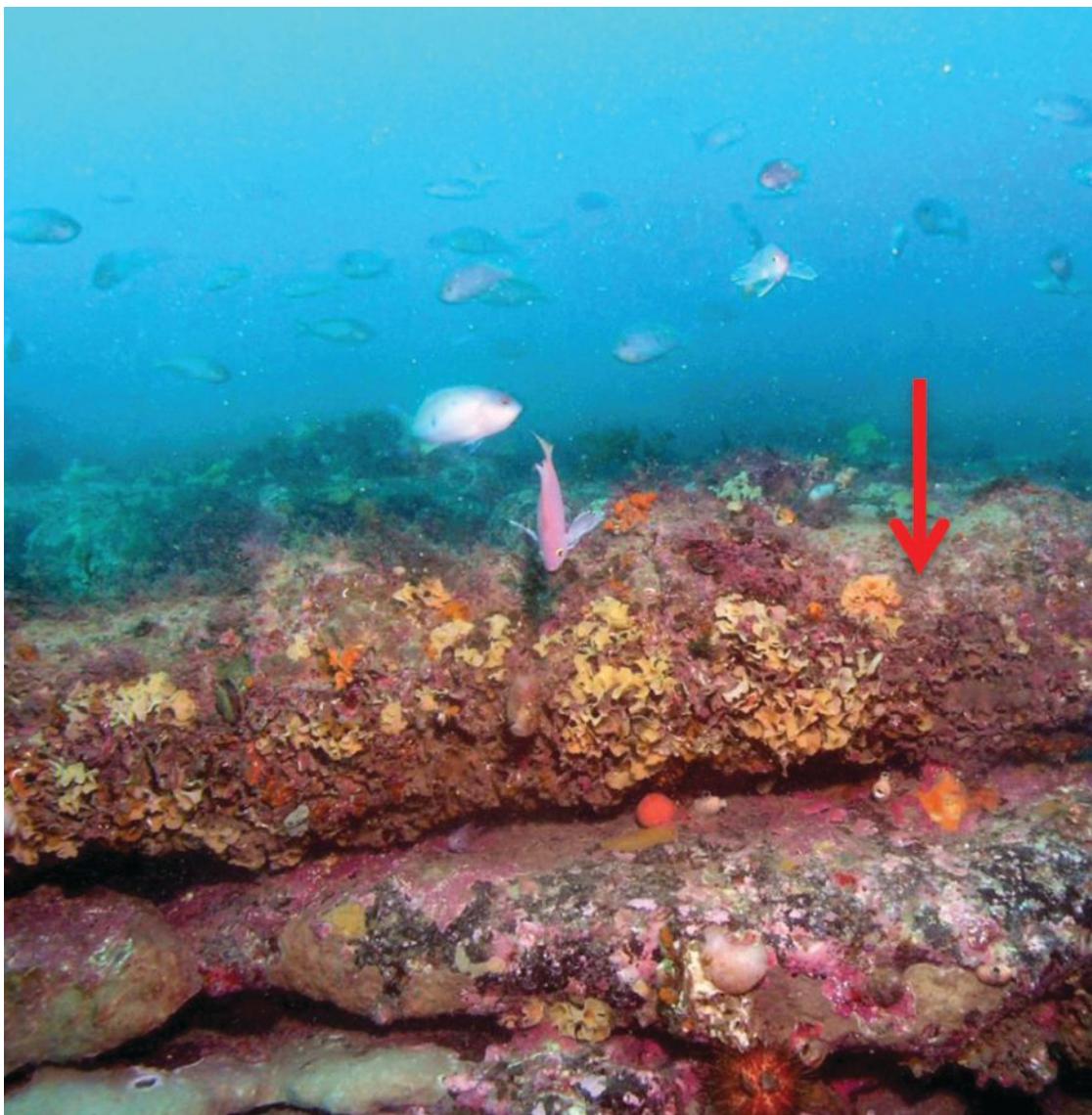
To oversee investigations into any ecological impact of laying and operating the cable, including its magnetic and electrical fields, an independent review committee was formed. Led by Associate Professor John Sherwood of Deakin University, Australia, the committee recently published their findings in the peer-reviewed *Journal of Ocean Engineering and Science*.

The publication comes at a time of much discussion about effects of subsea power cables on the marine environment. A common refrain of these discussions is that there are too few direct field observations of cables and the seabed environment. The new study, along with other recent research, are helping to rectify that limited knowledge base.

Using a suite of data that included repeated video surveys of the cable and seabed, the study has come up with the following findings:

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- Off Victoria, in water depths <15 m, the trench and cable were buried by sand and became indistinguishable from the natural seabed within 2 years.
- Off the rocky Tasmanian coast, the iron pipe conduit containing the cable became encrusted by marine species similar to those inhabiting the natural reef—that process occurring within 3.5 years.
- In deeper parts of the cable route (down to 80 m water depth), it took 1 to 1.6 years for all traces of the trench/cable to disappear. This change extended over one third of the cable route and resulted from natural sediment infilling the trench. Where infilling was incomplete, various organisms colonized drift material and consoli-



dated sediment present in the trench. However, those colonists disappeared as the trench filled with sediment and returned to its natural state.

- Direct measurement of the total magnetic field associated with the operating cable showed a variation of <1% of the natural field as measured 5 m above the cable. These observations were within 0.8% of calculated field values thus providing confidence in numerical models of the field.

As nations turn to renewable energy to reduce greenhouse gas emissions, to meet increased demand for power and to ensure secure supply, more subsea power cables are being laid. Offshore wind turbine farms, for example, require cables to connect with national grids. While assessment of the relationship of subsea cables with the marine environment is complex, a growing body of evidence, such as that from Bass Strait, are indicating impacts of cables are minor and transient, at least for the cable systems and marine organisms studied.

For more information, visit [www.iscpc.org](http://www.iscpc.org).



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# COMMUNICATION & SUBSEA CABLES



## SEA-ME-WE 5 Consortium Announces Completion of Cable System

The SEA-ME-WE 5 Consortium announced the completion of the 20,000-km subsea cable infrastructure developed by a 16-nation consortium. This submarine cable system won the Project of the Year – Subsea award at the Global Carrier Awards in Paris in November 2016 for its technological and managerial excellence. The SEA-ME-WE 5 subsea cable system, spanning over 16 countries from Southeast Asia to Western Europe, is a technological breakthrough that marks a global communications milestone. It is designed with a capacity of 24 Tbps on 3-fiber pairs, fully capable of accommodating the future demand of data from other bandwidth-intensive applications such as enterprise data exchange, internet TV, and online gaming.

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

## Prysmian Commissions Cebu-Negros-Panay phase 1 in the Philippines

Prysmian Group announced the successful commissioning of the submarine power cable link to connect Negros and Panay Islands in the Philippines. This is the first stage of the project CNP-1 (Cebu-Negros-Panay phase 1), awarded to Prysmian Group by the Filipino grid operating company NGCP (National Grid Corporation of the Philippines). This project is part of a larger development plan provided by NGCP to strengthen the Country's power transmission network.

<http://ont.news/2jHww84>



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*Photo courtesy TE SubCom.*

## TE SubCom Begins Manufacturing C+L Repeater Technology

TE SubCom, a TE Connectivity Ltd. company, has begun manufacturing of C+L optical transmission technology, a significant advancement for cable system operators seeking ultra-wide, low-latency transmission. C+L technology effectively doubles the available bandwidth and capacity per fiber pair. A second length of Erbium-doped fiber in the undersea repeaters provides amplification and support for wavelengths on the long wavelength side of the traditional C-band for telecommunications applications.

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

## ROG Completes the Modification and Recommissioning of Ndeavor

Rotterdam Offshore Group (ROG) based in the Waalhaven, Rotterdam, recently completed the conversion of the MPV (Multi Purpose Vessel) Ndeavor of Boskalis. The vessel was built in 2013 and is 99 m in length with a beam of 30 m, her gross tonnage is 7413 T. The vessel had been equipped for the last 2 years with rock dumping equipment. This included 8 stone holds weighing 180 T each, which had to be removed as part of the demobilization. These stone holds were lifted off the vessel utilizing the floating sheerleg crane 'Taklift 4' from Boskalis, which itself is capable of lifting 2200 T. This formed one part of the complex process to completely clear the aft deck to allow it to be fully reinstated

<http://ont.news/2kqM2JQ>



# MONTH IN REVIEW

## Castor Networks Acquires Watum, Launches One-Stop-Shop for Maritime IT

Castor Networks has acquired Watum Solutions effective immediately, a supplier of communication networks for the shipping and offshore industry.

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

## exactEarth Launches Maritime Payloads for its Real-Time Constellation

exactEarth Ltd. announced the successful launch of four hosted payloads for its next generation constellation, exactView™ RT powered by Harris.

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

## Huawei Marine to Deploy 100G Submarine Network in the Arctic

Huawei Marine will partner with Tele Greenland for the deployment of a 100G network along the west coast of Greenland and upgrade Greenland Connect.

<http://ont.news/2jXl8XX>

## Ooredoo, Huawei Marine Inaugurate National Submarine Cable in Maldives

Ooredoo Maldives and Huawei Marine have announced the inauguration of Ooredoo's Nationwide Submarine Cable.

<http://ont.news/2klDwt4>

## Stena Line Ferry Joins Marlink's Multi-Band Network

Marlink has added the first out of four additional Stena Line ships to its multi-band communications network; it now serves the entire fleet.

<http://ont.news/2jVl9tU>

## Vroon Extends Vessel Contract for KVH mini-VSAT Broadband Solution

Vroon has extended its contract for KVH Industries' maritime communications solution, choosing the mini-VSAT Broadband network for connectivity.

<http://ont.news/2jw3U6k>

## South Atlantic Inter Link (SAIL) to Establish New Internet Route

Work on the South Atlantic Inter Link (SAIL) fiber optic cable system connecting Cameroon and Brazil is underway following the signing of a C&MA.

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

## Ocean Engineering



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## U.S. Navy Tests Autonomous Swarmboats in Chesapeake Bay

Autonomous unmanned swarming boats were put through their paces in a recent demonstration in the lower Chesapeake Bay with results that show dramatic new possibilities for autonomy in future naval missions. Using a unique combination of software, radar and other sensors, officials from the Office of Naval Research (ONR)-together with partners from industry, academia and other government organizations-were able to get a "swarm" of rigid hull inflatable boats (RHIBs) and other small boats to collectively perform patrol missions autonomously, with only remote human supervision, rather than direct human operation, as they performed their missions.

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

## Airborne Laser Mine Detection System Achieves Initial Operational Capability

The U.S. Navy's AN/AES-1 Airborne Laser Mine Detection System (ALMDS), designed and manufactured by Northrop Grumman Corporation, has achieved Initial Operational Capability. ALMDS provides rapid wide-area reconnaissance and assessment of mine threats in sea lanes, littoral zones, confined straits, choke points, and amphibious areas of operations. "With Initial Operational Capability, the ALMDS program has delivered a new and important capability to the Navy and to our nation—the first of its kind for mine warfare," said Erik Maskelony, assistant program manager, Airborne Laser Mine Detection System, PEO LCS, Mine Warfare Program Office (PMS 495).

<http://ont.news/2kssB2W>



## Textron Systems Begins On-Water Testing for CUSV™

Textron Systems Unmanned Systems, a Textron Inc. business, announced that it began on-water testing for the fourth-generation Common Unmanned Surface Vehicle (CUSV™), supporting the U.S. Navy's Unmanned Influence Sweep System (UISS) program. Textron Systems completed the design, build, and component test phases of the UISS program in November 2016. Following component testing, Textron Systems began the systems level integration and test (I&T) phase, culminating in dockside and on-water testing in Lake Pontchartrain near its Marine & Land Systems facility in Louisiana.

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

## Ingalls Shipbuilding Awarded \$1.46B for Construction of LPD 28

Huntington Ingalls Industries (HII) announced that its Ingalls Shipbuilding division was awarded a \$1.46 billion, fixed-price incentive contract for the detail design and construction of the amphibious transport dock Fort Lauderdale (LPD 28). "This contract demonstrates the confidence the Navy has in our shipbuilders' performance in this program," said Ingalls Shipbuilding President Brian Cuccias. "Building LPD 28 allows the entire LPD industrial base to maintain a hot production line so that our sailors and Marines receive quality amphibious warships as efficiently and affordably as possible."

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



*HII rendering.*

# MONTH IN REVIEW

## Future USS Rafael Peralta Completes Acceptance Trials

The future USS Rafael Peralta (DDG 115) successfully completed acceptance trials December 16 after spending two days underway off the coast of Maine.

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

## SeaQuest Oversees Construction of State-of-the-Art Tanker for UK MOD

SeaQuest Marine Project Management has completed a project overseeing the construction of one of the UK Ministry of Defence's latest naval auxiliaries.

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

## UK Invests in Laser Weapon to Protect Ships from Attack by Air and Sea

The United Kingdom Ministry of Defence is spending £30 million turning science fiction into fact and test laser weapons on Royal Navy warships.

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

## DARPA TUNA Program Successfully Wraps Up First Phase

DARPA's Tactical Undersea Network Architecture (TUNA) program recently completed its initial phase, successfully developing concepts and technologies.

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

## Royal Australian Navy Launches Destroyer Brisbane

The second Hobart class destroyer marked a major milestone in its construction when she was officially named Brisbane and launched in Adelaide.

<http://ont.news/2jDD2g6>

## U.S. Navy Develops and Tests Maritime Autonomy in a Box

The Naval Surface Warfare Center Panama City Division has developed a way to change UUV mission information as easily as updating an app.

<http://ont.news/2jVt5LM>

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

Numerous users in the areas of Oil & Gas, Hydrography and Defence approve ECA Group solutions:

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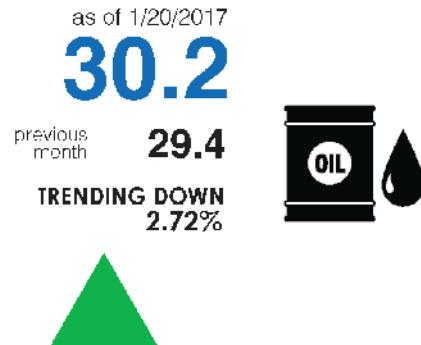
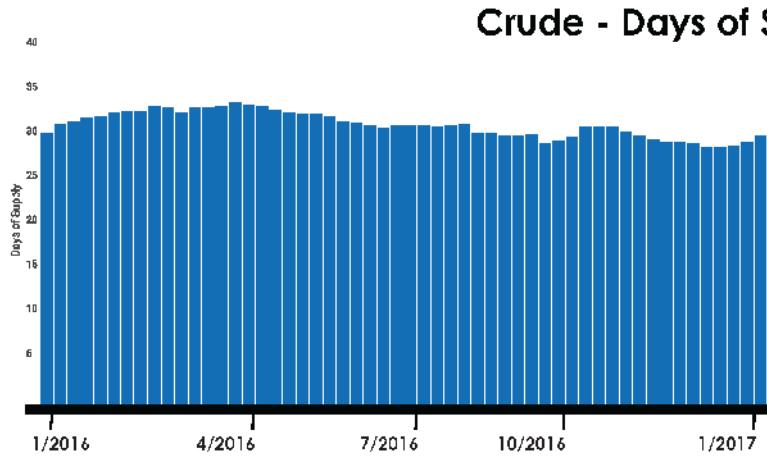
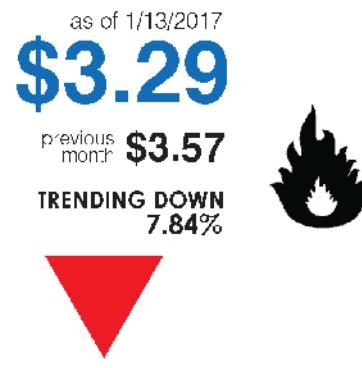
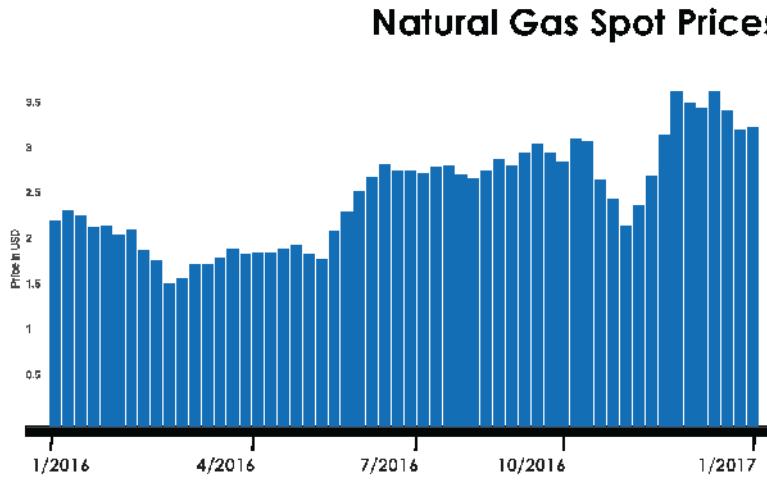
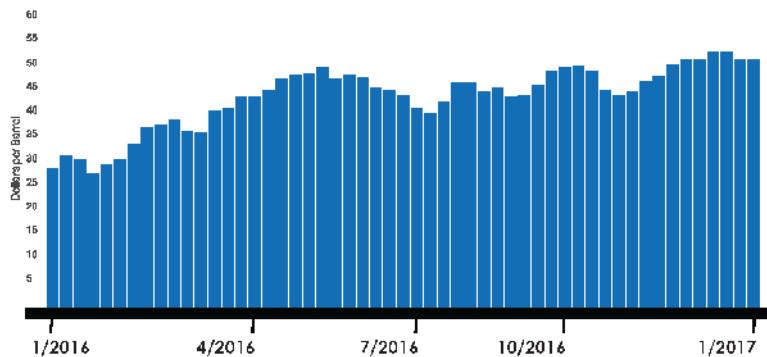


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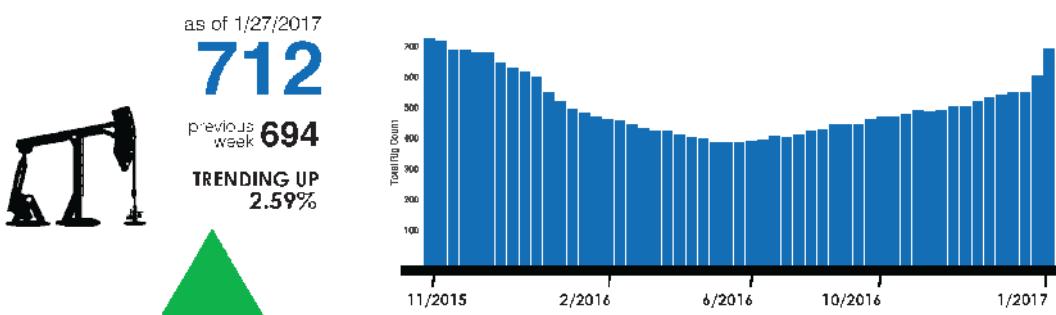
# OFFSHORE STATS & DATA

## Oil & Gas Industry Trends

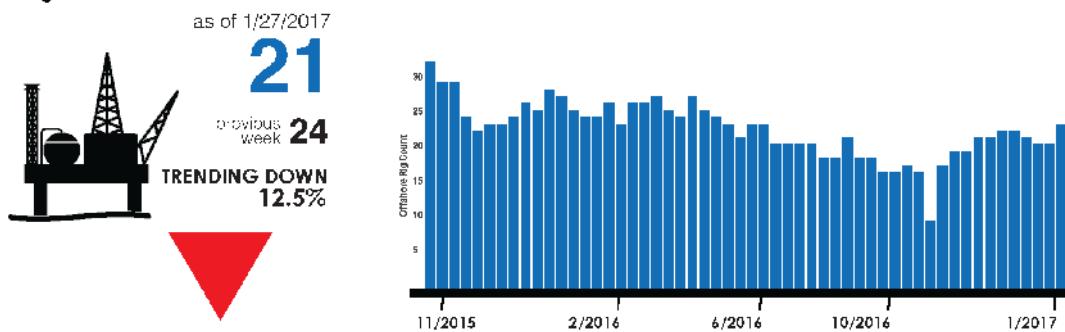
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## US Total Rig Count



## US Offshore Rig Count



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# 2017 EVENTS

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**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)

**Tokyo, Japan**

**MAST**  
June 12-14  
<https://mastconfex.com>

**Singapore**

**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

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## SHOW DISTRIBUTION

### JANUARY

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

### FEBRUARY

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

### MARCH

Canadian Underwater Conf & Expo – March 26-28  
Ballast Water Management – March 29-30  
MCE Deepwater Development – April 3-5  
Ocean Business – April 4-6

### APRIL

Int'l Offshore Wind Forum – April 19-21\*  
OTC – May 1-4  
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UDT – May 30 – June 1  
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Oceans 17 – September 17-21  
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Oilcomm – October 3-5  
MTS Dynamic Positioning – October 9-11  
Offshore Energy – October 9-11  
Offshore Well Intervention GoM – TBD  
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International Workboat – November 29 – December 1  
Offshore & Deep Sea Mining – TBD

### DECEMBER

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## OpenHydro Appoints New Chief Executive Officer

OpenHydro, the Irish-based tidal energy company and part of DCNS Energies, has appointed Mr. Patrick Gougeon as their new Chief Executive Officer. The appointment signals the company's ongoing drive towards commercialization of its tidal technology and follows the launch of DCNS Energies, a subsidiary of the DCNS Group, which recently secured €100 million in investment. Mr. Gougeon joined OpenHydro at the start of January 2017, having previously held the position of CEO of Colibrys, a high-technology industrial company based in Switzerland.

<http://ont.news/2jE17mK>

## Unique Group Completes Under Pressure Leak Sealing Project for ADGAS

Unique Group's On-Site Engineering division, through its Wellube brand, effectively performed the On-Line Steam Leak Sealing for Abu Dhabi Gas Liquefaction Company (ADGAS). The service was performed on the 2.4 m OD heat exchanger flange leak along the pipeline. Its design parameters were 434°C at 60 bar. Established in 1973, ADGAS was the first LNG production company in the Middle East and North Africa region.

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



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17<sup>TH</sup>  
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## Great Lakes Receives Award for Coastal Restoration on the Gulf Coast

Great Lakes Dredge & Dock Corporation, the largest provider of dredging services in the United States and a major provider of environmental and remediation services, announced the receipt of an \$88 million award for Phase I of the Mississippi Coastal Improvements Program (MsCIP) Comprehensive Barrier Island Restoration. MsCIP was initiated in 2005 in the aftermath of the damage and destruction caused by Hurricane Katrina and addresses hurricane and storm damage reduction, salt water intrusion, shoreline erosion, and fish and wildlife preservation.

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

## Olympus Marine Services Receives Significant Investment

Olympus Marine Services, which provides staffing solutions to the oil and gas sector and marine industries, has received a significant inward investment from two UK businessmen. Kevin Smith and Stewart MacRae will join the Dubai-headquartered crew management company, which presently employs over 20 office staff and 200 offshore personnel across bases in the Middle East, India, and Southeast Asia supplying drilling, marine and catering personnel.

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



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## MCE DEEPWATER DEVELOPMENT 2017

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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
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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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Website: www.a2sea.co.uk  
Contact: Ross Taylor



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Contact: Gary Brown, Sales Manager



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Fax: +1 772 219 3010  
Email: jbyous@oceanspecialists.com  
Website: www.oceanspecialists.com  
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Ocean Specialists, Inc (OSI) is a submarine fiber optic network development company with global project capabilities. OSI works with clients during all project phases of subsea network development, from planning and design to procurement and implementation. Our customers, primarily representing Oil and Gas, Telecommunications and Ocean Observing, recognize the value of fiber optic networks to their field and services solutions, and look to OSI to deliver the skills and experience that developing these networks require.

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Website: www.atlinc.com  
Contact: David Dack

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E-mail: gstevens@conshelf.com  
Website: www.csocean.com  
Contact: Gordon Stevens



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

## MOTION SENSING EQUIPMENT

### KONGSBERG SEATEX AS

Pirsentertet  
N-7462 Trondheim, Norway  
Tel: +47 73 54 55 00  
Fax: +47 73 51 50 20  
E-mail: km.seatex@kongsberg.com  
Website: www.km.kongsberg.com/seatex  
Contact: Finn Otto Sanne at finn.otto.sanne@kongsberg.com

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



KONGSBERG

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13355 Berlin, Germany  
Tel: +49 (0) 30 4679 862-0  
Fax: +49 (0) 30 4679 862-01  
E-mail: sales@evologics.de  
Website: www.evologics.de



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Fax: +47 73 51 50 20  
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## NETWORK AND DATA CO

### KONGSBERG SEATEX AS

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Fax: +47 73 51 50 20  
E-mail: km.seatex@kongsberg.com  
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- **Manufacturer's Representative:** Teledyne RD Instruments, Teledyne Oceanscience, Teledyne Benthos, WERA Northern Radar.

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- Provor and Arvor profiling subsurface floats (ARGO project): CTD, dissolved oxygen, BGC, deep; Argos and Iridium transmission.
- Drifting surface buoys with temperature and GPS receiver for Surface velocity project. Contact: Nathalie Le Bris - nlebris@nke.fr

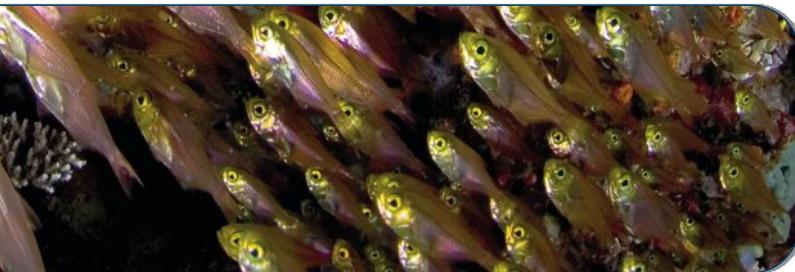
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Website: www.romor.ca  
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A leading solutions provider in Asia Pacific countries for Oceanography, Meteorology, Hydrography, Hi Resolution Marine Seismic studies, Coastal Monitoring, Hydrology and Environmental Surveys. With over 20 years of experience partnering leading worldwide manufacturers, SALT provides advanced technology hardware and software solutions, combined with Calibration, Training, Repairs, Cable Moulding services & RENTAL Equipment to the users in the region. In addition to our 60,000 square foot HQ in Singapore, SALT has offices in Malaysia, Indonesia, Thailand, Philippines and Australia.

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### STAR·ODDI

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Gardabæur, Iceland  
Tel: +354 533 6060  
Fax: +354 533 6069  
E-mail: baldur@star-oddi.com  
Website: www.star-oddi.com  
Contact: Baldur Sigurgeirsson

**STAR·ODDI**

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

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Tel: +1 281 858 6333  
Fax: +1 281 858 6363  
E-mail: sales@rovoco.com  
Website: www.rovoco.com  
Contact: Jessica McKenney



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# OCEAN INDUSTRY DIRECTORY

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Fax: +47 56 11 30 69  
E-mail: info@saivas.no  
Website: www.saivas.no  
Contact: Gunnar Sagstad

• STD/CTD, Sound Velocity probes/recorder with optional multi-parameter facilities; Turbidity, Fluorescence, Oxygen etc. The new CTD/STD model SD208 with wireless communication and high accuracy: 0.002 mS/cm, 0.002 °C

• Precision pressure /depth (0.01% accuracy) and temperature sensors/recorders. Applications: hydrographic profilings, installation on ROVs and towed systems, etc. Robust and compact designs are combined with accuracy and "plug-and-play" compatibility. Output format for sonar equipment, e.g. EM1002, EM3000, SSP, HiPAP and Reson 8125.

## SUBSEA FABRICATION

February 2017

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### HYDRA OFFSHORE CONSTRUCTION, INC.

14418 Brumbeelow Rd.  
Needville, Texas 77461  
Tel: (713) 818-6150  
Email: tdavis@hydraoc.com  
Website: www.hydraoc.com  
Contact: Trevor Davis



Hydra Offshore Construction, Inc. specializes in subsea fabrication and construction, heavy lift, maintenance, repair, and decommissioning. The Hydra 23 acre dockside facility in Port Arthur, Texas is also equipped for SIT (System Integrated Testing), and the fabrication of jumpers, PLETs, PLEMs, manifolds, custom drilling templates, spool pieces, trash caps, and equipment skid packages.

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6032 Railroad Avenue  
Morgan City, LA 70380  
Tel: +1 985 385 6789  
E-mail: bill.new@newindustries.com  
Website: www.newindustries.com  
Contact: Bill New



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

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P.O. Box 185  
Berwick, LA 70342  
Tel: +1 985 714 1767 or 985 518-0055  
E-mail: charles@subseamericana.com  
Website: www.subseamericas.com  
Contact: Charles Mayea



Subsea Americas (SSA) is a leading provider of rental ROV tooling equipment on a worldwide basis. SSA is a 24 hr. / 7 days a week service provider of a comprehensive range of standard subsea tooling equipment. From torque tools and flying lead orientation tools to 15k isolated hydraulic intensifiers and wire rope cable cutters - SSA can fully support the client's needs with quality service, and reliable equipment at a most competitive cost.

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a subsidiary of Kongsberg Maritime  
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Tel: +1 508 563 6565  
Fax: +1 508 563 3445  
E-mail: glester@hydroid.com  
Website: www.hydroid.com  
Contact: Graham Lester



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

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

### OCEANSERVER TECHNOLOGY, INC.

151 Martine Street  
Fall River, MA 02723 USA  
Tel: +1 508 678 0550  
Fax: +1 508 678 0552  
E-mail: sales@ocean-server.com  
Website: www.iver-auv.com  
Contact: Jim Kirk



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

## UNDERWATER VEHICLES/ROVS

### OCEANEERING INTERNATIONAL, INC.

11911 FM 529  
Houston, TX 77041  
Tel: 713.329.4500  
E-mail: info@oceaneering.com  
Website: www.oceaneering.com  
Contact: Bill Mallin



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

We are connecting what's needed with what's next as the world's largest ROV operator and the leading ROV provider to the oil and gas industry worldwide. We push the limits of ROV intervention and meet new, demanding tooling intervention.

### OUTLAND TECHNOLOGY

38190 Commercial Ct.  
Slidell, LA, 70458 USA  
Tel: 985-847-1104  
Fax: 985-847-1106  
E-mail: jeff@outlandtech.com  
Website: www.outlandtech.com  
Contact: Jeff Mayfield



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

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Canary Islands & Barcelona, Spain  
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Fax: +34 928 91 48 13  
E-mail: info@qstar.es  
Websites: [www.qstar.es](http://www.qstar.es) & [www.rovs.eu](http://www.rovs.eu)



QSTAR was established to offer services for industries that require effective solutions for Subsea projects through the use of our ROV fleet and high qualified personnel. Our World leading ROV Training Division offers High Quality Training for ROV PILOT TECHNICIANS as a World-Wide ROV Training Establishment Member of the IMCA.

**TELEDYNE SEABOTIX**  
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San Diego, CA 92131 USA  
Tel: +1 619 450 4000  
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E-mail: [SeaBotixInfo@Teledyne.com](mailto:SeaBotixInfo@Teledyne.com)  
Website: [www.SeaBotix.com](http://www.SeaBotix.com)  
Contact: Alasdair Murrie



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

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#### **VIDEORAY**

212 East High Street  
Pottstown, PA 19464  
Tel: +1 610 458 3000  
Fax: +1 610 458 3010  
E-mail: [sales@videoray.com](mailto:sales@videoray.com)  
Website: [www.videoray.com](http://www.videoray.com)  
Contact: Brian Luzzi



With more than 3,700 ROV's in service around the world, VideoRay is the global leader in Observation ROV technology. VideoRay's underwater robot systems are extremely versatile, portable, affordable, and reliable solution for underwater operations including surveys, offshore inspections, search & recovery, homeland & port security, science & research, aquaculture, and many other underwater applications. The latest Mission Specialist systems provide solutions for particularly difficult underwater challenges. VideoRay is available on the General Services Administration (GSA) Schedule.

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# UNDERWATER COMMUNICATION AND POSITIONING SOLUTIONS

# Evo Logics®



## 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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OCEANEERING®

Connecting What's Needed with What's Next™

A large subsea structure, possibly a decommissioned oil rig, stands vertically in the dark blue ocean. An orange-yellow robotic submersible vehicle (ROV) is positioned to its right, connected by a cable. The ROV has a clear protective cage around its lower section and various mechanical arms and sensors. The background shows the textured surface of the ocean water.

# SOLVE YOUR DECOMMISSIONING CHALLENGES

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To solve your decommissioning challenges in these dynamic times, Oceaneering does things differently, creatively, and smarter. As your trusted subsea partner, our unmatched experience and innovative technologies and solutions allow us to adapt and evolve regardless of market conditions.

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