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FEATURE STORY

## AUV Pipeline Inspection

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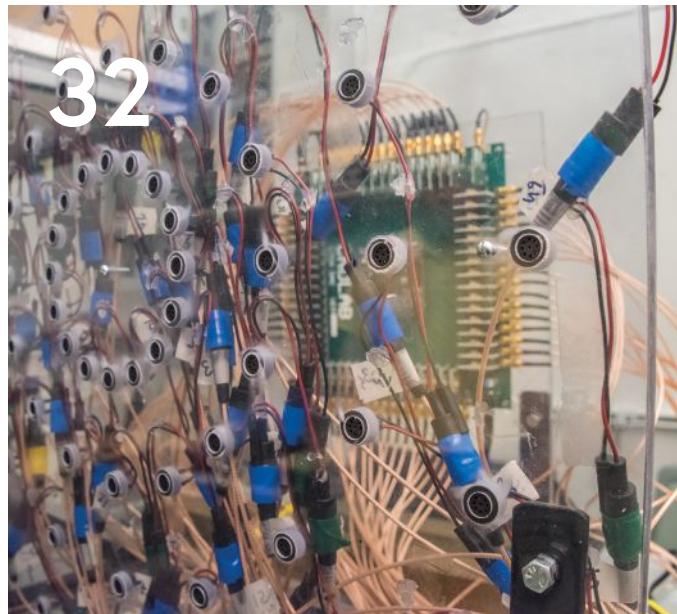
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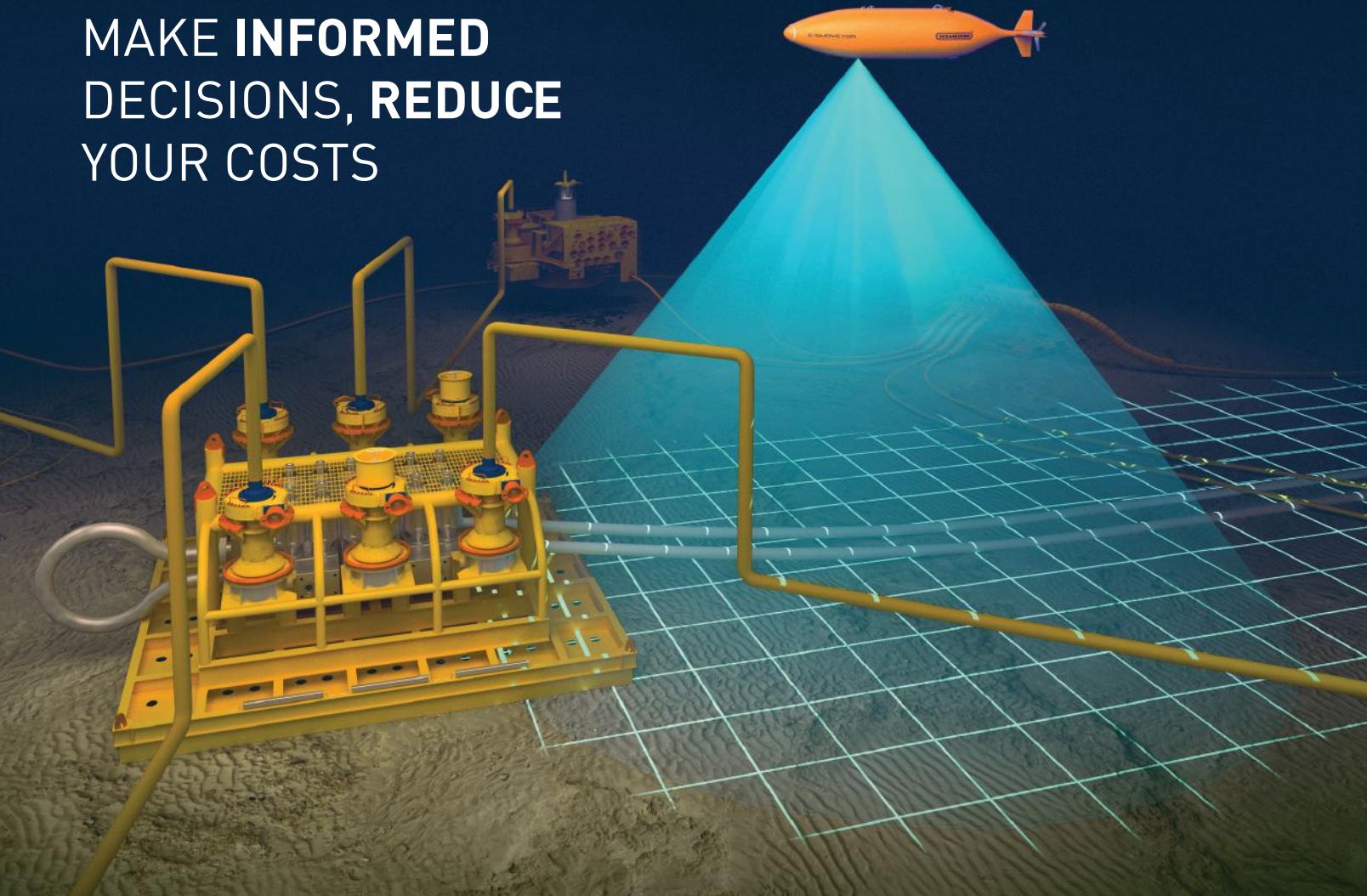
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Garry Kozak  
GK Consulting  
Undersea Search Specialist



## Deep Ocean Searches: The Challenge is not as Challenging Today

I look back to my first experience in 1979 in doing a side-scan sonar search in what I thought was an amazing depth of 2,000 meters. The challenges were many—needing large winches with up to 10,000 meters of tow cable and the subsequent problems associated with driving power down and sonar signals up these long cable lengths, not to mention cable failure from the loads experienced during towing operations. But this was the only way in those days to search in these deep depths.

Positioning of the towfish became a major issue, and position of the towfish is required to allow the calculation of a target position. The inelegant use of cable layback calculations to position the towfish would get target positions in the ball park of where they needed to be, but there was great uncertainty, resulting in a really large ball park. The use of acoustic positioning systems greatly improved the uncertainty in target positioning, and as the deep tow systems evolved, on-board INS systems were integrated to further refine towfish and target positions. Modern deep tow systems, such as the EdgeTech DT-2 used during the Malaysian MH370 search, use a USBL/INS solution that allows for position uncertainty of less than 50 meters with 10,000 meters of tow cable streamed.

Another frustrating part of deep tow operations is when a target is actually located and you want to make several more passes on shorter sonar ranges for higher resolution to allow the proper classification of the feature. The reality is that with 10,000 m of towable in the water, it will take many hours to make a U-turn to head back for another pass. The next challenge was that it was partially luck if the towfish would actually pass within the range of the sought target. A couple of deep tow systems were outfitted with horizontal thrusters to allow shifting the deep tow fish port or starboard to allow a higher success rate of re-acquiring a target.

The development of AUV technology has dramatically changed the challenge and difficulty of deep ocean searches. AUVs turn on a dime, so hours are no longer wasted making turns at the end of a line or in re-acquiring a sonar target. Navigation control is far more precise than towed systems, making even high-resolution photo mosaics possible. They follow terrain and can work in highly geologic areas where a towed system is an accident waiting to happen.

No longer do you have to deal with large winches and cables and the dreaded re-terminations when the cable fails. The maturity level of today's AUVs is such that they are very reliable workhorses. They have proven themselves on searches such as the Air France 447 (3,900 meters), the MH 370 search (4,000+ meters), and the very recent discovery of the long-lost Navy's USS Indianapolis (5,500 meters). A new company, Ocean Infinity, has recently acquired eight 6,000-meters rated AUVs and is pushing the coverage rate envelope by operating multiple AUVs in concert. It is an exciting time in deep ocean exploration, with more amazing discoveries to be made as more deepwater AUVs are put into service.

Riptide set out to change the undersea vehicle market by combining best in class hydrodynamics, ultra low power processing, and game changing new energy technology, while significantly reducing vehicle costs. To accomplish this, we introduced the small, yet highly-capable micro-UUV.

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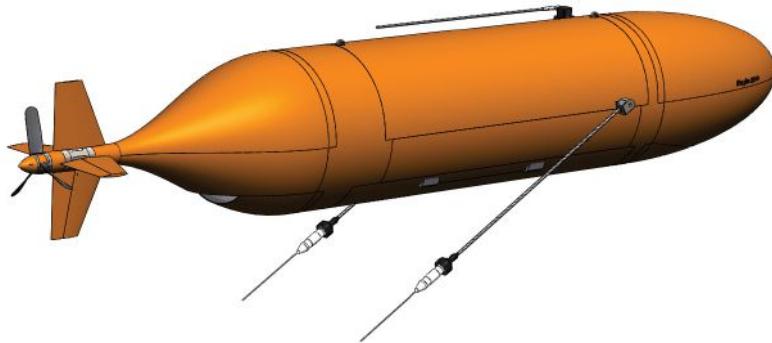


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# AUV PIPELINE INSPECTION: Autonomous Technology Comes of Age for Visual, Bathymetric, and Cathodic Inspection

**By Jami Cheramie,  
Oceaneering International, Inc.**

There is considerable discussion these days about self-driving cars. It may be several decades before autonomous vehicles are commonplace on our highways. There is, however, one industry where automation is already a matter of fact—automated underwater vehicles (AUVs) for pipeline inspection. In the past two decades, AUV technology has advanced to such an extent that now an AUV pipeline inspection is possible at up to five times the speed of a remotely operated vehicle (ROV) spread and at a fraction of the cost.

*Above: Cathodic protection sensors deployed from AUV.*



*Launch of C-Surveyor AUV.*

## Rapid Advances

At the turn of the century, autonomous robots entered the commercial world. At the same time, there was a race to build the first AUVs capable of surveying the seafloor for the oil and gas sector. Companies in the deepwater survey business saw a need for a change in the methodology used to access the ocean floor and AUVs provided an opportunity to make a step change in available technology.

Oceaneering Survey Services (formerly C&C Technologies) was one of the companies committed to developing AUVs. Based in Lafayette, Louisiana, Oceaneering Survey Services had been in the hydrographic survey market since 1992 and had used one of the first Kongsberg multibeam echosounders. Having worked with the U.S. Navy in the 1990s on autonomy for semi-submersible vehicles, Oceaneering was ideally positioned and experienced for developing bespoke software for collecting, processing, and controlling the sensors required by AUVs.

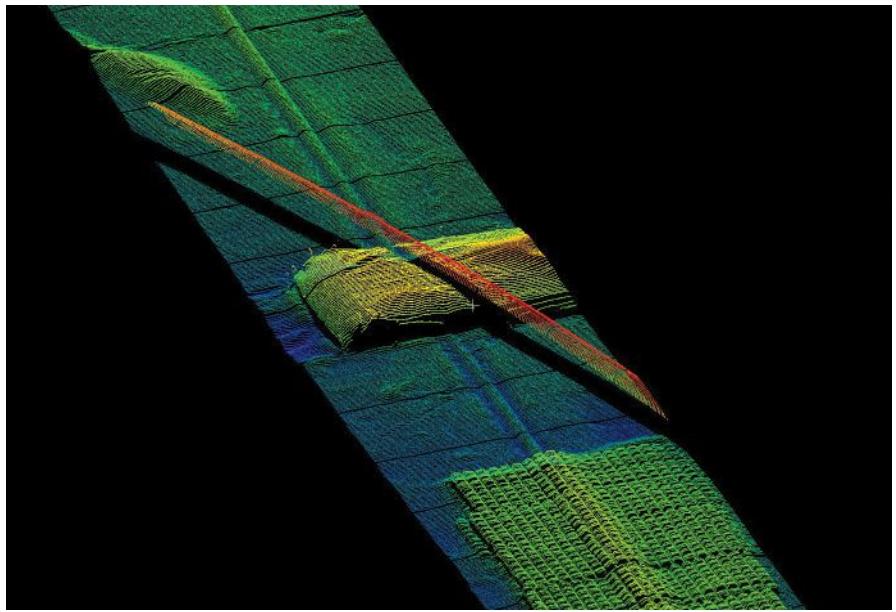
Oceaneering provided the “payload side” of the equation—mission software, sensor control, collection, and processing as well as selecting the optimum sensor suite. Kongsberg



*C-Surveyor Tracking Pipeline*

provided the “control side” of the equation—control software and hardware, propulsion, semi-fuel cell energy technology, and a robust navigation solution as well as the experience of building AUVs for the Norwegian Navy.

It is from this relationship that the C-Surveyor/Hugin 3000 line of Survey AUVs was born. These AUVs have served as the platform for more than 99% of deepwater AUV surveys conducted since 2001. While primarily used for deepwater



*Above: Laser Bathymetry of pipelines crossing.  
Right: AUV retrieval.*

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oil and gas operations, the C-Surveyor AUVs have also been used in search and marine archeology work.

## Extended Applications

During this time period (2001 to 2015), development of the “payload” continued to evolve in line with the advances of AUV technologies adopted in other areas and markets. Infrastructure inspection was the next logical target.

The oil and gas industry took advantage of the survey capabilities of the AUVs to bring deeper developments online, including pipe laying activities to support the developments. Installing infrastructure in such challenging environments generated a need for routine, regular, and regulatory inspections. Traditionally, these inspections had been conducted using ROVs based on the common use of ROVs in shallower water domains. However, using ROVs to complete infrastructure inspection quickly proved to be an expensive option in deepwater, primarily due to their dependence on a tether. The tether limited the speed at which the ROV could travel during an inspection. Additionally, a costly host vessel was needed to deploy the ROV.

Could an AUV do the same job, collect the right data, and complete the work faster? Yes.

## Technology for Deepwater Inspections

To support AUV-based deepwater inspections, three needs had to be addressed: 1) data requirements and the sensors



needed to collect the data, 2) autonomy for efficient and safe survey of the assets to be inspected, and 3) hovering. The first two requirements could be met with upgrades to the current line of C-Surveyor AUVs. However, supporting the hovering function required a redesign of the current line of AUVs.

## Modifying Sensors

The sensor suite carried on the AUV required an upgrade to meet the data requirements dictated for inspection. Prior to this time, standard geophysical and site classification survey data needs were met with multibeam, side-scan, and sub-bottom profiler choices made in 2000 at the beginning of this AUV era. Inspection needs are different and carry new requirements. Sensor choices were made based on those new requirements.

## Satisfying Data Needs

First up in the sensor suite was the need for general visual inspection (GVI). Inspection engineers were accustomed to receiving a video log of the pipeline or asset as the ROV traveled along the inspection corridor. This was not a problem for an ROV due to the tether providing nearly unlimited power to support the light source needs for continuous video. This posed a challenge for AUVs as they have limited power in

the form of batteries or a fuel cell. The decision was made to use a still camera with strobe flash to limit power needs. An analysis of the video log provided to the engineers showed that a continuous mosaic of the inspection corridor as well as a “pseudo” video was comparable to the ROV solution in many ways, and even better in some cases.

The bespoke camera system was treated as all the sensors in the survey suite. The camera system was calibrated to eliminate distortions from the lens and air-water interface. The image is “shot” on the body of the AUV to calculate its lever arms for applying navigation for georeferencing. This value is “patch tested” to calculate the misalignments of roll, pitch, and yaw—equivalent to the multibeam sensor. The individual images captured by the camera and the photo mosaics are survey grade for measurements and provide the same visual log of the asset as ROV video.

## Upgrade to Scanning Sensors

The second major upgrade to the survey suite was the need to match the resolution of the profilers and multi-beam scanner used by the ROV survey. This entailed upgrading the multi-beam to the new, dual-frequency Kongsberg multibeam and

matching the resolution of the scanning profilers. It was then decided to pursue the use of a subsea laser solution. A joint development between Oceaneering and 2GRobotic of Waterloo, Canada was undertaken to bring their static-based ULS-500 system to an AUV in 2013. In August of that year, the first use of an AUV with a laser-based bathymetric system was used to map the lateral movement of assets in the Gulf of Mexico. This system provided the same data needed for spanning, lateral buckling, and pipe measurements as a profiler from an ROV but at the increased speed of an AUV.

The third sensor was not an upgrade, but a new development dictated by inspection requirements, namely cathodic measurements. The need to understand the corrosion of a pipeline and infrastructure was a hurdle for an AUV that could not stop, hover, and use a probe to make contact with an anode or touch a pipe. A unique solution for this challenge was provided by a major oil and gas company in the form a "light" touch solution for measuring field gradients. During a joint development on autonomy for a Pipeline Inspection AUV (PI-AUV), the customer's light touch solution for measuring field gradients was incorporated and tested in December 2016. The solution involves the use of fixed arms with silver-chloride probes and flexible tips that the autonomous controller of the PI-AUV maneuvers to lightly touch the pipeline and anodes it is inspecting.

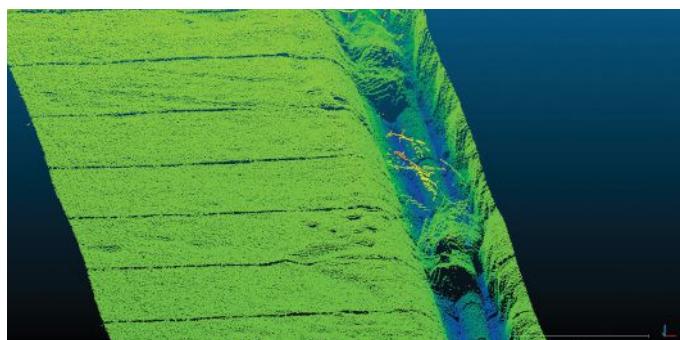
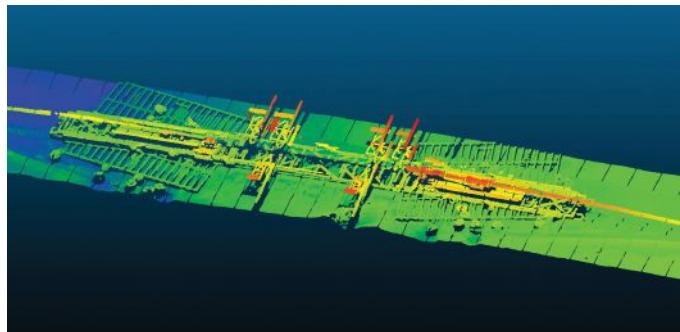
## Autonomous Technology

During the process of analyzing mission requirements for an AUV inspection of oil and gas producing assets, a re-evaluation of the "autonomous" portion of the definition of an AUV was needed. Oceaneering started this process in 2005 and, like self-driving cars, the need for greater situational awareness and an AI decision process was required to both collect acceptable data and safely execute the mission.

AUVs, to this point, simply "mowed the grass" for most survey needs and had basic collision-avoidance capabilities. This would need to change. For safe and efficient surveys of pipelines and assets, the AUV would now need to track pipelines, recognize assets (e.g., anodes, crossing, debris), and "know" what assets were in the field. With this knowledge of in-field assets, the AUV could make decisions on how to react to unknown objects it may detect during the survey and make appropriate decisions on how to dynamically modify its mission to safely complete the survey or abort and return to a safe recovery location.

## PI-AUV Development

From September 2014 to December 2016, further development of the PI-AUV, with two major oil companies, was undertaken to move the mission controller of the C-Surveyor AUV along the line of autonomy from the automation end, closer to a self-driving car. This development added the capabilities of tracking assets via camera, laser, and multibeam. Additional capability included acquiring knowledge of the in-field assets as



*Above: Laser bathymetry of infrastructure.  
Below: Laser bathymetry of pipeline in trench.*

defined in a GIS, forward-looking object detection out to 300 ft (91 m), and behaviors and triggers for use by the controller in making mission decisions.

Behaviors and triggers are used by the controller to define the behavior of the AUV during missions for recognized and unrecognized events and objects. For example, a defined behavior for the PI-AUV is to inspect all crossings of a pipeline along a ±250 m corridor. This behavior is triggered by detectors using camera, laser, and multibeam inputs. Should a detector find an object that is not in the GIS of an in-field object, the mission controllers determine whether it is safe to avoid the object and continue with the survey or proceed away from the obstructing object to the recovery point, as defined in the mission.

## Mission Ready for Faster, High-Quality Inspections

To date, development and testing of all the sensors and integration into the mission controller have been completed. The basic behaviors, triggers, and detectors have also been field tested in live environments and with real-world infrastructure. The final sensor in the suite, the light touch cathodic system, has undergone a proof of concept test with final industrialization of the system to be completed by the end of Q4 2017. With the addition of cathodic measurement to the PI-AUV development, the market will now have the option for pipeline inspection at up to five times the speed of an ROV spread at a fraction of the cost.

For more information, visit <http://www.oceaneering.com/survey-and-mapping/geoscience-and-auv-surveys>.

# Modelling the Dispersal and Settlements of Drill Cuttings

Drilling operations at sea produce a mix of fine rock fragments that need to be discharged into the ocean. While inert, these fragments (known as drill cuttings) can have sediments, contaminants and drilling fluids adhering to them. To help regulators and marine managers assess the potential impact of drilling operations, MetOcean Solutions is regularly engaged to model the dispersal and settlement of drill cuttings in the marine environment at locations all over the world.

"Drill cuttings settle on the seabed, where they can cause adverse environmental impacts," explains oceanographer Remy Zyngfogel. "The oceanic discharge of drill cuttings occurs over specific time periods, but their dispersal and deposition are driven by random variables such as currents and turbulence."

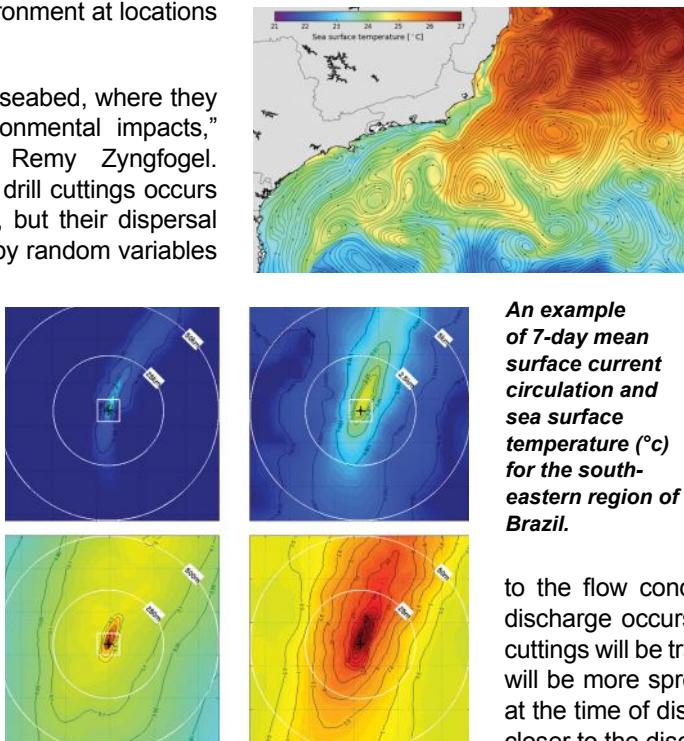
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To determine where the drill cuttings end up on the seabed, we use a variety of methods and leverage the expertise of our multidisciplinary science team. This includes modelling the hydrodynamics of the region and simulating the trajectory and the settling of the drill cuttings to the seabed. Regulators and marine managers require good knowledge of the likely footprint of deposition and how thick the deposits will be at increasing distances from the drill site."

Project director Dr. Brett Beamsley oversees the hydrodynamic modelling. "We use different models to produce the historical datasets needed for the studies," he advises. "Oceanic and coastal currents vary according to synoptic and seasonal winds, tides, and density differences. To account for this variability and to provide robust statistical estimates of dispersal and deposition, we use historical data to recreate the actual oceanographic conditions, typically hour-by-hour, for a 10-year period. We recreate these currents using the most appropriate model. For offshore studies, we use the Regional Ocean Modeling System (ROMS), whereas for smaller-scale studies at inshore sites SCHISM or Delft3D are used."

Zyngfogel uses the historical current dataset to determine the dispersal of drill cuttings. "Once we have the historical currents, we use a particle tracking model to trace the dispersal and deposition of drill cuttings for simulated discharges at different times of the year," he explains. "Ocean currents vary with factors like seasonal winds and riverine discharges, so the depositional footprint will differ depending on which time of year the drilling is done. The size of fragments discharged into the sea depends on the rock type and the drill bit design. From an estimate of particle size, we can determine settling velocities—the finest fractions of the drill cuttings settle through the water column very slowly and become widely dispersed, whereas larger particles settle quickly and much closer to the discharge location."

*An example of 7-day mean surface current circulation and sea surface temperature (°C) for the south-eastern region of Brazil.*



*Example deposition thickness for drill cuttings discharged from a marine location. The spatial distributions of deposition thickness are color-coded with values in mm on each contour line in four zoom views: 100x100 km (top left), 10x10 km (top right), 1x1 km (bottom left) and 100x100 m (bottom right). The release site is indicated as a black cross.*

"The modelling represents what is likely to happen statistically, over long time periods. Naturally, for any given discharge, the drill cuttings will disperse according to the flow conditions at the time. For example, if discharge occurs during high current flows, the drill cuttings will be transported further, and the deposition will be more spread out. If current velocities are low at the time of discharge, the cuttings will accumulate closer to the discharge point."

Where pre- and post-drilling sediment samples have been taken, it is possible to verify the dispersal modelling.

"We often use barium as a tracer," explains Zyngfogel. "Drill cuttings contain elevated concentrations of barium from the drilling fluids. This makes barium an ideal tracer of discharged cuttings. Seabed samples taken before and after drilling can be used to determine the change in barium concentration and thereby verify the modelled deposition of the cuttings."

"The modelling provides a statistical representation of possible outcomes, taking into account the natural variety of current flow conditions. The modelled results typically show good agreement with observed barium levels, which means that operators and regulators can confidently use the modelling to determine the extent of potential adverse effects. This information is used both when applying for permits and post-permit, in the design of environmental monitoring programs."

For more information, visit <http://www.metcean.co.nz>.

# The Unique Capabilities of ASL's Acoustic Zooplankton Fish Profiler

ASL announces that two Ph.D. candidates who are currently conducting studies that couple the unique capabilities of ASL's Acoustic Zooplankton Fish Profiler (AZFP) with predator telemetry and prey sampling to provide novel perspectives on predator/prey interactions in selected study regions in southern British Columbia, Canada.

These projects examine fine-scale processes with large-scale implications for marine ecosystems and the services that they provide. Rhonda Reidy and Will Duguid are part of the Fisheries Ecology and Marine Conservation group, working under thesis supervisor Francis Juanes of the University of Victoria. Collaborators on their projects include Stephane Gauthier and Svein Vagle from Fisheries and Oceans Canada. Both projects are briefly described below.

The objective of Reidy's study is to link humpback whale feeding behaviors to concurrent measurements of prey in southern BC waters. These details will provide scientists with fine-scale information on humpback whale predation, which can then be used to better inform fishery management decisions. The study will utilize three techniques to accomplish this objective: (1) a multi-sensor suction cup tag to record 3-D whale movement; (2) a vessel-mounted 38, 70, 125 and 200 kHz AZFP to concurrently map prey distribution during whale dive events; and (3) a mid-water tucker trawl to sample prey adjacent to foraging depths (~100 m). The samples collected from the nets will be examined to identify prey species and will be useful to calibrate species target strength.

Duguid is examining how interactions of tidal currents and abrupt topographic structure influence the feeding ecology of Chinook and Coho Salmon juveniles at fine spatiotemporal scales. A tidal jet (Sansum Narrows) and an adjacent reference site (Maple Bay) are being developed as a case study for fine-scale habitat use. Physical parameters (CTD casts) and prey distribution (zooplankton tows and hydroacoustics) are related to juvenile salmon distribution (acoustic telemetry and patterns of catch per unit effort) and biological characteristics (growth and diet) at previously unachievable resolution. It is hypothesized that tidal jets predictably advect zooplankton from depth, concentrating forage fish and larger, faster growing juvenile salmon. Surveys with the AZFP will be coupled to depth-stratified zooplankton tows throughout the tidal cycle to better understand how local oceanography influences the interaction of zooplankton, forage fish, and juvenile salmon.

For more information, visit <http://www.aslenv.com/>.



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## CSA Ocean Sciences Creating an Open-Water “Living Shoreline”

Contracted by the State of North Carolina Department of Transportation (NCDOT), CSA Ocean Sciences Inc. (CSA) is conducting a novel seagrass enhancement project by manipulating wind wave energy to provide new and sustained seagrass acreage in anticipation of unavoidable impacts, creating essentially an open-water “living shoreline,” although in the absence of an actual shore.

The Bonner Bridge, which connects Hatteras and Bodie islands at the Oregon Inlet—a lifeline for tourism and tropical storm evacuation of the North Carolina outer banks—has reached its engineering limits and is being replaced. The potential seagrass impact estimated from the new bridge installation required the recovery of no less than 1.28 acres of highly productive seagrasses, interspersed with widgeon grass. In January, Cape Dredging Company, under contract to CSA, completed installation of the Reefmaker wave attenuation units in coordination with the manufacturer, Atlantic Reefmaker.

Approved by both federal and state regulatory agencies, this project builds on extensive research previously conducted by current CSA staff in order to exploit and manipulate the relationship between seagrass bed patchiness and waves and currents as an enhancement strategy. Using wave forecasting techniques to guide the size and location of the 500-ft long wave break, CSA and its team designed and installed the wave break among chronically patchy

seagrass beds near the bridge. This wavebreak, which immediately began to alleviate disruption of seagrass beds from waves, is expected to allow the beds to coalesce, ultimately creating more complete and persistent seagrass cover of the seafloor.

Importantly, through this ecological engineering approach to seagrass enhancement, ecosystem services are provided even before any existing habitat is disrupted—a vital consideration in resource management where limited opportunities exist for enhancement. Added seagrass cover provides increased nursery and refuge areas for ecologically and economically important fish, shrimp, and crabs as well as increasing their abundance. This novel approach of creating an artificial shoreline in the open sound provides a new opportunity to both recover seagrass habitat loss associated with unavoidable project-related effects and create a structural basis for oyster colonization and fish utilization just as when applied along an actual shoreline. NCDOT and CSA will continue monitoring the effects of the wavebreak on seagrass expansion and its colonization by oysters and other marine life for the next five years.

For more information on this project or regarding CSA’s habitat mitigation services, please contact Dr. Mark Fonseca at +1 (772)-219-3065.

For more information, visit <https://www.csaocean.com/>.

# BOEM Releases GOM Geological & Geophysical Final Programmatic EIS

The Bureau of Ocean Energy Management (BOEM) has released the Gulf of Mexico (GOM) Outer Continental Shelf (OCS) Geological and Geophysical (G&G) Final Programmatic Environmental Impact Statement (Final PEIS). The Final PEIS satisfies a commitment made in a 2013 settlement agreement with Natural Resources Defense Council and other parties, under which BOEM continues to authorize G&G activities in the GOM.



The analysis contained in the Final PEIS shows that, subject to adequate mitigation measures, a decision from BOEM to continue authorizing G&G activities in the GOM would not result in major impacts to the environment. The Final PEIS addresses potential environmental impacts of G&G surveys (deep-penetration, high-resolution geophysical, electromagnetic, deep stratigraphic, and remote sensing) conducted in connection with BOEM's oil and gas, renewable energy, and marine minerals programs. The area evaluated in the Final PEIS includes the OCS waters of the GOM off Texas, Louisiana, Mississippi, Alabama, and Florida. BOEM also analyzed potential effects within the state waters of Texas, Louisiana, Mississippi, Alabama and Florida, because G&G activities in OCS waters can impact resources in state waters since sound can travel from OCS areas to state waters.

BOEM was the lead agency for the Final PEIS, with the Bureau of Safety and Environmental Enforcement and the National Marine Fisheries Service (NMFS) as cooperating agencies.

The Final EIS will be used by BOEM to assess the environmental impacts associated with permitting or authorizing G&G activities on OCS waters in the GOM in accordance with the National Environmental Policy Act (NEPA). The Final PEIS will also allow NMFS to comply with its obligations under NEPA in connection with the application for Incidental Take Regulations under the Marine Mammal Protection Act that NMFS is currently evaluating for G&G

activities on the GOM OCS.

The purpose of the PEIS is to evaluate the impacts of G&G activities on marine resources, such as marine mammals, benthic communities and fisheries in the Gulf of Mexico Outer Continental Shelf and adjacent state waters. This Final PEIS establishes a framework for BOEM to guide subsequent NEPA analyses of site-specific actions and identifies and analyzes appropriate mitigation measures to be required in future approvals for G&G activities on the GOM OCS in support of BOEM's programs. BOEM will analyze the potential impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20), which will tier from the Final Programmatic EIS.

BOEM has conducted studies on marine mammals, including \$50 million in protected species research, to ensure BOEM-authorized activities do not harm marine populations.

For more information, visit <https://www.boem.gov/GOM-G-G-PEIS/>.

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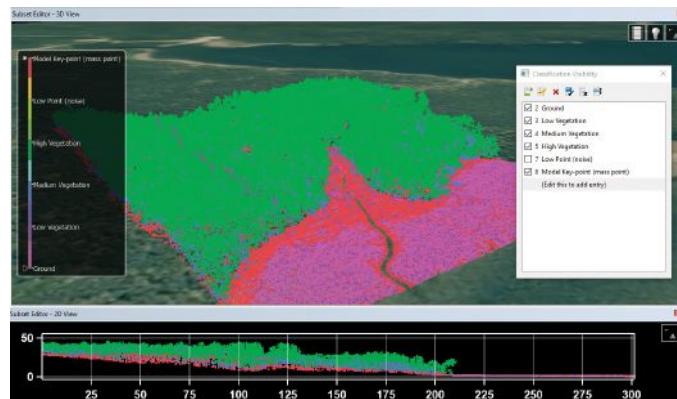
This advertisement for subCtech Subsea Technologies highlights their range of ocean engineering products. It features five main product categories: a pCO<sub>2</sub> Analyzer (LI-COR Biosciences model), an OceanPack™ FerryBox, Subsea Sensors, AUV Batteries, and Battery Systems. The ad emphasizes the company's commitment to quality and reliability, mentioning MIL-STD, ISO 13628-6 approval, and IPC class 3 production. It also notes their ability to provide custom solutions and personalized support. The ISO 9001 certification is prominently displayed.

## Teledyne CARIS™ Announces the Release of Bathy DataBASE™ (BDB) 4.4

Teledyne CARIS™ announces the release of Bathy DataBASE™ (BDB) 4.4. This new version addresses the important areas of feature generalization and automation of product generation for chart compilation as well as the increasing emphasis on bathymetric Lidar surveys.

A collection of new techniques for generalizing bathymetry in chart compilation workflows can be found in BASE Editor™, which is part of the BDB suite. Point suppression and smoothing techniques help reduce the manual work associated with turning survey data into chart-ready vector features. These techniques can be used in isolation or together with other bathymetric feature compilation tools to produce the best results possible.

New Lidar point cloud editing tools allow for visual inspection, elimination BDB 4.4 also offers improved automation for



S-102 and bENC overlays through the inclusion of new sample process

For more information, visit <http://www.teledynecaris.com/>.

## 18 High-Resolution Mapping of Deep-Sea Vertical Walls Using Ocean Robots

A new study published by the National Oceanography Centre (NOC) combines novel autonomous underwater vehicle (AUV) and remotely operated vehicle (ROV) mapping and imaging methodologies to reveal the complex 3D terrain of deep-sea vertical cliffs and the diversity of species associated with them.

Deep-sea cliffs associated with submarine features such as canyons and escarpments can host a wide range of species, including a particularly high number of ecologically important cold-water corals. The complex habitat created by these corals provides other animals with living space, improving access to food and offering protection from predation.

Understanding the localities and the environmental drivers of these cold-water coral habitats is of considerable interest. Owing to their steep nature, these vertical habitats provide natural protection from bottom-trawling activities and, therefore, these corals have the potential to be an important source of larvae for recolonization of previously damaged cold-water coral reefs.

However, for many deep-sea environments, only coarse resolution ship-derived maps are available and in most cases, the finer details of seafloor features, such as vertical walls, are absent. Furthermore, traditional seafloor mapping and surveying techniques are usually restricted to downward-looking approaches and, as a result, these vertical habitats are often overlooked.

Commenting on the study, which is published in Nature

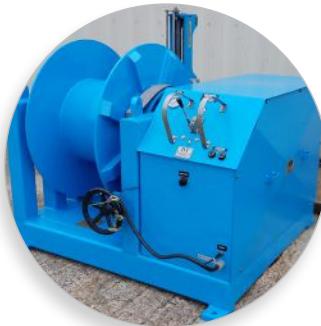
Scientific Reports, NOC researcher and lead author Dr. Kathleen Robert explains, "To map the seafloor, ship-mounted multibeam echo sounders are used. These sonars create a swath of sound across the path of the ship and measure the time for the sound to leave the ship, bounce off the seabed, and return. This estimates the depth below the ship and provides our first map at approximately a 50-meter pixel resolution. But to get more detail, we have to get closer to the seabed. This is where AUVs and ROVs are useful; they can fly much closer to the seafloor and the maps that these vehicles generate are of much higher resolution."

To examine the vertical walls, the researchers worked with NOC engineers to mount the multibeam echo sounder sideways on the AUV. Forward-looking ROV multibeam and high-definition videography surveys were also conducted at two locations in the North Atlantic. This allowed the team to map these vertical walls at <50-cm pixel resolution and, using photogrammetry techniques, 3D reconstructions of the habitats were created, allowing the precise location of individual animals.

Dr. Robert continues, "As the 3D image reconstructions of the coral habitats also retained colours, we were able to quantify the amount of live coral colonies versus the amount of dead coral framework and the individual animals associated with the coral reefs. The combination of these new technologies has allowed us to map the physical 3D structure of previously inaccessible habitats and demonstrates the complexity and importance of these vertical walls in the deep-sea environment."

This research was funded through the Natural Environment Research Council, the Irish Marine Institute, and the ERC starting grant, CODEMAP.

For more information, visit <http://www.noc.ac.uk/>.



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# Southern Ocean Wave Buoy Heading for Chile

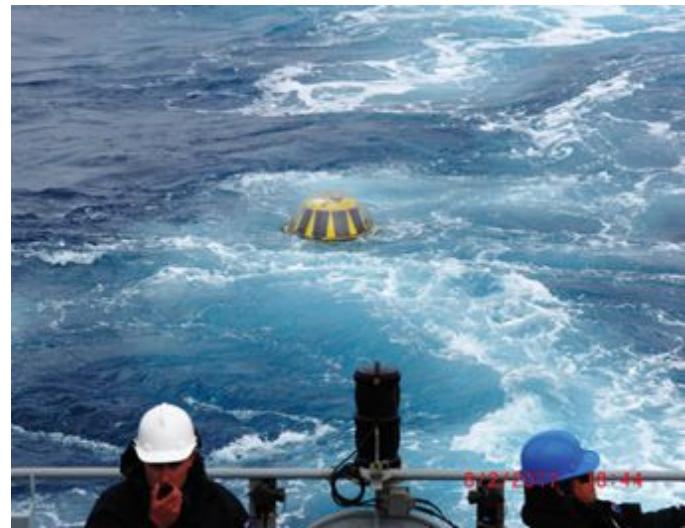
On Friday 28 July, New Zealand's Southern Ocean Wave Buoy started drifting eastward with the ocean currents.

"We're not exactly sure what happened," explains oceanographer Dr. Peter McComb. "However, it's likely the compliant bungy section of the mooring failed under the extreme wave conditions down there. Since February 2017, the maximum wave heights have exceeded 10 m for 26% of the time, and there are very few places on our planet that are energetic. At the start of the project there were many uncertainties. Would there be enough solar power to keep it alive during the deep south winter? Would the mooring survive the constant stresses and ride out the ferocious storms? Ultimately, we are very pleased to have succeeded in our goal of making almost 6 months of very detailed spectral measurements at this location in the sub-Antarctic."

The HMNZS OTAGO deployed the buoy in February 2017 for a collaborative research

to develop a global wave model with improved performance in the Southern Hemisphere and will use the data to verify the next generation of model physics. The wave data will also be made freely available to the international research community. The Southern Ocean is known to play an important role in the climate system—cycling heat, carbon, and nutrients. Waves modulate the air-sea fluxes and the swells generated in this region have far-reaching effects, contributing significantly to the wave climate in all the major ocean basins.

Another positive outcome is the realization that the research project is not over yet—the buoy continues to measure wave spectra and send its data via the satellite link as long as there is sufficient solar power.



*The buoy was deployed in February 2017.*

project between the Defence Technology Agency and MetOcean Solutions. From the chilly waters just south of Campbell Island, the buoy has been sending back vital wave spectral data via a satellite link. These data will now be used by the New Zealand Defence Force to design the next class of patrol ships suited to the harsh Southern Ocean climate. MetOcean Solutions has a research project

"Now we have a new and unique opportunity to make ongoing Southern Ocean wave measurements at the very extremity of the planets' largest ocean—the Pacific. It's highly valuable data for oceanographers," says McComb. "Conceivably, it might take over a year to reach Chile, which would make a fantastic and very significant dataset. Let's hope there is enough sunlight to keep powering the system during this journey."

MetOcean Solutions plans to deploy another wave buoy at the Campbell Island site in February 2018, with the goal of establishing a long-term sub-Antarctic wave monitoring station.

"The international ocean research community recognizes the value of detailed wave spectra collected at this remote location," notes McComb, "and Campbell Island is the perfect site to make baseline measurements for climate change studies as well improving our fundamental understanding of wave physics at a planetary scale. New Zealand can make a very practical contribution to global oceanography by making high-quality, real-time measurements from this site. As a nation, we are very fortunate to have some Deep South real estate with a great harbor. It's got a lot of potential for meaningful, long-term research."

For more information, visit <http://www.metocean.co.nz/>.

# WHOI Scientist Selected as 2017 Recipient of Walter Munk Award

Andone Lavery, an associate scientist with tenure in the Applied Ocean Physics & Engineering (AOPE) at the Woods Hole Oceanographic Institution (WHOI), has been selected by the Oceanography Society as the 2017 recipient of the Walter Munk Award for Distinguished Research in Oceanography Related to Sound and the Sea.

The citation that will be included on the certificate signed by the Secretary of the U.S. Navy and the president of The Oceanography Society reads as follows:

*Through discrimination between the scattering by zooplankton and physical microstructure using broadband acoustic measurement methods and models, Andone Lavery has quantified important biological and physical parameters leading to new understanding of both ocean physical processes and marine biology.*

An excerpt from the nomination letter written by WHOI colleague James Lynch, a scientist emeritus in the AOPE department, states that "Andone's work has been very much in the spirit of acoustical oceanography and the Walter Munk Award's stated criteria for acoustics, ocean science, and instrumentation development. Her Arctic oil spill work also has a fine-scale echo of Walter's ATOC work, where he was concerned with measuring ocean warming due to anthropogenic activity. Both pieces of research have a deep societal motivation."

Lavery will receive the Munk Award during the 174<sup>th</sup> Meeting of the Acoustical Society of America in New Orleans, Louisiana (December 4-8, 2017), and she will also be recognized during the Ocean Sciences Meeting in Portland, Oregon (February 11-16, 2018). She will give presentations at both meetings.

The Walter Munk Award is granted jointly by The Oceanography Society, the Office of Naval Research, and the Office of the Oceanographer of the Navy. Recipients are selected based on their:

- Significant original contributions to the understanding of physical ocean processes related to sound in the sea;
- Significant original contributions to the application of acoustic methods to that understanding; and
- Outstanding service that fosters research in ocean science and instrumentation contributing to the above.



*Andone Lavery, an associate scientist with tenure in the WHOI Applied Ocean Physics & Engineering department, was selected the 2017 recipient of the Walter Munk Award for Distinguished Research in Oceanography Related to Sound and the Sea. Photo by: Jayne Doucette, Woods Hole Oceanographic Institution.*

The award consists of a medal designed by Judith Munk, a commemorative lapel pin, and a certificate bearing the signatures of the Secretary of the Navy and the President of The Oceanography Society.

Lavery, the first female scientist selected for the honor, joins the list of distinguished prior recipients of the Walter Munk Award:

- 2015: Carl Wunsch, Massachusetts Institute of Technology and Harvard University
- 2013: Steven Holbrook, University of Wyoming
- 2011: William Kuperman, Scripps Institution of Oceanography, USA
- 2009: James F. Lynch, Woods Hole Oceanographic Institution, USA
- 2006: Peter F. Worcester, Scripps Institution of Oceanography, USA
- 2003: H. Thomas Rossby, Graduate School of Oceanography, University of Rhode Island, USA
- 2001: Robert C. Spindel, Applied Physics Laboratory of the University of Washington, USA
- 1999: Robert Pinkel, Scripps Institution of Oceanography, USA
- 1997: Stephen A. Thorpe, Southampton Oceanography Centre, UK
- 1996: Leonid M. Brekhovskikh, Moscow Institute of Physics and Technology, Russia
- 1994: David M. Farmer, Institute of Ocean Sciences, Canada
- 1993: Walter Munk, Scripps Institution of Oceanography, USA

For more information, visit <http://www.whoi.edu/>.

# Inertial Navigation in Ferrous Environments: Improved ROV Stability and Automated Performance with a FOG INS

By Marybeth Gilliam,  
Chief Marketing Officer & VP Sales, Greensea

To better utilize inspection-class ROVs for complex operations, many operators within the marine industry are interested in improving ROV stability and reducing operator load during surveys and inspections. Operators are increasingly looking towards autonomy, mission planning, and advanced vehicle control modes to improve data quality and reduce fatigue. Ideally, they would like to have tools that support automated horizontal, vertical, and relative navigation maneuvering without manual input.

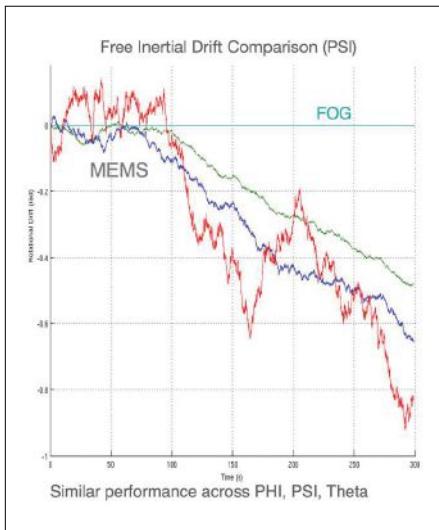
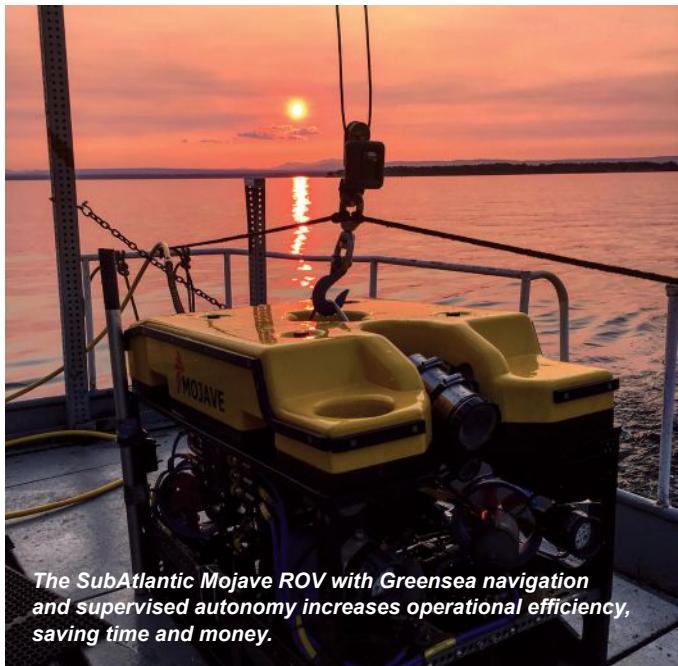
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These objectives are not impossible to attain, but it is important to understand the ROV environment. Areas of survey and inspection often include ferrous materials, including pipes, metal pylons, and rebar found in concrete. The ferrous materials critically compromise the performance of traditional small navigation systems used by inspection-class vehicles, and consequently, negatively affect ROV stability and autonomy performance.

## ROV Stability and Automated Performance is Directly Related to Navigation Performance, Which is Affected by Magnetic Variations

Operating environments with non-uniform magnetic fields can dramatically affect vehicle control performance if the vehicle's core navigation solution uses a magnetic compass sensor to determine heading. Environments with large ferrous content or variable magnetic fields, such as generated by electric motors, severely impact the heading accuracy of these types of systems. As most ROV navigation systems are dead reckoning, they rely on an accurate heading solution to calculate distance traveled, and ultimately position, from aiding sensors. If the heading is corrupt, the position estimate will be corrupt as well. This is readily seen as positioning errors, "drift," or "noise" in the navigation and control solutions.



## There are Two Options for Accurate Heading in an Underwater System

We can use a true north-seeking system that orients by sensing the spin of the Earth and does not use any magnetic technology to find north. Or, we can initialize the system in a benign environment and then maintain an orientation estimate using a high-quality gyro. Typically, the size and cost of non-magnetic true-north-seeking systems are prohibitive to small vehicle applications, so we use inertial methods with a good heading initialization. This relies on an accurate gyro with low drift characteristics that is generally impervious to changing magnetic fields.

## A FOG INS Achieves Stability and Improved Control—Even in Environments with Significant Magnetic Variations

A FOG INS provides magnetically impervious navigation estimates for stable autonomy in a wide operational envelope. FOG inertial navigation systems use high-accuracy gyroscopes to estimate heading, which is highly resistant to magnetic disturbances. A stable heading directly translates into greater positional stability, which, in turn,



directly translates into stability for the vehicle control system.

#### Advantages

- Highly resistant to magnetic disturbances
- Higher accuracy navigation system
- Stable heading directly translates into greater positional stability
- Navigational stability directly translates into control stability
- Widens effective operational envelope
- Greater reacquisition effectiveness
- Critical for deploying autonomous systems in ferrous environments:
  - Ship hull inspection
  - Harbor inspection
  - Tunnel inspection
  - Test pools

#### **A SWaP-C Optimized FOG INS Helps Small Vehicles Accomplish Complex Tasks**

A SWaP-C optimized FOG INS can help small vehicles conduct meaningful work by dramatically improving the accuracy of their navigation without the burden of excessive size, weight, power, and cost (SWaP-C). Although several accurate, commercial inertial navigation products exist, they are too large, heavy, and power-hungry for small, autonomous vehicles with limited payload capacity.

The SWaP-C optimized FOG INS provides navigational accuracy and stability—even in difficult inspection environments. Organizations operating small vehicles in highly ferrous environments (e.g., tunnels, port and harbors, pipelines, etc.) find it supplies magnetically immune navigation estimates to provide superior control during complex automated operations.

We want to hear from you. Send your navigation questions to [info@greenseainc.com](mailto:info@greenseainc.com) and we'll consider your question for our next column.

# ENGIE Announces First Gas from Cygnus Bravo in Southern North Sea



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First gas has been exported from Cygnus Bravo, the satellite wellhead platform in the Southern North Sea's Cygnus development, operated by ENGIE E&P UK Limited.

On the morning of August 1, first gas from Bravo was exported 7 kilometers SE to Cygnus Alpha, which itself has been at a plateau of 250 million cubic feet per day since December 13, 2016. Combined output then travels from the Alpha processing unit, 150 kilometers off the coast of Lincolnshire, via a 55 kilometers link to the Esmond Transmission System – which ultimately lands at the Bacton gas terminal in Norfolk.

The overall Cygnus complex comprises four platforms and two subsea structures, serving an estimated field size of 250 square kilometers. It contributes 5% of UK gas production; sufficient to heat the equivalent of 1.5million UK homes.

Maria Moraeus Hanssen, CEO of ENGIE E&P, commented: "This is a major milestone for the Cygnus development. It is a very successful achievement; well controlled and safely delivered. I want to congratulate all the teams that have been involved."

"Gas from this second drill center will contribute significantly to extending the plateau production that Cygnus Alpha has

been achieving for the last eight months," she added.

Bravo first gas was delivered from well B5 in one of the platform's 10 well slots, out of 20 across the whole Cygnus complex. A further three Bravo wells are expected to come online during August with a total of five available in 2018, after drilling of well B1 is completed.

Over 80% of the contract work during Cygnus construction was secured by British businesses, supporting more than 5000 jobs at peak. Cygnus represents a significant boost to the UK's long term energy security, with an estimated 2P (proved and probable) reserves of 110 mmboe (million barrels of oil equivalent) and an anticipated production life exceeding 20 years. In addition to output from the complex itself, the partners are evaluating further opportunities in the Greater Cygnus area with the aim of bringing additional volumes through Cygnus when capacity becomes available.

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

For more information, visit <http://www.engie-ep.com/en>.

# BP Begins Production from Juniper Project in Trinidad

BP Trinidad and Tobago (BPTT) has announced first gas from the Juniper development, the fifth of BP's seven Upstream major project start-ups planned for 2017. Juniper has begun production on schedule and under budget.

The project is expected to boost BPTT's gas production capacity by an estimated 590 million standard cubic feet a day (mmscf/d).

With an investment of approximately US\$2 billion, Juniper is BP's first subsea field development in Trinidad. It produces gas from the Corallita and Lantana fields via the new Juniper platform, 80 kilometers (50 miles) off the south-east coast of Trinidad in water approximately 110 meters deep. The gas then flows to the Mahogany B hub via a new ten-kilometer flowline that was installed in 2016.

Bernard Looney, chief executive of BP's Upstream business, said: "Delivered on schedule and under budget, Juniper is a major milestone in BP's more than 50 years of investment in Trinidad and Tobago. It is the largest new project brought into production in Trinidad for several years and the second major project we have started here this year. Together they represent a significant portion of the new production capacity we expect to bring online in 2017."

Another major project in Trinidad, the Trinidad Onshore Compression project, began operations in April. In June BPTT announced that it had sanctioned development of the Angelin gas field, which is expected to start production in late 2019. BPTT also announced two gas discoveries which may support future developments offshore Trinidad.

"The safe start-up of production from Juniper is a proud moment for BPTT, and further demonstrates our commitment to helping improve production capacity for Trinidad and Tobago," said Norman Christie, BPTT's regional president. "We thank

the Government, our contractors and the hundreds of team members across the globe that worked to safely bring Juniper on to production."

Juniper is BPTT's 14th offshore platform in Trinidad and its sixth to be

constructed at the fabrication yard in La Brea, Trinidad.

For more information, visit [http://www.bp.com/en\\_tt/trinidad-and-tobago/about-bp-in-trinidad-and-tobago.html](http://www.bp.com/en_tt/trinidad-and-tobago/about-bp-in-trinidad-and-tobago.html).

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## Osbit Expands Offshore Access Offering for Landmark Scylla Vessel

Osbit Ltd has completed its first project for Seajacks with the delivery of a bespoke access system for the world's most advanced offshore wind farm installation and maintenance vessel, Seajacks Scylla.

The gangway, which is now in operation aboard the Seajacks Scylla, has been deployed to the DONG Energy Walney Extension Offshore wind farm development in the Irish Sea, off the west coast of England. Once fully completed in late 2018, the offshore wind farm will become the world's largest at 659MW – capable of powering more than 500,000 homes.

Providing access from the vessel to turbine transition pieces, the telescopic, variable height gangway is a new addition to Osbit's existing offshore access capability and has been specially-designed to suit Seajacks' requirements.

Extending up to a distance of 35 metres, the gangway has a wider than usual operational height capability of between -45 degrees and +15 degrees to ensure it is not restricted by the jack-up vessel's height. The Scylla jack up vessel is fitted with 105 metre-long legs, which have the ability to install components in water depths of up to 65 metres.

Certified by DNV GL to its personnel transfer offshore gangway standard, the gangway is deployed using a dedicated auxiliary crane, which enables the vessel's 1,500 ton leg encircling crane to focus on installation operations.

Designed at its Riding Mill office and assembled at its Port of Blyth base in the North East of England, Northumberland-based Osbit completed the project within its 18-week schedule. The gangway was road transported from the Port of Blyth to Holland, where the vessel was mobilized.

Osbit engineers oversaw the system's delivery, installation & commissioning and also provided training on its operation and maintenance to vessel crews.

Brendon Hayward, Managing Director of Osbit Ltd, said: "We're delighted to work with Seajacks, in this exciting project which further expands our presence in the offshore access solutions market and demonstrates our capability to diversify and adapt our solutions to meet the cost savings and efficiency improvements required by our clients."

"Collaborating closely with Seajacks, our bespoke gangway is designed to provide a wide scope of height deployment, which will prevent operational downtime and enable seamless integration into its landmark vessel's extensive jack-up capabilities."

For more information, visit <http://www.osbit.com>.

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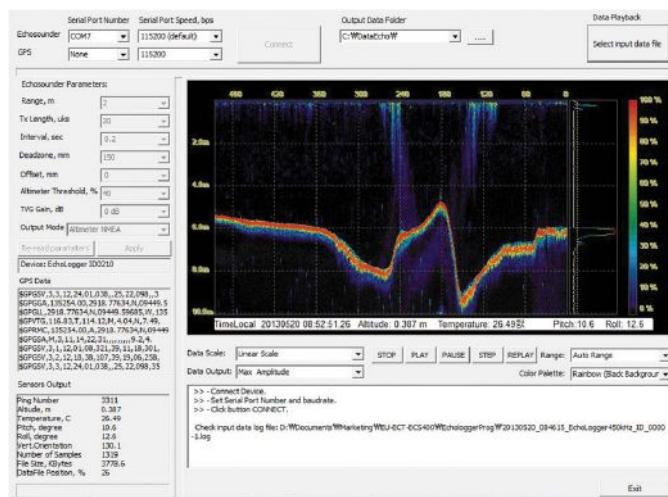
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# Echologger Series: Sophisticated Sonar for Underwater Monitoring

Echologger, is designed and manufactured by EoE Ultrasonics Co., LTD. The company has designed the EU400 to measure the strength of returned signals accurately in the water column. Its compact size and top-of-the-line quality are only a few of the reasons the Echologger EU400 is a must-have for anyone looking for a sonar product to do seabed mapping, sediment move monitoring, or bridge scour moving. The Echologger EU400 is for the professional seeking real-time data and a USB-powered device. The Echologger EU400 is the only device of its kind on the market, but to take the experience to the next level, its newer counterpart, the Echologger EU D24, is on the cutting-edge of new technologies in the research of marine sciences.



## Plug and Play

From its inception, the Echologger EU400 was the first and only device to not only receive its power via a USB cable but also to incorporate a plug-and-play feature utilizing the USB cable in a simple, easy-to-use way. Now, the Echologger EU D24 also shares these features without sacrificing any other features or the size and design of the device. Each of the Echologger devices is designed to be compact, measuring at 56 mm (depth) by 80 mm (height).

## Real-time Data

In our society today, people are able to retrieve data and information at their fingertips at anytime. Similarly, Echologger has designed its devices to provide real-time backscatter data along full water columns. The ability to receive the data in an instant (up to 100 Hz) will allow users to explore new avenues of research more easily and adjust tactics for data collection on the go.

The ease of data collection and analysis is furthered by Echologger devices' ability to integrate with the provided GUI software as well as its compatibility with professional hydrographic software such as Hypack, Topcon, HydroPro (Trimble), and more. This flexibility allows users to maximize the data collected—which, in turn, maximizes the results of surveys and the ability to provide compelling studies in a more timely manner.

## Dual Frequencies

In addition to all of the valuable offerings described above, the newest model, the Echologger EU D24, is the only device to offer USB power, compact design, and professional quality while also delivering dual frequencies of 200 kHz / 450 kHz. The dual frequency feature is absolutely essential for the professional seeking enhanced research and data.

Echologger devices come with a promise of quality and efficiency. Whether the Echologger EU400 is right for you or the newest technology in the Echologger EU D24 is the product you need, Echologger strives to continually offer the best products and support—providing an exceptional experience for every customer. Visit [www.echologger.com](http://www.echologger.com) for more information.

**Top : Dual Frequency Precision Echologger EU D24. Left : GUI software for Echologger EU400**

# Fourchon LNG, LLC Formally Kicks Off FERC Process for \$888 Million Investment

The Greater Lafourche Port Commission (GLPC) and tenant Energy World USA (Energy World) announces that wholly owned Fourchon LNG LLC has filed its formal letter to request initiation of the pre-filing review process with the US Federal Energy Regulatory Commission (FERC). Upon completion of the pre-filing process, Fourchon LNG LLC intends to file an application with FERC for authorization to construct the proposed 5 million tons per annum mid-scale liquefied natural gas (LNG) production and export facility at Port Fourchon.

Once constructed, Phase 1 of the Fourchon LNG project will produce 2 million tons of LNG per year for export, with a program to increase capacity up to 5 million tons in Phase 2. Fourchon LNG also plans to reserve up to half a million tons of LNG per year for domestic use, with the intent of providing LNG to fuel the next generation of offshore supply vessels (OSVs) powered by LNG and operating in the Gulf of Mexico.

"We welcome this critical milestone for the Fourchon LNG project by our tenant Energy World, and we are excited to have the opportunity to add their proposed facility and its services to Fourchon's diverse and extensive list of offerings," said GLPC's Executive Director Chett Chiasson. "We are looking forward to working with Energy World and our community to move forward through the regulatory process and keep Port Fourchon at the forefront of the oil and gas service industry."

The Fourchon LNG facility is to be constructed to the west of Belle Pass on a site of up to 150 acres located on port-owned property outside of the port's existing developments.

The project developer, Fourchon LNG LLC, is a newly established project company owned by Energy World (USA) Inc. and is part of the Energy World International Ltd. (EWI) group of companies. The EWI group is engaged in the business of developing, constructing, and operating in property investment, infrastructure, power generation and energy-related projects.

"The Energy World Group of companies has over 20 years' experience in the safe production, storage, transportation and delivery of LNG to its customers in Australia; and the Group is completing two world class LNG facilities in Indonesia, which will be the reference plant for Fourchon LNG, and the very first import terminal in the Philippines. We appreciate the opportunity to bring this type of new development to Port Fourchon," said Graham Elliott, Project Director for Energy World.

"Energy World is pleased to commence our first US-based project by kicking off the formal regulatory process with

FERC following over two decades of sustainable, safe, and timely delivery of similar projects in sensitive environments across the globe. We look forward to incorporating the LNG produced at Port Fourchon into our global supply chain to fuel our own gas-fired power plants right across the Asia-Pacific region as well as providing a clean, green source of fuel for the next generation of US marine vessels. Additionally, we hope to export to Jamaica and the wider Caribbean, where Energy World is separately proposing to develop an LNG hub terminal and gas-fired power plants consistent with our goal of delivering clean and affordable electricity to developing countries on a global platform," added Stewart Elliott, Managing Director of Energy World International.



The proposed facility will represent an investment of upwards of \$888 million for Phase 1, making it the largest single initial investment in the history of both Port Fourchon and Lafourche Parish.

"Our community has been dealing with an economic downturn for a few years now, so we are excited for the opportunities that this project will provide by bringing hundreds of jobs during the construction phase, and dozens of good-paying permanent jobs once the facility is operational, which will help our young families and workers," said GLPC Board President Perry Gisclair.

GLPC has been working with Energy World to produce a Preliminary Waterway Suitability Assessment with the US Coast Guard, which will help to ensure that current and future port activities are not adversely affected by the operation of the potential facility and support EWUSA's application for FERC approval.

For more information, visit <http://portfourchon.com/>.

# UK Subsea Sector Urged to Seek Opportunities in Offshore Wind

With global offshore wind expenditures expected to rise to over £350 billion between now and 2026, there is a huge opportunity for subsea companies to step up and play their part in helping to meet the world's renewable energy targets.

This will see a significant number of developments taking off over the next few years, and with world renowned experience in offshore oil and gas engineering, the UK has the skills and expertise to lead the way - delivering investment and creating jobs.

Subsea UK will be running an event in September, to explore the offshore wind developments that are currently underway, while offering practical help and advice to companies looking to access the rapidly growing offshore renewables market.

Chaired by Neil Gordon, chief executive of Subsea UK, the event will welcome speakers from SIEM Offshore Contractors, Ecosse Subsea Systems, DeepOcean and James Fisher Marine Services, to discuss the synergies between the subsea and offshore renewable industries, share lessons learned, and examine the role that offshore renewables will play in the future energy mix.

The seminar will also look at ways in which the industry could work together to simplify existing initiatives in a bid to increase efficiencies and reduce the cost of installing and maintaining wind farms.

Neil Gordon, commented: "The offshore wind market is growing at an incredible rate, presenting a wealth of opportunities for the UK supply chain. By closely examining some of the developments that have proven to be successful, we can help companies overcome the barriers and make their mark in the offshore wind sector.

"The UK is home to some of the world's largest wind farms across all stages of production, including operation, construction, and in planning. However, there are still a number of challenges to overcome to ensure that offshore wind fulfils its potential.

"It's vital that the industry works together to share knowledge, get costs down and find smarter ways of working to increase the UK's competitiveness in a growing global industry. This means building alliances, strengthening the supply chain and embracing new technologies.

"By bringing together companies that are already active in the offshore renewables space, we can help guide newcomers through the steps required to break into the industry, while highlighting the opportunities most accessible to the UK supply chain."



The event will take place on September 20 at The Chester Hotel, Aberdeen. Those wishing to attend can book their place online via the Subsea UK website - <http://www.subseauk.com/8681/offshore-wind-developments>.

As a self-sustaining body, Subsea UK represents over 300 members and acts as a focal point to promote the sector and maximise its opportunities, providing a national forum for collaboration, diversification and technology development.

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

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# Bureau Veritas Releases New Rules for Offshore Service Vessels, Tugs

Leading international classification society Bureau Veritas has issued new rules for the Classification of Offshore Service Vessels and Tugs, including new class notations for pipelay vessels, accommodation units, offshore construction vessels and offshore support vessels.

Gijsbert de Jong, Bureau Veritas Marine Marketing and Sales Director, said: "With this new publication Bureau Veritas provides the industry with a clear framework for the classification of offshore service vessels and tugs based on an end-user friendly system of class notations reflecting the terminology used by the industry. This document is the culmination of a development plan aimed at addressing the specific requirements of key offshore operations in our rules."

The new rules entered into force on July 1 and set out requirements for the classification of a wide range of vessels performing construction, installation, maintenance and other support activities at sea. These requirements cover towing, anchor handling, supply, fire-fighting, oil recovery, diving support, lifting, standby and rescue, accommodation, pipe laying, cable laying and semi-submersible heavy transport vessels.

OCTOBER 2017

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OCEAN NEWS &amp; TECHNOLOGY

## MacArtney Introduces CEMAC: Proven Technology for Safe Cable Handling

MacArtney's offshore cable handling equipment, named CEMAC, is designed for power and telecommunication cables and for cable handling operations within the renewable energy industry, in particular the offshore wind sector.

CEMAC offshore handling equipment belongs to a product line that incorporates both cable carousels, offshore track tensioners, linear cable engines, and offshore power quadrants. Featuring durability, high performance, and easy integration, they come in standard and custom configurations, are easily combined, and fully synchronisable with each other by means of the application of standard software control systems.

The design of these CEMAC appliances represents compact and modular systems, which are easily mobilizable and cost-effective in terms of transportation. All main components are standardized, which facilitates adaptation and upgrading to the required performance and capacity.

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

New and updated class notations and service features have also been included for:

- Wind turbine installation vessels
- Self-elevating units covering the legs and elevating systems fitted on liftboats
- MOUs (Mobile Offshore Units) Code compliant accommodation
- SP[PoB]-capable (Special Purpose / number of persons on-board), indicating compliance with the 2008 SPS Code for an anticipated increase of the number of persons on-board
- Service notations for tugs and escort tugs – indications for the design values of bollard pull, steering/braking force and speed, in combination with operating area notations for restricted operations as applicable, i.e. for harbour tugs or coastal tugs.

Feedback, from international cross-industry projects and working such as SafeTug and a range of IMO groups focused on stability for towing, anchor handling, lifting operations and supply operations, has been incorporated into the new rules.

For more information, visit [www.bureauveritas.com/marine-and-offshore](http://www.bureauveritas.com/marine-and-offshore).



*Above: CEMAC Cable Carousel.  
Below: CEMAC Offshore Track Tensioner*



# John Crane Wins North Sea Contract with Maersk Oil

John Crane Asset Management Solutions (JCAMS) has secured a contract to supply Maersk Oil with data services to support the planned maintenance strategy at the Culzean field, one of the largest new developments in the UK North Sea.

JCAMS will provide data build services as well as establishing a maintenance plan for all topside equipment. A Detailed Criticality Analysis and Maintenance Definition (DCAMD) strategy will be developed to cover high-criticality equipment with generic procedures being used for non-critical appliances.

The Culzean gas condensate field has resources estimated at 250-300 million barrels of oil equivalent. Located in the Central North Sea, the high pressure, high temperature field is expected to commence production in 2019 and supply enough gas to meet 5% of total UK demand at its peak in 2020-21.

James Reid, Project Manager at JCAMS, said: "We are pleased to deliver a smooth planned maintenance programme for Maersk Oil that combines both preventative and condition based maintenance."

John Morrison, Managing Director at John Crane Asset Management Solutions, said: "To be involved in supporting the maintenance strategy on one of the most significant projects on the UK Continental Shelf in recent years is fantastic news for the company. Having an effective strategy will stand the development in good stead for years to come, giving those in charge the confidence that their topside equipment will perform reliably and efficiently."

For more information, visit <https://www.johncrane.com/>.



## MONTH IN REVIEW

### Total Acquires Maersk Oil for \$7.45 Billion

A.P. Møller – Maersk will receive a consideration of \$4.95 billion in Total shares and Total will assume \$2.5 billion of Maersk Oil's debt. <http://ont.news/2xyxiyw>

### Kosmos Energy Successfully Completes Tortue Drill Stem Test

The Tortue-1 well flowed at a sustained, equipment-constrained rate of approximately 60 MMcf/d during the main, extended flow period.

<http://ont.news/2fmCnn0>

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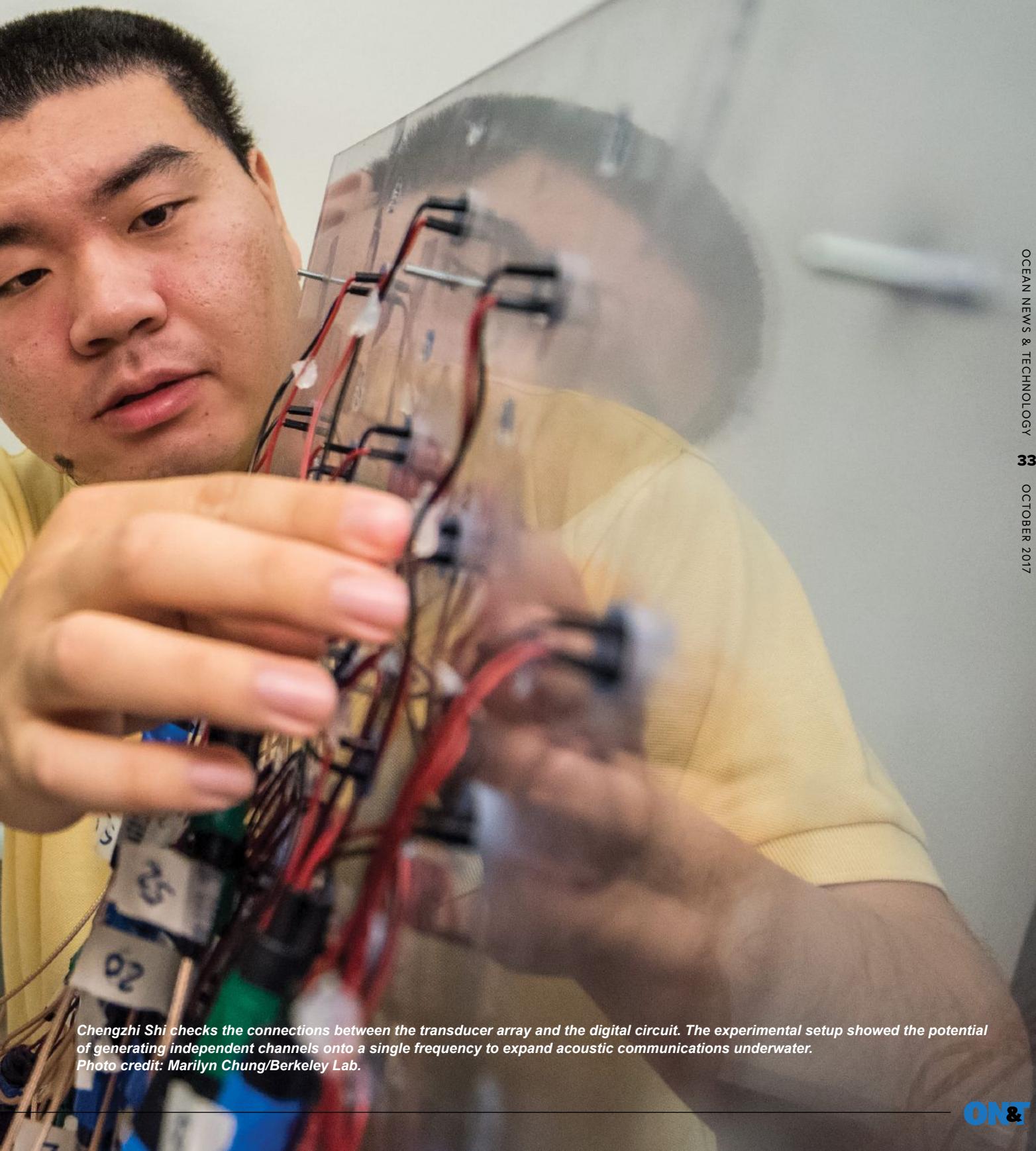
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# The Dawn of High-Speed Underwater Communication

By Kira Coley, UK Correspondent





*Chengzhi Shi checks the connections between the transducer array and the digital circuit. The experimental setup showed the potential of generating independent channels onto a single frequency to expand acoustic communications underwater.*

*Photo credit: Marilyn Chung/Berkeley Lab.*

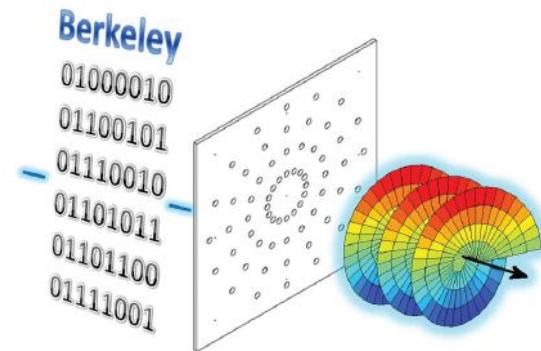
Human presence continues to intensify in the ocean environment, now reaching remote corners of the world thought unreachable just decades ago. These days, the underwater realm hums with the sound of robots, offshore activities, and exploration. But our ability to communicate underwater has not kept pace with our ambitions for the marine landscape, limited to a great part by nature and physics. Microwaves are quickly absorbed in water, so transmissions cannot get far, and optical communication is no better as light is scattered by underwater microparticles when traveling over long distances. There are enormous challenges ahead for scientists and engineers fighting against nature's laws. But now, researchers at Lawrence Berkeley National Laboratory might have discovered the solution to achieving high-speed long-range communication underwater. This discovery will not only advance marine science and offshore industries, but hold the potential to entirely transform the way humans work and explore the largest ecosystem on the planet.

"The issue for communicating underwater is the underwater environment itself. High-speed wireless communication networks like cell phone data and Wi-Fi are all based on microwave (RF) technology, but microwaves can be easily absorbed by water. For example, when you put a cup of water into a microwave oven, the water will heat up due to this absorption. In this case, the energy is absorbed and the information carried by the microwave is lost and cannot be broadcasted over long distances," explains Xiang Zhang, a professor at University of California, Berkeley and Berkeley Lab, who led this study.

Chengzhi Shi, a Ph.D. candidate in Zhang's group and the lead author of this work, added, "Some people have also explored optical waves, and the story of Li-Fi is beautiful. But the issue of light is the wavelength is too small and can be easily scattered by microparticles and marine life. Through this scattering process, the information is also lost. In nature, sunlight can penetrate 200 m of water at most, which means that any communication relying on light will struggle to reach even 200 m."

For these reasons, sonar remains the dominant technique used for long-range underwater communication today. Applications for sonar include navigation, seafloor mapping, fishing, offshore oil surveying, and vessel detection.

But using acoustic waves had its own problem: to reach distances above kilometer scale, the available frequency bandwidth is narrow and the frequency is low at below 20 kHz. Shi said, "We know that the carrier frequency limits the data transmission speed. With low acoustic frequency and narrow available frequency bandwidth, we live with low-speed communication underwater like what we experienced back in the days of dial-up Internet connections and 56-kilobit-per-second modems. The way we communicate underwater is still quite primitive, and there is a need for a better solution."



*Binary data representing the word "Berkeley" is converted by the digital circuit to information encoded in independent channels with different orbital angular momentum. The transducer array sends the information via a single acoustic beam with different patterns. The colors in the helical waveform shows different acoustic phases. Image credit: Chengzhi Shi/Berkeley Lab and UC Berkeley.*

Now a new strategy for sending acoustic waves through water could potentially open the world of high-speed communications activities, including scuba diving, remote ocean monitoring, and deep-sea exploration. Researchers at Berkeley Lab have found a way to pack more channels onto a single frequency, effectively increasing the amount of information capable of being transmitted.

A technique widely used by telecommunication and computer networks called "Multiplexing" combines different channels together over a shared frequency. While successful on land, this approach has never been applied to underwater acoustics until now.

As sound propagates, the acoustic waveform forms a helical pattern or vortex beam. The rotation of the helical waveform of an acoustic vortex beam is known as the "orbital angular momentum" (OAM). The OAM of this wave provides a spatial degree of freedom and independent channels upon which the researchers could encode data.

This added capacity could eventually make the difference between sending a text-only message and transmitting a high-definition feature film from below the ocean's surface.

"With the OAM multiplexing, we expand this single lane road to a multi-lane highway."

Shi explains: "First you need to understand that spatial degree of freedom [a space variable] is independent to frequency [a time variable]. Even though the available frequency carriers through which information can get from point A to B is limited, the space variable is not. So, how can we increase the space such that more information can travel at the same time? We use OAM of acoustic waves as an example of spatial modulation. Acoustic waves with different OAM are described as having a different 'topological charge'; this helps us characterize how fast the helical wavefront of an acoustic vortex beam rotates."

Topological charges help scientists identify independent information channels in a single superimposed acoustic beam, allowing them to encode more information onto a single beam at once.

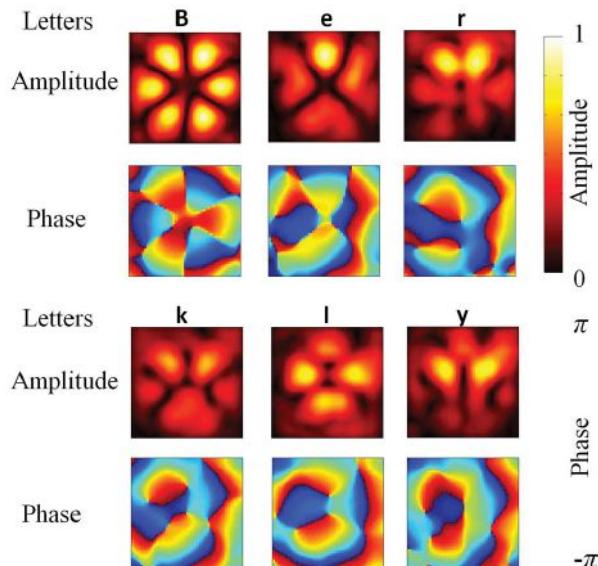
"Only recently, we realized that OAM multiplexing as a spatial modulation, can increase the acoustic communication speed drastically."

Researchers demonstrated this by encoding in binary form of the letters that make up the word "Berkeley" and transmitting the information along with an acoustic signal that would normally carry less data.

"It has taken a long time to improve underwater communication because wireless acoustic communication relies on amplitude and frequency modulations traditionally used for RF communications dating back to WWII. No one has considered applying this technique to acoustic communications, even though there have been discussions over the last two decades about using spatial modulation to improve the communication speed in optics. Only recently, we realized that OAM multiplexing as a spatial modulation can increase the acoustic communication speed drastically. It is revolutionary in how we encode information onto acoustic waves to achieve high-speed communication underwater," explains Shi.

"We could have real-time communication between our mother ship and the vehicles, allowing the exploration of the underwater environment faster than ever before."

Expanding the capacity of underwater communications could open new avenues for exploration. And when it comes to underwater exploration and scientific research, sensors and underwater vehicles could send data without the need to surface.



*Letters are encoded onto independent channels, with the amplitudes and phases forming different patterns. Image credit: Chengzhi Shi/Berkeley Lab and UC Berkeley.*

"I believe this research will benefit the whole human society in different aspects, including gaining more knowledge about the ocean and our own planet, exploiting more marine resources, and more. The development of underwater communication will be fast in the next few years. Now, we've discovered this new technique and we will continue to look at how we can further optimize it. It opens doors to applications we haven't thought of before, and I believe, because of this work, high-speed communications that we use now in our daily lives will become available in the underwater environment in the near future."



## Acknowledgements

Findings have been published in the Proceedings of the National Academy of Sciences. This research is supported by the University of California Berkeley Ernest Kuh Chair Endowment, Berkeley Fellowship for Graduate Study, and the Gordon and Betty Moore Foundation. The other researchers on this team are Marc Dubois and Yuan Wang, both members of Zhang's group.

# DNV GL Applies Data Analytics Techniques to Reduce Downtime

Opportunities for digitalization are currently being embraced by the oil and gas sector. However, there are few practical use cases of it yet. Lundin Norway and DNV GL have developed the first step in a solution for predicting unplanned shutdowns of Lundin Norway's Edvard Grieg production platform.

The Edvard Grieg production platform is a modern hydrocarbon processing facility that has been in operation for nearly two years. It is located at Utsira High in the North Sea and operated by Lundin Norway (65%), OMV Norge (20%) and Wintershall Norge (15%). The energy required by this infrastructure is monitored by more than 2,000 sensors. The aim of this project was to demonstrate the suitability of data analytics techniques to detect events that might cause an unplanned shutdown, and thereby initiate necessary preventive actions. Lundin and DNV GL - Oil & Gas gave four students the challenge to develop a data analytics application. With some fresh minds on board and supported by experienced experts from both companies, progress has been beyond expectations.

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"In a very short time frame, the project team has come a long way in substantiating the value of using data analytics techniques to improve our operations," says Kari Nielsen, Head of Field Operations, Lundin Norway. "This is very encouraging and motivates us to continue our efforts."

"We've seen similar results in several other digitalization initiatives we've had lately. Engineers with domain knowledge of oil and gas operations are critical to complement the data analytics approach. This means that DNV GL, as a technically

skilled company, has a significant role to play in the digital future," says Kjell Eriksson, Regional Manager Norway, DNV GL - Oil & Gas.

The students created several statistical models which they refined using the data generated by a selection of the sensors available in the system. An application was built to analyze the results of each statistical model and generate a warning message any time there is a high probability that a trip can occur, giving the operator a time window to take preventive actions.

"It's been a huge inspiration to work with such a motivated and creative team. Experienced engineers who have been in the game for some time benefit from having unbiased and fresh digital minds on board," says project manager Francisco Martin-Recuerda, DNV GL – Oil & Gas.

For more information, visit <https://www.dnvg.com/>.



# EdgeTech Sonar Utilized in the USS Indianapolis Discovery

EdgeTech, a leader in high resolution sonar imaging systems and underwater technology, is proud to learn that the company's AUV-based side scan sonar system played a key role in the recent discovery of the USS Indianapolis wreckage 5,500 meters deep in the Philippine Sea. The sinking of the USS Indianapolis had the greatest loss of life from a single ship in the history of the US Navy.

The EdgeTech 2205 AUV-based sonar system is one of many advanced underwater technology systems on-board the R/V *Petrel* which discovered the wreckage recently. The system is integrated into a deep water AUV and is used on the AUV to acoustically image large swathes of the seafloor as the AUV swims thousands of meters below the surface. The EdgeTech system is configured as a dual frequency 75 / 230 kHz side scan sonar and bathymetry providing the ability to image over 1,000 meters from each side of the AUV as it conducts its search pattern in deep waters.

EdgeTech takes great pride in providing high quality, and more importantly reliable underwater acoustic imaging



AUV with EdgeTech Sonar Installed. Photo credit: EdgeTech

systems that are utilized by organizations and individuals such as Paul Allen and the R/V *Petrel*. EdgeTech's side scan sonars, bathymetry systems and sub-bottom profilers are used daily throughout the world in modern research and military operations. This discovery highlights the important role the technology can also play in the historical understanding and recognition of past military operations as well.

For more information, visit <http://www.edgetech.com/>.

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A detailed advertisement for the Barracuda ROV. On the left, there's a vertical blue graphic with the 'SHARK' logo and 'SHARK MARINE TECHNOLOGIES INC.' text. The main area features a large yellow ROV with black trim, labeled 'BARRACUDA'. Above the ROV, its capabilities are listed. Below the ROV, two smaller images show the vehicle being deployed from a boat and operating on the seabed. The background is a stylized illustration of an underwater scene.

Shark Marine Technologies Inc. [www.sharkmarine.com](http://www.sharkmarine.com) sales@sharkmarine.com Ph: (905) 687 6672

## RJE International Helps China Study the Deep Sea

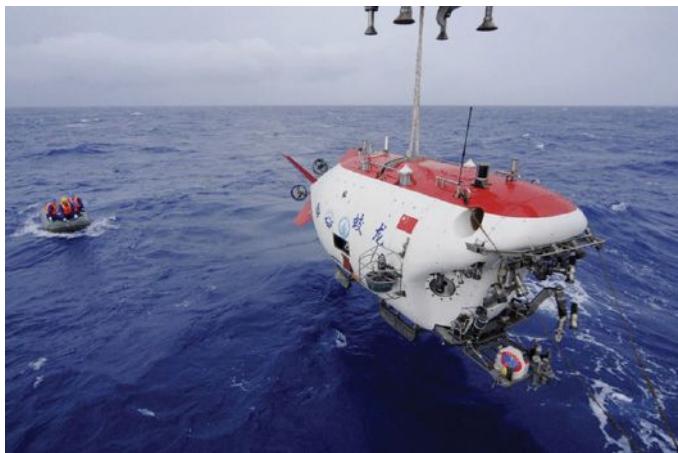
RJE International announced a partnership with China's major oceanographic institute to take a closer look at the ocean floor.

China's National Deep Sea Center -- founded several years ago to advance the country's marine research -- plans to deploy scientific equipment to depths of 6000 meters below the surface in order to gather valuable data from the sediment and surrounding subsea environment.

RJE will help the Center recover the equipment mooring after it completes its months-long study. When the data has been collected, the equipment will be released from its anchor and float to the surface to be recovered by researchers.

In the likely event the equipment surfaces far away from its original location, the Center plans to use our ATT-400/6KM Acoustic Transponder and our STI-350 Surface Acoustic Receiver to retrieve it.

"Operating at depths of 6000 meters is always a challenge," said Bruce O'Bannon, the VP of Sales at RJE. "But our line of acoustic beacons and receivers are up to the task."



The ATT-400/6KM Transponder is a small, battery-operated acoustic beacon that is designed to withstand the enormous pressure of the deep ocean. It assists in recovering subsea assets and equipment when paired with the STI-350 and DPR-275 acoustic directional receivers.

This opportunity was made possible through Qingdao Haiyan Electronics Co., Ltd, a company based in China and a partner of RJE.

For more information, visit <http://www.rjeint.com/>.

## Teledyne Seabotix Integrates Kongsberg M3 Sonar on ROV



The KONGSBERG M3 Sonar® system can now be mounted on the Teledyne Seabotix vLBV Observation Class ROV. The M3 Sonar is a 2D multibeam system with sophisticated imaging and profiling capabilities. It provides high-resolution and easy to interpret images by combining the rapid refresh rate of conventional multibeam sonar with image quality comparable to a single-beam sonar.

The new M3 Sonar integration package developed by Teledyne Seabotix enables detection of small objects at distances of more than 150 meters combined with a 120° to 140° field of view, allowing the operator to see the complete underwater picture in real-time. It features multiple modes for multiple applications, GeoTIFF output, multiple true zoom windows, and CHIRP and Doppler modes of operations.

The M3 Sonar includes two distinct transmitters. The eIQ enhanced image quality transmitter operates at 500 kHz and provides clear images well past 150 meter range. The VVBT variable vertical beam-width transducer allows the operator to reduce the across-path beam height from 30 degrees to 15 degrees and even 7.5 degrees, to reduce surface returns in images. The VVBT transducer generates point cloud data that integrates with Hypack and Qinsy software.

Teledyne Seabotix's Tool Skid Mount allows the KONGSBERG M3 Sonar to be installed in two modes: forward looking or downward bathymetry. The integration package includes flotation and trim weights to adjust trim of the vLBV with the M3 Sonar installed. Testing of the vLBV with the M3 Sonar has demonstrated high stability while operating at full speed.

The M3 Sonar, Tool Skid Mount, and software can be purchased directly from Teledyne Seabotix.

For more information, visit <http://www.kongsbergmesotech.com/> or <http://www.teledynemarine.com/seabotix/>.

# Total Autonomy for AUVs with AvTrak 6

By Dr. Ioseba Tena, Global Business Manager, Marine Robotics, Sonardyne International Ltd.

Sonardyne's multi-function acoustic instrument, AvTrak 6, is one of the most versatile sensors you can fit to an AUV. Use it for inertial aiding, long-range tracking, communicating, and mission planning and start improving the accuracy and value of AUV surveys or working on collaborative unmanned operations of unmanned systems.



**AvTrak 6 is a popular choice for vehicle manufacturers as it combines transponder, transceiver, and telemetry link in one low-power unit to meet the requirements of a wide variety of AUV mission scenarios and vehicle types.**

AUVs use an Inertial Navigation System (INS), aided by a Doppler Velocity Log, to continuously work out their position. However, over time, the estimated position of the INS system "drifts" as small dead-reckoning errors accumulate. Providing acoustic position updates to the AUV can mitigate this effect—and that's where AvTrak excels.

Three models are now available, with the smallest OEM version roughly the same size as a business card, and the deepest being depth rated to 7,000 meters. All are built on

Sonardyne's 6G (sixth generation) hardware and Wideband 2 digital acoustic signal platform so not only can they measure ranges to reference transponders with great precision, they can also exchange data within each range update cycle and share mission goals with other AUVs and other underwater platforms operating nearby.

Here's a closer look at six of AvTrak 6's features:

**Communication** – AvTrak 6 is an advanced, bi-directional modem supporting user data rates from 100 to 9,000 bps. Open interfaces and protocols, access to raw 6G and Wideband 2 ranging, and data exchange capabilities mean that AUVs can communicate with surface vessels, transponders on the seabed, and other AUVs.

**Compatibility** – It is compatible with all the Sonardyne 6G systems fitted to many vehicles and ships across the oceans. Change missions parameters, retrieve vehicle status information, and send large volumes of sensor data—this is all done with fast, efficient, low-latency robust communications.

**Positioning** – AvTrak 6 is a USBL transponder so any vehicle fitted with it can be accurately positioned from any Sonardyne Ranger2 USBL system on a vessel or third-party USBLs operating in a compatible mode. The AUV's position calculated on the ship can then automatically and efficiently

be sent down to the vehicle in one short cycle, aiding any on-board INS system. Vehicle position and status data are sent back up.

**Navigation** – AvTrak 6 can be used to communicate position, status, and range to hundreds of other AUVs fitted with one. It can also range to seabed transponders to enable very high accuracy aiding of the INS. Interrogate one at a time or interrogate a whole swarm.

**Emergency** – AvTrak 6 contains a small battery that supports its high-power transmissions so if vehicle power is dead, you can still find it and communicate with it. Integrated outputs enable control of a release, burnwire, or drop-weight functions.

**Support** – An Interface Control Document (ICD) enables your engineers to quickly talk the language and integrate it into any vehicle. Sonardyne is flexible and will often adapt functions to your particular needs; its engineers are available to help.

As developers evolve concepts for AUV swarms for sensor node delivery or large area surveys, the ability to have AUVs communicate and range will be instrumental. Fit AvTrak and your vehicle is pretty much ready for anything.

## Sonardyne Sonars Installed to Protect New Middle East Energy Facility

Sonardyne International Ltd, UK, has announced that its underwater intruder detection sonar technology, Sentinel, has been installed on the site of a new Critical National Infrastructure (CNI) facility in the Middle East to monitor unauthorized access from the sea. The program of work included the supply of multiple in-water sonars and redundant control room equipment in order to provide uninterrupted situational awareness over a large waterfront.

CNI facilities such as power plants, dams, gas storage terminals and offshore oil platforms represent attractive targets for sabotage. Many of these installations have comprehensive above-the-water security systems that can include physical barriers, access control, surface radar and long range opto-electrical sensors. However, many are vulnerable to intrusion from the water, and in particular, from below the surface.

Sonardyne's Sentinel closes this gap in surveillance capability. It reliably detects, tracks and classifies divers and small underwater vehicles approaching a protected asset, alerting security personnel to the potential threat. With a track record spanning more than 10 years, Sentinel is widely regarded as the security industry's most extensively deployed diver detection sonar.

## Locating 'Bouncing Bombs' in Scottish Loch

A specialized piece of underwater scanning equipment has been used to locate and identify WW2 'bouncing bombs' in a Scottish loch.

GSE Rentals, part of Unique System UK, provided the scanning equipment and engineering support to produce sonar images of the sea bed at the dive site currently being explored by the British Sub-Aqua Club.

Scuba divers have completed a daring mission to raise two historic, 'Highball' bouncing bombs like those used by the Dambusters squadron on the successful raid of the Eder Dam. Footage of the Highball bombs being tested was used in the World War II film classic, "The Dambusters."

Mike Osterberger, Unique Group's senior engineer said, "We are pleased that the quality of the images allowed us to identify not only a debris field with a number of Highballs but additional debris that we believe to be side charges from the X Craft type submarine."

The scanner was pulled by a workboat from fellow Scottish

The small, lightweight design of Sentinel's in-water sonar unit makes it ideal for mobile security operations but for this contract, Sonardyne's in-country partner installed the sonars on permanent seabed mounts placed in key locations around the shoreline. Each sonar is designed to provide 360 degrees of coverage and provides long range warning of incoming targets for the local security personnel to intercept the threat. It is even able to determine, with a high degree of probability, what type of diving equipment they are wearing; open or closed circuit.

Due to the strategic importance of the new facility within the region, for the first time Sonardyne was requested to supply dual redundant control-room equipment to ensure uninterrupted service. All equipment was interfaced with the facility's third party C2 (Command and Control) security system.

Speaking about the contract, Paul Rosewarne, Maritime Security for Sonardyne in the Middle East said, "Our announcement today marks the end of many months of planning and on-site activities with our local technical partners and end client to deliver, install and commission Sentinel at this important new facility." He added; "We're confident that our diver detection technology will provide the same peace of mind as the many other Sentinel systems that are in service across the region."

For more information, visit <https://www.sonardyne.com/product/sentinel-diver-detection-sonar/>.



company Aspect Surveys. Sub Sea Tooling Services based near Aberdeen also provided an underwater ROV (Remotely Operated Vehicle) to assist with filming the searches.

Around 200 Highballs have lain at the bottom of Loch Striven in Argyll, for almost 75 years since they were tested by the Royal Navy for use against enemy ships and for the Eder Dam raid in the Second World War.

The bombs, which are inactive, were secured by the divers ready for lifting by the Royal Navy and then winched to the surface before being packed, ready for transport in wet tanks containing a special salt-water solution to prevent them from corroding. The Highballs will be donated to two museums for public exhibit, in time for the 75th anniversary of the Dambusters raid, in 2018.

For more information, visit <http://www.uniquegroup.com/>.



## MONTH IN REVIEW

### The Groundbreaking Black Sea MAP Project

Black Sea MAP, one of the largest maritime archaeological projects ever staged, has been investigating the changes in the ancient environment of the Black Sea region. <http://ont.news/2fdEgPj>

### CGG Starts Espírito Santo IV Survey Offshore Brazil

This industry-supported survey will cover 10,300 sq km and be processed at CGG's Rio de Janeiro Subsurface Imaging center. <http://ont.news/2xUeScx>

### IMCA Publishes ROV Personnel and Vehicle Statistics

There is now a thorough reassessment of the original reported data going back to 2010 in order to identify long-term trends. <http://ont.news/2fDXrlO>

### Smartrak Offers Buried Pipeline & Submarine Cable Tracking on AUVs

INNOVATUM has carried out successful testing, including autonomous operation of the Smartrak cable and pipeline tracking system on AUV. <http://ont.news/2xlgIPF>

### Newton Labs' Underwater Laser Scanners New Features

The scanners are now available with two scanning modes, dynamic and static – easily configured with the click of a button. <http://ont.news/2ff35KA>

### Precision Measurement Engineering Launches New miniPAR Logger

The miniPAR is a Li-Cor Underwater Quantum Sensor, which measures photosynthetically active radiation from all angles in one hemisphere. <http://ont.news/2fmdacx>

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*"Large deep-water assets require the best, most reliable networks available. Onboard communications are the crew's lifelines, and the connection must be good at all times. Ku-band, C-band and now Ka-band VSAT solutions have been trusted for many years and will continue to evolve. However, the development of fibre connectivity in some areas has also become a great option."*

## Vessel Operators Must Consider Trade-Offs in Cost and Efficiency When Considering Different Communications Solutions

By Rolf Berge, Director for Energy Products, Speedcast

As crews return to vessels and companies gear up for work after the downturn in the energy market, the efficiency and effectiveness of communications solutions are a top priority. Available technologies include VSAT, such as time-division multiple access (TDMA) and single channel per carrier (SCPC), long-term evolution (LTE)/4G, in-port wireless, fiber, satphones, and L-band and Ka-band.

While each solution has its own advantages and disadvantages, operators must consider the size of their vessels, the regions in which their vessels will be traveling or stationed, the amount of data assets will need to exchange, and the needs of their crew before determining the best communications solution.

### Individual Solutions

**VSAT** is a common choice when it comes to offshore communications for larger vessels like drill ships, cruise liners, and ferries. Within VSAT, there are two main options: TDMA and SCPC.

- **TDMA** – TDMA is a shared bandwidth concept and is ideal for more than one site. This is often the best option for fleets of ships that want to have a solution where vessels can share bandwidth. With this technology, if some vessels are not using their committed information rate, other vessels can use more than their allotted amount for a maximum information rate. While this is a cheaper and more efficient solution than SCPC, there is more processing overhead with TDMA.
- **SCPC** – With SCPC, operators buy bandwidth that is dedicated for one site (i.e., not shared) and is priced per unit of required capacity (megabits per second [Mbps]). SCPC is the best choice for highly reliable connectivity and typically performs better than TDMA. Additionally, it is often easier to set up quality of service (QoS) parameters on this network.

**LTE/4G** has a lower latency and, thus, higher performance than VSAT. However, availability of LTE/4G depends on where a vessel is operating as LTE/4G base stations are mostly shore based. Although, recent studies show that



**Above:** "While VSAT is still the common choice for most offshore assets, other options are available to complement the satellite connection as ships approach shore, such as 4G/LTE and in-port wireless. Hence the emergence of hybrid networks. The combinations of communications technologies allows vessels to use VSAT when the ships are not within an LTE/4G network, and switch over once the network is in range, helping control bandwidth usage, increase efficiency and become more cost-effective."

**Left:** Rolf Berge, Director for Energy Products, Speedcast

many vessels operate closer to land than we might expect them to be. Ships may be within coverage of LTE/4G up to 60% of their voyage. Additionally, LTE/4G is better in terms of capacity and cost than VSAT as the cost is volume based (per megabyte).

**In-port wireless** allows vessels to connect wirelessly at popular ports along their voyage. This high-capacity radio solution is beneficial because operators pay a fixed cost rather than by volume. This solution enables companies to offload a large amount of data, conduct maintenance and update software and systems on board while at port.

While **fiber** is also available offshore and is extremely fast and reliable, it is only currently available in certain regions like the North Sea and the Gulf of Mexico. In these areas, most platforms are connected via fiber, with VSAT or LTE/4G as a backup.

Another satellite connectivity solution is **L-band**. While traditional satellite connectivity (VSAT) uses Ku-band, C-band, or now also Ka-band, L-band has a lower frequency and is often chosen by shipping companies and commercial

maritime because the overall cost can be cheaper and is bought by the volume of data needed. However, costs can grow if the data exceed the subscribed quota. Additionally, the connectivity speeds are lower than VSAT, up to 432 kilobits per second (Kbps), and the L-band antennas are smaller and less costly compared to other VSAT. Rain fade is also much less of an issue than with the larger VSAT Ku-band or C-band systems.

There is an enormous market for L-band due to these benefits, and Speedcast is the largest reseller of L-band connectivity from Inmarsat to the world.

Even with these benefits, L-band solutions are not for heavy data usage applications (i.e., data conferencing, video conferences, etc.) and work best for smaller vessels with crews of 10 people or less.

## Satphones

Satphones are not used as much now that there are other connectivity options, but they are the ultimate backup if everything else fails. Satphones are voice only, are primarily used for safety and calling for help, and are offered by many different companies, including Speedcast.

## Hybrid Networks

While each technology can be used independently, the best connectivity comes when these solutions are used together. This is considered a hybrid network. With hybrid networks and packages that enable bundling of different solutions, the end user experiences continuous reliable connectivity.

For example, a dual or hybrid solution where VSAT and LTE/4G coverage is combined allows vessels to use VSAT when the ships are not within an LTE/4G network. To create such a solution, vessels require a system in place that would enable switching from one solution to the other.

Speedcast has a system that does just that—its global LTE/4G program, Go4Speed. This program allows users to roam the world with one SIM card and enjoy 4G capacity anywhere in the world that has an LTE/4G network available from shore.

As the need for connectivity continues to grow, networks that bond different solutions to provide comprehensive communications coverage will continue to grow in popularity and companies like Speedcast who provide these types of solutions will flourish.

# Hawaiian Telcom Announces Completion of SEA-US Transpacific Cable

Hawaiian Telcom announced that the historic \$250 million Southeast Asia – United States (SEA-US) undersea fiber cable system is complete and ready for commercial service. Hawaiian Telcom is a part-owner and operator of the ultra-long-haul submarine fiber system connecting Indonesia, the Philippines, Guam, Hawai'i and California.

"We're proud to be part of this significant achievement for Hawai'i as SEA-US is the most technologically advanced trans-Pacific cable system that will meet the growing broadband demands between the U.S. and Asia," said President and CEO Scott Barber. "This landmark cable system ensures Hawaiian Telcom has the capacity to cost-effectively support bandwidth requirements of cloud, streaming video, "Internet of Things" (IoT), and new applications that spur innovation and economic growth for Hawai'i's residents and businesses."

To offset this substantial investment, Hawaiian Telcom offered bandwidth directly to carriers and enterprise customers. By 2015, the year construction on the cable began, nearly \$30 million of its capacity was sold, validating the need for bandwidth on the trans-Pacific route and confirming a strong return on investment. Not only have capacity sales already exceeded Hawaiian Telcom's investment, but it has access to additional excess capacity to further monetize.

The SEA-US cable system is designed with state-of-the-art 100 Gigabit per second technology delivering 20 terabit per second capacity. However, the system is engineered to enable far greater capacities as technology advances in the future. It provides the fastest direct access between the U.S., Philippines and Indonesia, extending nearly 9,000 miles on a route that bypasses congested, earthquake-prone regions.



According to a report completed by the University of Hawai'i Applied Research Laboratory and the Johns Hopkins University Applied Physics Laboratory, Hawai'i's economic future was at risk because existing trans-Pacific cables were reaching the end of their useful lives and new undersea cables had bypassed the state.

"Hawaiian Telcom and the other members of the SEA-US consortium have provided our state with critical infrastructure and virtually unlimited connectivity across the Pacific that effectively ensures our economic vitality today and into the future," said Governor David Ige.

The trans-Pacific fiber network also provides critical route diversity to the Northern Pacific route between Japan and the U.S. Backed by expansive and redundant terrestrial networks connecting cable stations and data centers in California, Guam and Hawai'i, SEA-US strengthens Hawai'i's position as a key strategic hub.

In addition to Hawaiian Telcom, the SEA-US consortium includes Globe Telecom (Manila, Philippines), GTA (Tamuning, Guam), GTI (Los Angeles, California), RTI (San Francisco, California), Telin (Jakarta, Indonesia), and Telin USA (Los Angeles, California).

For more information, visit <http://www.hawaiiantel.com/>.

## Installation of Africa-South America Cable Underway in Angola

Angola Cables took a step closer to completion of the South Atlantic Cable System (SACS) at an official launch in Sangano, Angola. SACS is the first direct link between Africa and South America. The installation of the SACS—a subsea cable with 40 Tbps of capacity that will extend more than 6,500 km to Fortaleza, Brazil—began on the Angolan coast in the municipality of Quissama. SACS is being constructed by NEC Corporation.

The launch event was attended by José Carvalho da Rocha, the Angolan Minister of Telecommunications and Technologies, local and international business leaders, as well as the shareholders and guests of Angola Cables. The installation of SACS is considered a strategic project for Angola to advance the region's digital economy and to improve global communications.

When the entire network is completed, along with associated elements such as data centers and Internet Exchange Points, SACS will offer a paradigm shift in Africa's telecommunications sector. According to António Nunes, CEO of Angola Cables, "For Angolans, the time to access

content available in America—the largest center for the production and aggregation of digital content and services—will improve fivefold." Currently it takes approximately 300 milliseconds to connect between Angola and Brazil. With SACS, the latency—the time lag between a data packet being sent and received—is expected to be reduced to approximately 60 milliseconds.

"Angola is becoming one of the telecommunications hubs in sub-Saharan Africa," added Nunes. "Current cable systems, such as WACS, together with the SACS and Monet cables systems – complemented by local data centers – will improve connectivity, but also economically benefit Angola and the surrounding regions as tech companies requiring high connectivity establish and grow their operations in Africa."

The installation phase of the cable on the Angolan shore is one of the most important aspects of the project as several levels of interaction and activity are required with several entities simultaneously, and therefore constitute a critical and high risk moment. The protection of both the cable and the teams involved is one of the aspects analyzed and therefore the work is rigorous and well planned. "The installation of SACS represents the realization of a dream, a development that reflects our ability to find solutions and overcome challenges, always having in mind the final objective," said António Nunes.

For more information, visit <https://www.angolacables.co.ao>.



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# Global Marine Group Chooses Port of Blyth to Extend UK Footprint

The Global Marine Group (GMG) announced that it has expanded its operations base in the United Kingdom to include the Port of Blyth, Northumberland. Blyth, a modern, well-specified port, has emerged as a major support base for UK offshore energy projects. Operating from the Port of Blyth, both of GMG's two business units, CWind, which provides services to the offshore wind industry, and Global Marine, which provides fibre optic cable solutions to multiple sectors, will be able to offer regionally-focused support, resulting in faster mobilisation, greater flexibility and enhanced response times for customers.

The expansion to the Port of Blyth is the latest step in GMG's plan for continued growth and the development of a suite of local operational hubs situated where customers need support. Beginning in August, Blyth will serve as a regional base for strategic asset management and modular equipment storage, as well as a mobilisation and deployment site for the GMG fleet, complementing the Group's existing operational UK bases at Grimsby, Lincolnshire and Portland, Dorset. A number of GMG assets, including *C.S. Sovereign* and *C.S. Recorder*, two highly capable, multi-role DP2 vessels with excellent track records in both power and fibre optic cable installation and repair, will operate out of Blyth, utilising local engineering skills and regional business support networks.

Recently, *C.S. Recorder* and Q1000, a jet-trenching remotely operated vehicle (ROV), mobilised from Blyth to undertake a cable reburial contract for the Prinses Amaliawindpark, located off the West Coast of the Netherlands. Subsequently, the port will serve to mobilise future telecommunications and power projects for the GMG.

Portland will continue to provide services to GMG's power, renewable energy, oil & gas and telecommunications cable maintenance agreement customers, while Grimsby will predominantly deliver regional support for the offshore wind sector. Blyth will enable GMG access to a wider market in the Greater North Sea, as well as further afield in Europe, where a large offshore wind customer base already exists.

"It has been a pleasure to work with the Port of Blyth, which has been extremely supportive throughout our integration period," said Ian Douglas, Chief Executive Officer of GMG. "We expect that by operating in close physical proximity to our customers, suppliers and trusted partners, we will further strengthen our relationships with key market players and continue to reinforce our reputation for delivering projects safely, on time and to a high level of quality. The combination of being in the right physical location, having a team of highly-capable onshore and offshore staff and access to Group assets, enables us to offer cohesive installation and maintenance services to our customers in multiple sectors."

"We are very pleased to have attracted a company with the profile of Global Marine Group to operate from the Port of Blyth," said Martin Lawlor, Chief Executive of the Port of Blyth. "We view this as another critical step forward in our development as an offshore energy base. We believe building infrastructure and partnerships in a single location is the formula for growth and innovation in the sector."

For more information, visit [www.globalmarine.group](http://www.globalmarine.group).



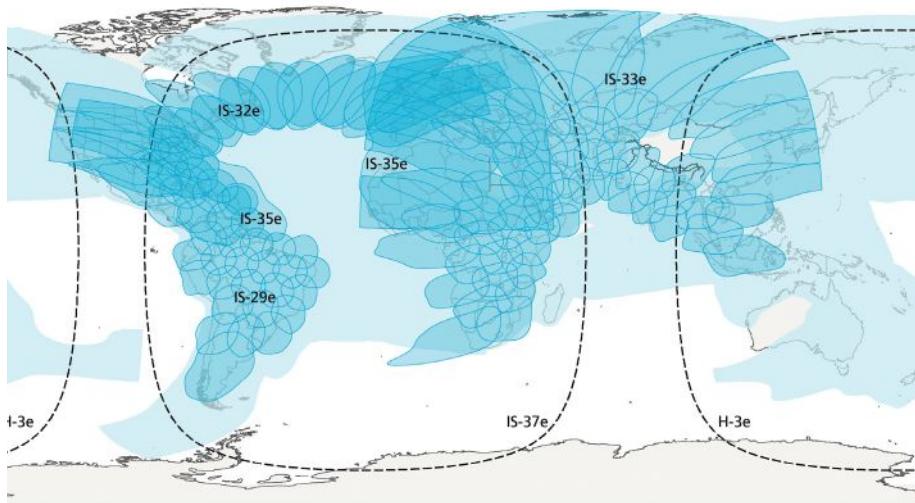
# Intelsat Provides Satellite Services to Brazil's Mreste

Intelsat S.A. announced that Brazil's Mreste Equipamentos e Serviços de Telecomunicação Ltda. will use Intelsat satellite services to deliver communications solutions for maritime customers.

Under a new, multi-year agreement, Mreste, a privately held company based in Rio de Janeiro, will offer Ku-band communications services delivered by the Galaxy 28 satellite for the leisure, fishing and coastal sectors in Brazil, Peru, Argentina, Chile and Uruguay. Mreste will package the satellite services with its Ello product, which includes antennas and hardware, to provide a cost-effective satellite communication system designed to serve smaller coastal and regional vessels, where physical space for onboard equipment and budgets can be scarce or limited.

"With access to Intelsat's satellite fleet and services, Mreste will be able to rapidly grow into a market that has traditionally been underserved," said Márcio Esteves, Mreste's President. "These leisure, fishing and coastal sectors traditionally have been forced to settle for low-speed, expensive connections. With faster, more affordable broadband connectivity, Ello will solve the communications challenges for these customers, delivering a cost-effective satellite system that can be easily and rapidly deployed on smaller vessels."

"Satellites are delivering next generation broadband services to the maritime sector. Intelsat is focused on simplifying the process of acquiring the services and integrating them into existing operations," said Carmen González-Sanfeliu, Intelsat's Managing Director, Latin America & Caribbean, Sales. "Intelsat makes it easier to access connectivity from across the Intelsat fleet, including the Intelsat EpicNG platform and IntelsatOne Flex for Maritime service. For network operators and service providers,



Intelsat delivers accelerated time to market, ensured availability and secure delivery of bandwidth." For more information, visit <http://www2.intelsat.com/>.



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## KT SAT Signs Agreement to Enter Japanese Maritime VSAT Market

KT SAT has signed a partnership agreement with Hun's Corporation, a Japanese ship network supplier, for distribution of Maritime VSAT (MVSAT) in the Japanese market. KT SAT's MVSAT will enable seamless global communication for vessels owned by Japanese shipping companies, starting in September.

Hun's Corporation specializes in supply and maintenance of ship networks provides its service to more than 900 vessels from 53 companies in Japan.

Through this agreement, Hun's will be the official sales agent of KT SAT in Japan and will be in charge of MVSAT service distribution. KT SAT will provide MVSAT service and technical support to Hun's contract customers.

Japan has 4,187 owned vessels which makes it the third largest global ship owning country after China and Greece, based on last year's research of the Institute of Shipping Economics and Logistics. The Japanese maritime telecommunications market is dominated by global satellite operators and Japanese telcos such as KDDI.



KT SAT plans to penetrate Japanese market with more reasonable service rates and superior quality control compared to other companies. KT Sat aims to earn US\$27 million with 300 vessels on MVSAT service in the Japanese market by 2021.

For more information, visit <https://www.ktsat.net>.

## Speedcast Awarded Communications Contract for Fred. Olsen Cruise Lines

Speedcast International Limited announced that the company has been selected by UK-based Fred. Olsen Cruise Lines to provide end-to-end communication services for voice and data on board its fleet of four cruise ships.

Speedcast will leverage satellite Very Small Aperture Terminals (VSAT) and land-based 4G/LTE connectivity to deliver communications for Fred. Olsen guests and crew on board its fleet of four cruise ships *Balmoral*, *Braemar*, *Boudicca* and *Black Watch*—wherever they are in the world. The integration of both satellite and land-based infrastructure allows Fred. Olsen to optimise the use of its ships' networks.

The Speedcast multi-band managed communications platform will be installed on each of Fred. Olsen's ships, monitoring for and adopting the 'best fit' satellite, wireless or terrestrial network. Speedcast's Intelligent Communications Director technology will provide seamless, automatic switching between the different networks and technologies to ensure robust connectivity at all times.

"Having access to a truly global communications network, capable of ensuring that our fleet will be always connected wherever we sail, was the most compelling factor when making this important decision, and Speedcast certainly delivers



that. This also allows us to operate more efficiently between ships and onshore offices, with seamless connectivity from anywhere," says Damon Impett, Head of IT for Fred. Olsen UK Group.

"We are excited to add Fred. Olsen as a new global cruise customer," says PJ Beylier, CEO of Speedcast. "Our core competencies of supplying reliable communication and IT solutions to highly-mobile ships sailing in remote areas fits Fred. Olsen's connectivity needs and company infrastructure very well. We are proud to have the opportunity to assist them with their goal of providing a top-notch guest and crew experience on board their cruise ships, through a combination of innovative technology and a high level of customer service."

The Speedcast solution will include 24x7x365 support from its customer service centres, located on five continents, as well as robust monitoring tools to manage Fred. Olsen's network proactively, ensuring the highest availability and most efficient use of satellite and 4G/LTE connectivity.

For more information, visit <https://www.speedcast.com>.

# Vocus Schedules Early Delivery of Australia Singapore Cable

Vocus confirmed that the build of its Australia Singapore Cable (ASC) is scheduled to be delivered ahead of schedule. The ASC was originally scheduled to be delivered in September 2018 but the company confirmed that the build has less than 12 months to go with a targeted go live date of July 2018.

"We've been able to achieve the earlier date through condensing the program of works to deliver ahead of schedule, in July 2018," noted Vocus Group CEO, Geoff Horth, "The Vocus and Alcatel build teams are familiar with each other having worked together on the successful delivery of our North West Cable System, which has facilitated the shorter timeframe for completion."

Vocus also announced that the cable would be adding a landing on Christmas Island, following several strong expressions of interest from a range of Government agencies. Christmas Island is a location that has struggled to secure required infrastructure to support local service requirements.

"The ASC establishes a new global route from South East Asia – the Great Southern Route," continued Horth, "avoiding geologic instability around Japan and geopolitical challenges



in Guam and the South China Sea, to provide a safer route to the US, thus opening up the cable to new markets."

For more information, visit <http://vocusgroup.com.au>.

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# Teledyne Gavia Demonstrates AUV Capabilities at ANTX 2017

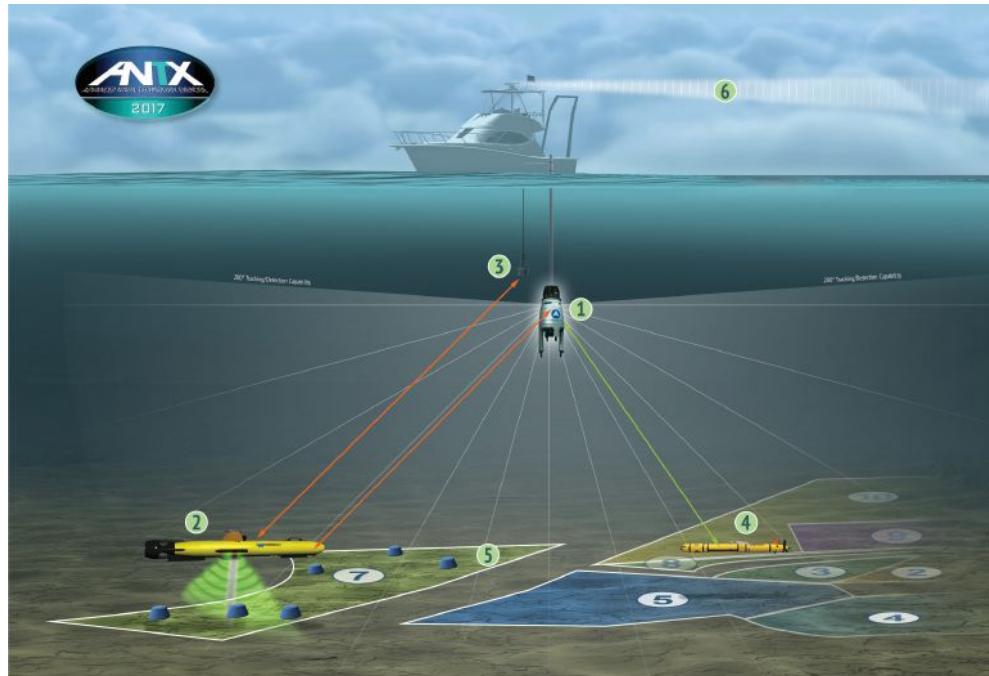
A global leader in the provision of Autonomous Underwater Vehicles (AUVs), Teledyne Gavia recently participated in the U.S. Navy's Advanced Naval Technology Exercise (ANTX 2017) which took place at the Naval Undersea Warfare Center (NUWC) in Newport, Rhode Island. Teledyne Gavia partnered with iXblue to demonstrate iXblue's Global Acoustic Positioning System (GAPS) Ultra Short Baseline (USBL) system for Situational Awareness and Gavia's survey capabilities for MCM (Mine Countermeasure) and ISR (Intelligence, Surveillance and Reconnaissance) surveys.

During the three day event, iXblue demonstrated its GAPS in collaboration with Teledyne

**50**  
Gavia's Autonomous Underwater Vehicle (AUV) to provide situational awareness and C2 capability to users on the surface and/or at remote locations. As an integral part of the demonstration, the Teledyne Gavia AUV performed a high-accuracy MCM survey and a shallow water ISR mission, leveraging USBL fixes from the GAPS as additional aiding to its standard inertial navigation system/Doppler velocity log (INS/DVL) navigation suite.

The Gavia AUV is a man portable, 1000 meter depth rated, fully modular survey platform capable of delivering high quality data while operating from vessels of opportunity or from the shore. The Gavia AUV can carry a variety of sensors that are especially well suited for military and security applications including Rapid Environmental Assessment, Mine Countermeasures and Sonar Training. At ANTX the Teledyne Gavia AUV was configured with an iXblue C5 INS, Teledyne RD Instruments DVL, Edgetech side scan sonar, Teledyne BlueView MB-2250 microbathymetry sonar used for gap fill of the side scan nadir gap, and a Teledyne Benthos modem for command and control of the Gavia AUV with real-time aiding of the onboard iXblue INS.

"The ANTX event allowed us to highlight our innovative autonomous technology directly to our Navy and Government customers," said Bob Melvin, Vice President of Engineering for Teledyne Marine Vehicles. "The Teledyne Gavia AUV has a truly modular, plug and play, capability that is unmatched by other systems. Popular with our NATO Allies, it was a pleasure to be able to demonstrate its ease of operation and



open architecture with partner's iXblue and Charles River Analytics in the waters off of NUWC Newport."

ANTX provides live demonstrations of tactics, techniques, and procedures showcasing technologies in action in fleet relevant scenarios.

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

# HII's Proteus Successfully Completes Unmanned Missions Testing

Huntington Ingalls Industries announced that Proteus, its dual-mode undersea vehicle, successfully completed autonomous contested battlespace missions during the 2017 Advanced Naval Technology Exercise (ANTX) at the Naval Surface Warfare Center (Panama City Division).

During ANTX, the Naval Surface Warfare Center, in cooperation with HII, Battelle, Northrop Grumman and Riptide Autonomous Solutions, conducted aerial, surface and underwater vehicle advance mission capability demonstrations through relevant operational scenarios while communicating real-time mission performance to remote operations headquarters. The underwater mission segment focused on Proteus' unmanned missions capabilities.

Proteus, developed by HII's Technical Solutions division (Undersea Solutions Group) and Battelle, entered a contested battlespace to deliver and launch three smaller unmanned undersea vehicles (UUVs) with unique roles in the overall mission objective. When launched, Riptide's micro-UUVs and Northrop Grumman's REMUS UUV successfully



executed unique mission plans according to their onboard sensors and payloads to investigate and prepare the contested battlespace.

"ANTX provided us an excellent opportunity to demonstrate Proteus' capabilities to Navy leadership, the Navy technical community and our industry partners as we work to meet the Navy's future requirements," said Ross Lindman, director of operations, Undersea Solutions Group. "We are very pleased with how Proteus performed during the exercise."

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



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# A Successful Float-Out for USNS Hershel "Woody" Williams

On Saturday, August 19, General Dynamics NASSCO successfully completed the float-out for USNS Hershel "Woody" Williams, the second Expeditionary Sea Base (ESB) to be constructed for the U.S. Navy by NASSCO shipbuilders.

A float-out occurs when a ship is ready to be moved from NASSCO's graving dock to one of NASSCO's piers for the next phase of construction. It is a lengthy and carefully-coordinated process that begins months in advance and requires the detailed attention of several departments and outside agencies.

As part of the process, seawater flows into the graving dock, gradually raising the ship until it floats on its own.

Named after retired U.S. Marine and Medal of Honor recipient, Hershel Woodrow "Woody" Williams, the 784-foot-long ship will serve as a flexible platform to support a variety of missions, including air mine countermeasures, counter-piracy operations, maritime security and humanitarian missions.



The ship will provide for accommodations for up to 250 personnel, a 52,000-square-foot flight deck, fuel and equipment storage, and will also support MH-53 and MH-60 helicopters with an option to support MV-22 tilt-rotor aircraft. The ship is expected to be completed in the first quarter of 2018.

General Dynamics NASSCO has delivered three ships in the class to the Navy: USNS Montford Point (ESD 1), USNS John Glenn (ESD 2) and USS Lewis B. Puller (ESB 3). In addition to USNS Hershel "Woody" Williams (ESB 4), a fifth ship as part of the program is under construction at NASSCO.

For more information, visit <https://nassco.com>.

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# Cathelco to supply equipment for Royal Navy's Type 26 Frigates

Cathelco have signed a contract to supply equipment for the first three vessels in a new generation of warships which will have a major role across the full spectrum of the Royal Navy's operations.

The Type 26 Frigates will be installed with two types of Cathelco systems, one protecting the underwater hull surface against corrosion and the other designed to prevent blockages in engine seawater cooling system pipework caused by bio-fouling.

Due to start the manufacturing phase in the coming weeks at BAE Systems' shipyard in Glasgow, the first ship is scheduled to enter service in the 2020s.

"As a British company, we are delighted to be supplying equipment for the Type 26 warships, particularly as we supplied and upgraded systems on their predecessors", said Justin Salisbury, managing director of Cathelco.

A key role of the Type 26 warships will be to protect the new Queen Elizabeth Class aircraft carriers from hostile

submarines. Cathelco have also supplied hull corrosion protection and marine growth prevention systems for these vessels.

The hulls of the new warships will be protected with Cathelco ICCP hull corrosion protection systems consisting of an arrangement of hull-mounted anodes and reference electrodes connected to a control panel. In operation, the reference electrodes measure the electrical potential at the hull/sea water interface and send a signal to the control panel which automatically adjusts the output to the anodes so that the hull receives the optimum corrosion protection at all times.

Cathelco marine growth prevention systems (MGPS) will protect nine seachests on each vessel against blockages in sea water cooling lines caused by the growth of barnacles and mussels. The seachests will be installed with copper and ferrous anodes wired to a control panel.

The copper anodes produce ions which create an environment where larvae do not settle or breed, whilst the ferrous ions produce an anti-corrosive layer on the internal surfaces of pipes. The concentrations of copper are extremely small – less than two parts per billion –and therefore the system is environmentally benign and does not harm the wider marine environment.

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



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# Hurricanes Harvey and Irma Have Disrupted the Nation's Energy Market

When Harvey came ashore the night of August 25 near Rockport, Texas, the major concern was its strong 120-mile per hour winds and heavy rainfall. Meteorologists worried that the potential path for the storm would see it execute a loop and head back into the Gulf of Mexico, and then head eastward toward the upper Texas Gulf Coast or into Southeastern Louisiana. That scenario dictated that the U.S. refining and petrochemical industries that are concentrated in that region would be severely impacted, but less harm would befall offshore production.

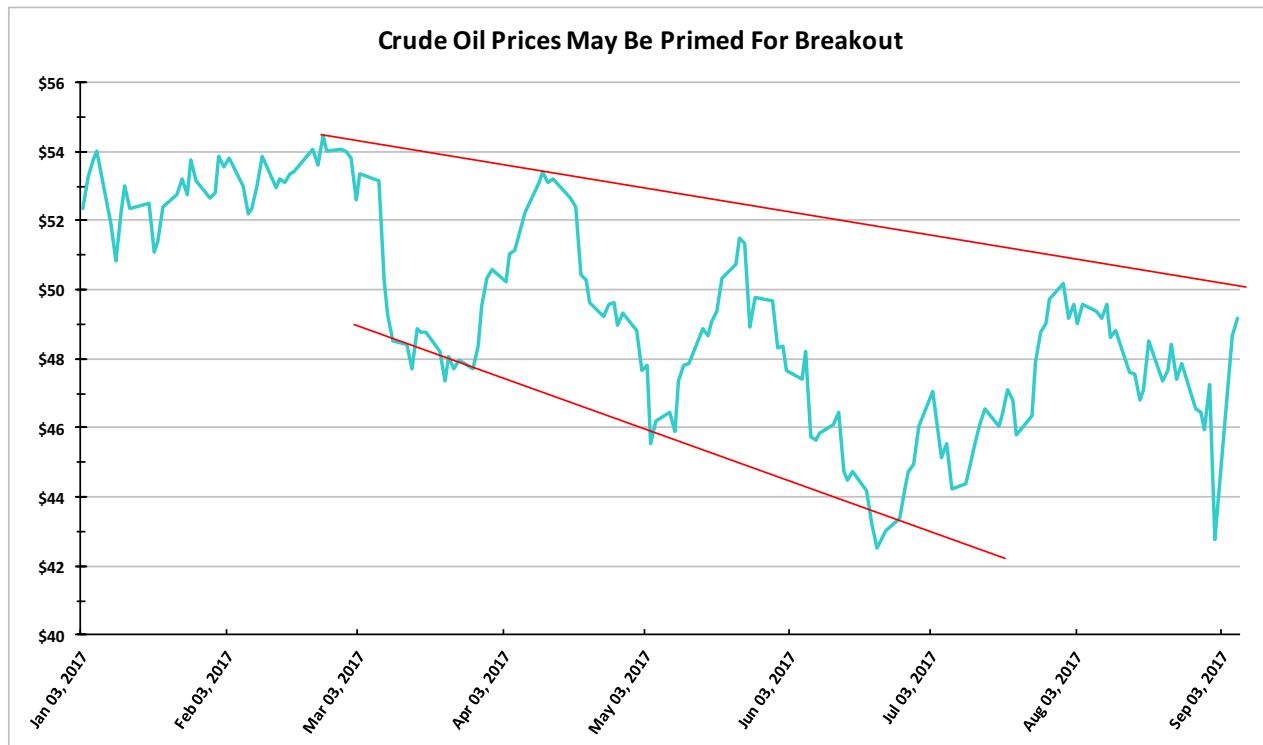
The fears were realized as two very large high pressure weather centers kept Harvey bottled up in Texas, before the storm was able to reverse into the Gulf and then move ashore in the Baytown, Texas area near the Louisiana border. For days, the storm, and subsequent flooding, caused energy companies to close or reduce operations at nearly 31 percent of the nation's refining capacity. The loss of these facilities had an immediate impact on demand for crude oil, even though imports of foreign crude oil was shut down at the ports of Corpus Christi and Houston, until the danger had passed. There was much speculation about how long many of these refiners would be off-line due to concern about how much damage they might sustain.

The good news was that the damage to refineries was nowhere as great as thought possible. As Harvey moved away, the recovery effort began, and before too many days,

the refineries began returning to service. Drivers throughout the eastern half of the United States suffered as gasoline supplies in the East and Southeast regions were limited and shortage fears created panic buying in some isolated locations. The biggest impact from the gasoline supply issue was at the pump, where prices jumped by 35 cents per gallon over the Labor Day weekend, according to the AAA.

Once Harvey moved inland and weakened, crude oil prices jumped, although gasoline futures prices began slumping after having soared given the prospect for the refinery shutdowns. The commodity markets quickly adjusted their assessment of the lingering impact on crude oil and petroleum products due to Harvey, and then from the potential interruption due to Hurricane Irma. Those concerns pushed both crude oil and gasoline futures prices higher as the possible track of Irma might take it into the Eastern Gulf of Mexico and impact offshore production, something that Harvey didn't impact much.

Another consideration in the movement of crude oil futures was the action of financial speculators in the commodity markets. Over the past few weeks, these speculators had been aggressively unwinding their bets for higher crude oil prices, taking them down sharply. That unwinding occurred immediately before crude oil futures began rising in response to the storms. While it will be another week or more before we have data that might show whether these speculators have





By G. Allen Brooks  
Author of "Musings From the Oil Patch"  
[www.energymusings.com](http://www.energymusings.com)

jumped back into the market, it's likely that is why oil prices experienced a sharp move higher in the days immediately after Labor Day.

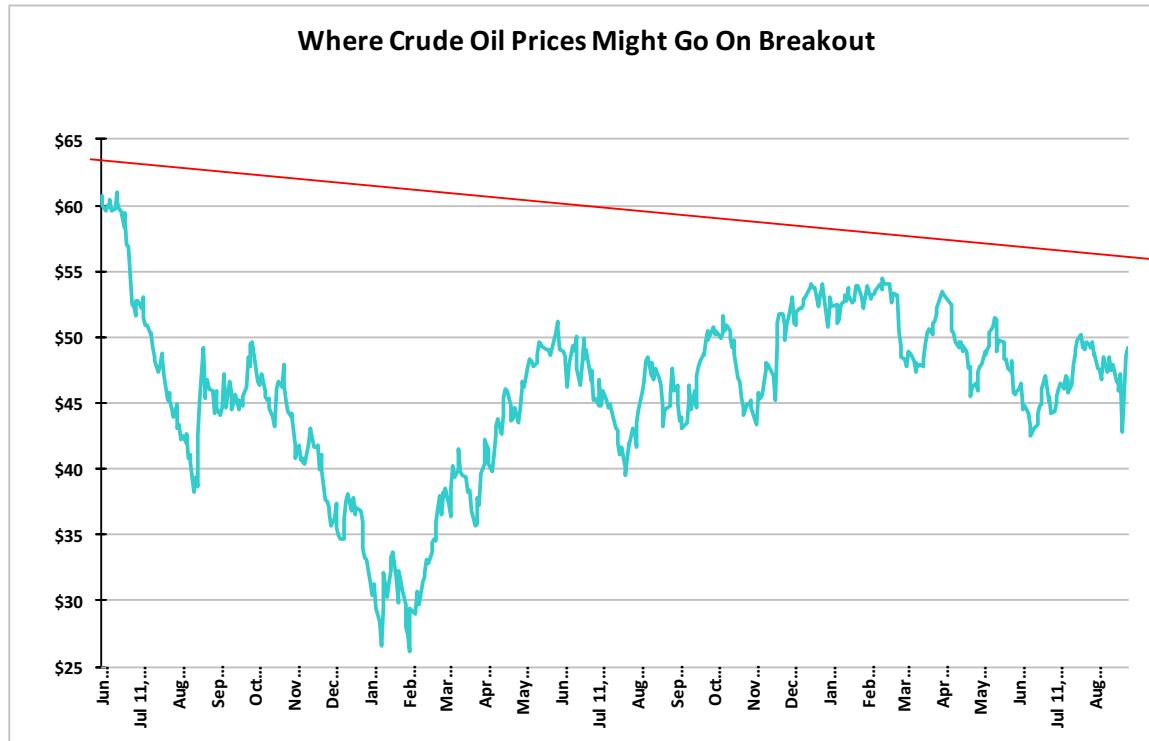
As we look at crude oil prices for 2017, we find that prices, after climbing higher during the first two months of the year, have subsequently been in a downtrend ever since. As seen, the spike in crude oil prices at the start of September has pushed them up to the line of resistance, which reflects a downward sloping line marking the series of lower high oil prices during the year. That resistance line suggests that if prices exceed \$50 a barrel, they will pierce the resistance line and would then be poised to climb higher. The issue then becomes, where might oil prices be capped out on the upside assuming they break through the resistance line?

A longer term chart of crude oil prices enables us to gain perspective on where crude oil prices might go to the upside. Extending a resistance line drawn from the June 2014 oil price peak through the February 2017 peak indicates that the next resistance point above \$50 is likely \$54 a barrel. For many speculators, a move from about \$50 to nearly \$54 would be a meaningful profit-generating opportunity. At that point, we might expect them to shift their bets on the next move in crude oil prices from the long side to the short side, or from a bullish to a negative outlook.

What about the fundamental picture? What we know is

that low crude oil prices have contributed to slightly better demand growth estimates for 2017. However, it seems that the outlook for 2018 isn't being raised, at least at the present time. That is probably a function of the general expectation that economic activity in the developed world may be slowing as higher interest rates take a bite out of growth. That being the case, commodity speculators will be focusing on how higher oil prices impact oil shale drilling and production in the U.S., but more importantly, how compliance among OPEC members with the production cut agreement fares. Compliance has faded from its very positive rating earlier this year, but the longer low oil prices prevail, the greater the need for additional income may push OPEC members to begin cheating on their reduced output quotas. Cheating highlights the enormous challenge facing OPEC – how to reverse their production cuts without undercutting the higher oil price. Supporting higher oil prices will be less of a concern for Saudi Arabia, assuming it does complete the Saudi Aramco IPO next February.

Forecasting crude oil prices is not our focus. However, understanding what is influencing the price movements is. The forces at work in the oil market often signal fundamental changes underway. The problem, as we stressed in discussing the long-term price scenario, is that the OPEC production cut agreement is helping to shrink global oil inventories, but there remains lots of oil in the market, a condition that is not going away anytime soon.



# Crude Oil & Natural Gas Spot Prices

Prices in \$USD as of September 20, 2017

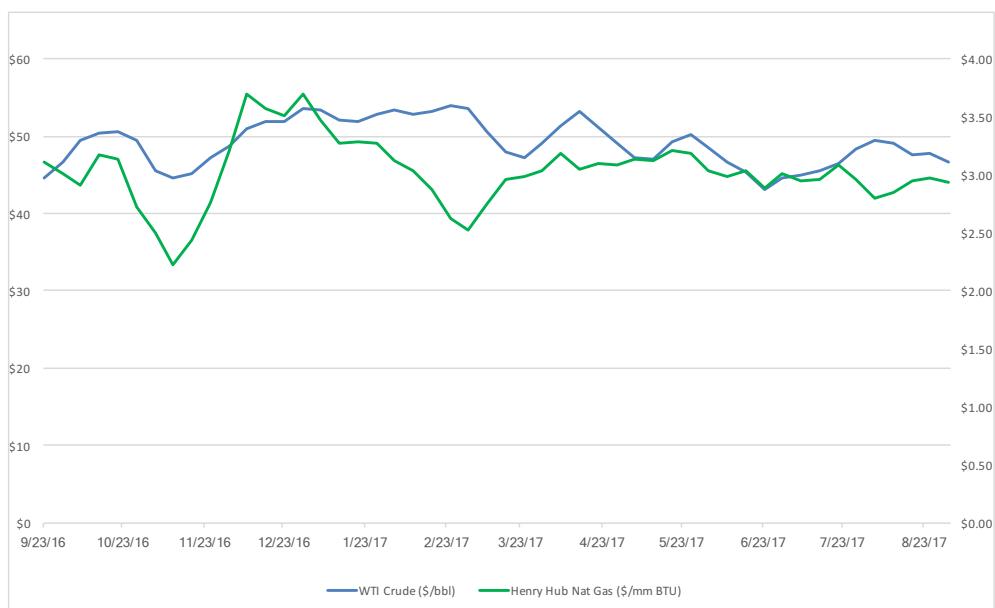
Crude oil prices have been bouncing back and forth between the mid-\$40s a barrel and the high-\$40s for several months. Oil prices have only recently broke the magical \$50 a barrel mark, a price level assumed necessary to make producers happy, while still keeping consumers largely satisfied. OPEC members and its non-OPEC supporters are adhering to the group's nearly two million barrel-a-day production cut, which was designed to reduce global petroleum inventories that have been depressing world oil prices. The speed and magnitude of the drawdowns have been limited primarily by the resumption of output growth from America's oil shale producers. Those producers have been energized by their ability to cut the cost of finding and producing new shale oil output to, or below, \$40 a barrel, giving them a profit margin despite the moderate oil price.

The outlook for oil prices suggests they may rise above \$50 a barrel, but not rocket substantially higher for three reasons. First, America's shale operators will become even more active than they presently are, boosting U.S. oil output, which now can be exported to the global market. Secondly, OPEC members will be tempted to cheat on their reduced output quotas in an effort to boost their country's revenue. And third, higher oil prices will slow demand growth, which may also be impacted by the world's central banks raising interest rates, further crimping economic activity. The 'lower for longer' mantra adopted

by the oil industry in early 2015, in response the upending of the prior oil bull market, seems to be gaining increased acceptance as demonstrated by the large number of oil forecasters who have recently lowered both their near-term and longer term price forecasts. Many in the oil business will continue to be disappointed by the lack of higher oil prices, but this may be the 'new normal.'

Natural gas prices over the past few weeks have generally risen since the lows established last June. The price rise of ten to fifteen cents per thousand cubic feet has not been dramatic, but certainly it is a better environment than one marked by falling prices such as prevailed since late winter 2016 to now. The decline, like the rise, was not significant,

Weekly WTI Crude & Natural Gas Spot Prices  
(Last 52 Weeks)



**\$50.41**

previous month



TRENDING UP



**Cushing, OK**  
**WTI Spot Price**

**\$3.15**

\$2.94 previous month



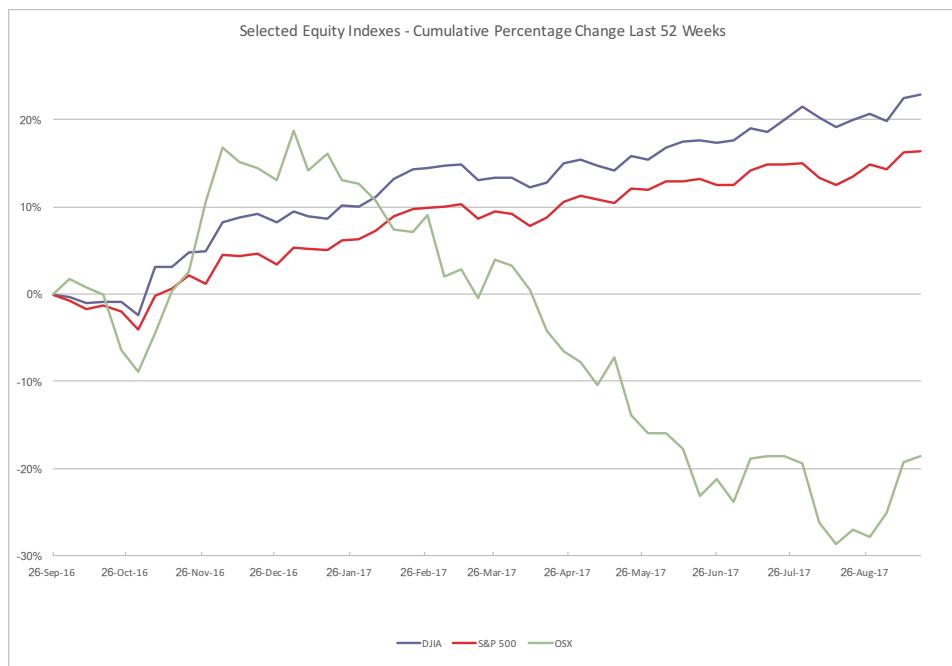
**Henry Hub**  
**Spot Price**



TRENDING UP

reflecting the market's marking time while seeking direction. That direction seems to be emerging, but it is not as optimistic as gas producers had envisioned about 10 months ago. At that time, natural gas prices were heading toward the \$4/Mcf level, which would have driven a stronger drilling response. Instead, the increase in the gas rig count moderated when gas prices fell below \$3/Mcf, which is rapidly becoming the likely target for gas prices for the longer term.

The war on coal has driven its price down to a level that has sapped utility demand for now more expensive natural gas. Weaker gas demand growth has been cushioned by stepped up LNG exports, but the opening of additional terminals have been pushed into 2018 due to regulatory and construction delays. At the same time, increasing associated natural gas output from stepped up oil shale drilling activity, especially in the Permian basin, has reversed the decline in U.S. gas production, putting further pressure on gas prices. The potential impact in the future will depend on what happens to crude oil prices and how U.S. shale oil producers respond. Another potential challenge lurking for the gas market is recent comments from the leading Permian basin driller that their latest wells are producing greater volumes of associated natural gas than anticipated. Given these issues, forecasters are calling for natural gas prices to remain \$3/Mcf for the next several years. This certainly is not an optimistic scenario for gas producers.



## Key Equity Indexes

Prices in \$USD as of September 20, 2017

U.S. equity markets slipped through much of August due to tensions with North Korea and political turmoil at home. The DJIA, which had surpassed 22,000 in early August, lost more than 400 points by the middle of the month, only to rise again, closing at 22,412.59 as of September 20, 2017. The S&P 500 lost more than 50 points during the same time, but as with the DJIA made virtually all of it back before August ended and rose to 2,508.24 as of September 20, 2017. Stocks dipped lower in the immediate aftermath of Harvey and with another major hurricane (Irma) moving towards Florida in early September, they may be poised to take another hit. The OSX rallied to 136.35 from an August low 119.42 as the onshore oil and gas services segment shows signs of life.

**22,412.59**

+800.81 from previous month



TRENDING UP

**DJIA**

**2,508.24**

+34.79 from previous month



TRENDING UP

**S&P 500**

**136.36**

+1.66 from previous month



TRENDING UP

**OSX**

## 2017 EVENTS

### CUCE

Vancouver, Canada  
March 25-27, 2018  
[www.underwaterconference.ca](http://www.underwaterconference.ca)

### Subsea Expo

Aberdeen, UK  
February 7-9, 2018  
[www.subseaexpo.com](http://www.subseaexpo.com)

### Pacific Marine Expo

November 16-18  
Seattle, WA  
[www.pacificmarineexpo.com](http://www.pacificmarineexpo.com)

### AWEA Offshore Wind

New York, NY  
October 24-25  
[www.awea.org](http://www.awea.org)

### LAGCOE

Lafayette, LA  
October 24-26  
[www.lagcoe.com](http://www.lagcoe.com)

### WorkBoat

New Orleans, LA  
November 29 - December 1  
[www.workboatshow.com](http://www.workboatshow.com)

### GoM Oil Spill & Ecosystem

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

### Underwater Intervention

New Orleans, LA  
February 6-8, 2018  
[www.underwaterintervention.com](http://www.underwaterintervention.com)

### MTS Dynamic Positioning

Houston, TX  
October 9-11  
[www.dynamic-positioning.com](http://www.dynamic-positioning.com)

### SPE ATCE

San Antonio, TX  
October 9-11  
[www.spe.org](http://www.spe.org)

### Offshore Well Intervention GoM

Houston, TX  
November 1-2  
[www.interventiongom.offsnetsevents.com](http://www.interventiongom.offsnetsevents.com)

### Clean Gulf

Houston, TX  
December 5-7  
[www.2017.cleangulf.org](http://www.2017.cleangulf.org)

### OilComm

Houston, TX  
December 6-7  
[www.oilcomm.com](http://www.oilcomm.com)

**Offshore Energy**

Amsterdam  
October 9-11  
[www.offshore-energy.biz](http://www.offshore-energy.biz)

**WindEurope**

Amsterdam  
November 28-30  
[www.windeurope.org/confex2017](http://www.windeurope.org/confex2017)

**Oceanology International**

London, UK  
March 13-15, 2018  
[www.oceanologyinternational.com](http://www.oceanologyinternational.com)

**ADIPEC**

Abu Dhabi, UAE  
November 13-16  
[www.adipec.com](http://www.adipec.com)

**Marine Data Infrastructure**

Dubai, UAE  
February 12-13, 2018  
[www.marinedatainfrastructuregcc.com](http://www.marinedatainfrastructuregcc.com)

**World Congress of Ocean**

Shenzhen, China  
November 3-5, 2017  
[www.bitcongress.com/WCo2017](http://www.bitcongress.com/WCo2017)

**Asia Pacific Deep Sea Mining**

Singapore  
November 9-10  
[www.asia.deepsea-mining-summit.com](http://www.asia.deepsea-mining-summit.com)

**UDT Asia**

Singapore  
January 30-31, 2018  
[www.asia-decs.com](http://www.asia-decs.com)

**Asia Pacific Maritime**

Singapore  
March 14-16, 2018  
<http://www.apmaritime.com/>

# 2017 EDITORIAL CALENDAR

## CALENDAR

### JANUARY

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

### FEBRUARY

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

### MARCH

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

### APRIL

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

### MAY

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

### JUNE

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

### JULY – Digital Distribution

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

### AUGUST

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

### SEPTEMBER

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

### OCTOBER

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

### NOVEMBER – Digital Distribution

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

### DECEMBER

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

## 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  
Telecom Exchange – June 20-21\*

### APRIL

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

### MAY

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

### JUNE

Teledyne CARIS User Workshop – June 19-22\*

### JULY – Digital Distribution

TBD

### AUGUST

SPE Offshore Europe – September 5-8

### SEPTEMBER

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

### OCTOBER

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

### NOVEMBER – Digital Distribution

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

### DECEMBER

TBD

\* Digital Distribution

◊ Pending

## MILESTONES



### Reflex Marine Broadens Global Awareness of Personnel Transfer

Reflex Marine, a global leader in offshore access, is looking forward to further expanding its global footprint after the company enhanced its international activity in the last 12 months, including the launch of its latest product, WAVE.

Reflex Marine expanded its presence in the Americas which it regards as a one of the key markets for growth, while COO Sandra Antonovic relocated to the Middle East as an indication of how important the company considers this market.  
<http://ont.news/2xUyehS>

### HR Wallingford's John Harris Appointed RAEng Visiting Professor to UCL

HR Wallingford Technical Director, John Harris, has been appointed Royal Academy of Engineering Visiting Professor in Coastal and Offshore Engineering at UCL (University College London) within the Civil, Environmental & Geomatic Engineering Department. <http://ont.news/2ygpxua>



### Bluestream and Skeye Partner in Offshore Inspection Services

Bluestream, one of the leading providers of innovative inspection services to the oil, gas and wind industry, and Skeye BV from Alphen aan den Rijn, one of the most successful UAV operators in the Netherlands and UK, have announced a partnership providing visual inspection services

and geographic data acquisition for offshore assets using unmanned aerial vehicles (UAV).

According to a statement by both companies, this move is a good example of embracing innovations in the inspection market. <http://ont.news/2wDsZ5Q>

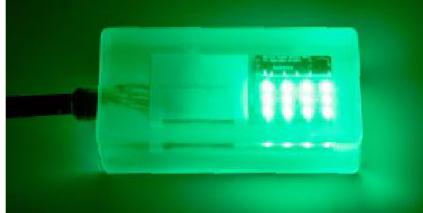
### Vestdavit Opens Office in the US

Safe boat handling specialist Vestdavit has responded to a sustained positive trend in North American business levels by opening an office in the United States.

The Bergen-based supplier of davits and other boat launching equipment is opening an office in Seattle and says that direct representation will help it build on its existing strong regional reputation. Its davits are already widely used by the US Navy, the US Coast Guard, the National Oceanic and Atmospheric Administration (NOAA), and in the offshore oil industry among others. <http://ont.news/2fDWEI6>



The swarm technology experts

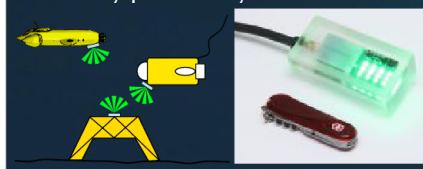


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## SeaCatalog Partnership

62

OCEAN NEWS &amp; TECHNOLOGY

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

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 Tel: 858 842 3020  
 E-mail: sales@rowetechinc.com  
 Website: www.rowetechinc.com  
 Contact: Chris Arends, Global Sales Director



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

## BUOYS

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 Website: www.metocean.com  
 Contact: Emily MacPherson



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 Website: www.DeepWaterBuoyancy.com  
 Contact: Dan Cote, Sales Manager



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

**NAUTILUS MARINE SERVICE GMBH**  
 Alter Postweg 24  
 Buxtehude, 21614, Germany  
 +49 (0) 41618 66250  
 info@nautilus-gmbh.com  
 www.vitrox.com  
 Contact name: Steffen Pausch

**Nautilus**  
 MARINE SERVICE GmbH



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

**SUBSALVE USA**  
 P.O. Box 2030  
 North Kingstown, RI 02852  
 Phone: 401-884-8801  
 Fax: 401-884-8868  
 E-mail: richard@subsalve.com  
 Website: www.subsalve.com  
 Contact: Richard Fryberg



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

# OCEAN INDUSTRY DIRECTORY

## CABLES

**A-2-SEA SOLUTIONS LTD**  
Unit 15 Romsey Industrial Estate,  
Romsey, Hampshire SO51 0HR,  
United Kingdom  
Tel: +44 (0)1794 830 909  
E-mail: ross@a2sea.co.uk  
Website: [www.a2sea.co.uk](http://www.a2sea.co.uk)  
Contact: Ross Taylor



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

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

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

**CORTLAND COMPANY**  
10333 Richmond Ave  
Suite #1000  
Houston TX 77042-4128  
Tel: +1 (832) 833-8000  
Fax: +1 (832) 833-8002  
E-mail: [cortland@cortlandcompany.com](mailto:cortland@cortlandcompany.com)  
Website: [www.cortlandcompany.com](http://www.cortlandcompany.com)  
Contact: Marco Cano



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

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

**FALMAT CABLE**  
1873 Diamond Street  
San Marcos, CA 92078  
Toll Free: 800 848 4257  
Tel: +1 760 471 5400  
Fax: +1 760 471 4970  
E-mail: [sales@falmat.com](mailto:sales@falmat.com)  
Website: [www.falmat.com](http://www.falmat.com)  
Contact: Shawn Amirehsani



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

**SOUTH BAY CABLE CORP**  
54125 Maranatha Drive  
P.O. Box 67  
Idyllwild, CA 92549  
Phone: (951) 659-2183  
Fax: (951) 659-3958  
E-mail: [Sales@southbaycable.com](mailto:Sales@southbaycable.com)  
Website: [www.southbaycable.com](http://www.southbaycable.com)  
Contact: Gary Brown, Sales Manager



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

## CONNECTORS

**BIRNS, INC.**  
1720 Fiske Place  
Oxnard CA 93033-1863 USA  
Int'l: +1 805 487 5393  
Fax: +1 805 487 0427  
USA: +1 888 BIRNS 88 (+1 888 247 6788)  
E-mail: [service@birns.com](mailto:service@birns.com)  
Website: [www.birns.com](http://www.birns.com)  
Contact: Eric Birns



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

**BIRNS AQUAMATE LLC**  
122 Waltham St.  
Pawtucket, RI 02860 USA  
Tel: +1 (401) 723 4242  
Fax: +1 (401) 753 6342  
E-mail: [sales@birnsaquamate.com](mailto:sales@birnsaquamate.com)  
Website: [www.birnsaquamate.com](http://www.birnsaquamate.com)  
Contact: Eli Bar-Hai



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

**SEACON**  
1700 Gillespie Way  
El Cajon, CA 92020 USA  
Tel: +1 619 562 7071  
Fax: +1 619 562 9706  
E-mail: [seacon@seaconworldwide.com](mailto:seacon@seaconworldwide.com)  
Website: [www.seaconworldwide.com](http://www.seaconworldwide.com)



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

## TELEDYNE MARINE INTERCONNECT SOLUTIONS

1026 N. Williamson Blvd.  
Daytona Beach, FL 32114  
Tel: 386-236-0880  
E-mail: [TeledyneMIS@teledyne.com](mailto:TeledyneMIS@teledyne.com)

Website: [www.teledynehmarine.com](http://www.teledynehmarine.com)

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

## DESIGN AND ENGINEERING

**HYDRO LEDUC NA, INC.**  
19416 Park Row, Ste. 170  
Houston, TX 77084  
Tel: 281-679-9654  
E-mail: bogden@hydroleduc.com  
Website: www.hydroleduc.com



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

## EQUIPMENT RENTAL

**OKEANUS SCIENCE & TECHNOLOGY, LLC**  
2261 Denley Road  
Houma, LA 70363  
Tel: 985-346-4666  
Fax: 985-346-8444  
E-mail: Bleblanc@oceanus.com  
Website: www.oceanus.com  
Contact: Benton LeBlanc



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



## FIBER OPTIC PRODUCT/SERVICES

**OCEAN SPECIALISTS, INC.**  
8502 SW Kansas Ave  
Stuart, FL 34997  
Tel: +1 772 219 3033  
Fax: +1 772 219 3010  
Email: jbyous@oceanspecialists.com  
Website: www.oceanspecialists.com  
Contact: Jim Byous



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

## GYRO COMPASSES

**KONGSBERG SEATEX AS**  
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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

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.

## INSURANCE

**JOHN W. FISK COMPANY**  
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Toll Free: +1 888 486 5411  
E-mail: insure@jwfisk.com  
Website: www.jwfisk.com



Fisk Marine Insurance provides all types of insurance to any limit required for commercial diving, marine contractors, offshore oilfield and platforms, plug and abandonment (P&A) contractors, land based energy, ocean marine cargo and oceanographic research worldwide. Our coverages include Workers Compensation (USL&H & Jones Act, General Liability, Professional Liability, Hull P&I, Equipment Bonds and International Packages for clients working outside of the USA. Contact us for more information: 1-888-486-5411 or insure@jwfisk.com. Visit our website: www.jwfisk.com

## LIQUID STORAGE

**AERO TEC LABORATORIES, INC. (ATL)**  
45 Spear Road Industrial Park,  
Ramsey, NJ 07446 USA  
Tel: +1 201 825 1400  
Fax: +1 201 825 1962  
E-mail: atl@atlinc.com  
Website: www.atlinc.com  
Contact: David Dack



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

## MARINE ENVIRONMENTAL CONSULTING SERVICES

**CSA OCEAN SCIENCES INC.**  
8502 SW Kansas Avenue  
Stuart, FL 34997  
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Fax: +1 772 219 3010  
E-mail: gstevens@conshelf.com  
Website: www.csaocean.com  
Contact: Gordon Stevens



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

## MOTION SENSING EQUIPMENT

**KONGSBERG SEATEX AS**  
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Fax: +47 73 51 50 20  
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Website: www.km.kongsberg.com/seatex  
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# OCEAN INDUSTRY DIRECTORY

## NAVIGATION & POSITIONING SYSTEMS

### ADVANCED NAVIGATION

Level 8, 37 Pitt Street, Sydney 2000  
New South Wales, Australia  
Tel: +61 2 9099 3800  
E-mail: sales@advancednavigation.com.au  
Website: www.advancednavigation.com.au



ADVANCED  
NAVIGATION

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

### EVOLOGICS GMBH

Ackerstrasse 76  
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



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

### KONGSBERG SEATEX AS

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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

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

## NETWORK AND DATA COMS

### KONGSBERG SEATEX AS

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E-mail: km.seatex@kongsberg.com  
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## OCEANOGRAPHIC INSTRUMENTS/SERVICES

### ASL ENVIRONMENTAL SCIENCES, INC.

Victoria, BC, Canada  
Tel: +1-250-656-0177  
E-mail: asl@aslenv.com  
Website: www.aslenv.com



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

• **Oceanographic Products:** Ice Profiler IPS5 & shallow water SWIP, Wave Profiler, Acoustic Zooplankton Fish Profiler (AZFP), Acoustic Scintillation Flow Meter (ASFM), Imagenex scanning sonar logger (IRIS), instrument cages, bottom frames. Custom acoustic products and system integration.

• **Consulting:** Field work, data collection, analyses, numerical modelling, acoustics, remote sensing, oceanographic mooring design and system integration.

• **Manufacturer's Representative:** Teledyne RD Instruments, Teledyne Ocean-science, Teledyne Benthos, WERA Northern Radar.

### NKE INSTRUMENTATION

rue Gutenberg  
56700 Hennebont, France  
Tel: +33 2 97 36 41 31  
Fax: +33 2 97 36 10 12  
E-mail: info.instrumentation@nke.fr  
Website: www.nke-instrumentation.com



• Fresh and marine waters multiparameter probes: CTD, dissolved oxygen, turbidity, chlorophyll, Phycocyanin, Phycoerythrin, CDOM, detection of hydrocarbons, pH, Redox

• Dedicated monitoring data loggers and equipment for: sediment transport, underwater systems behavior, marine corrosion, pCO<sub>2</sub> sensor (stand alone or on drifting buoy), density, absolute salinity.

• Intelligent network: environmental parameters (meteorologic and oceanographic), Ecosystems Approach to Fisheries (EAF - Voluntary fishing vessels), Webdata application. Contact: Valérie Le Pen - vlepen@nke.fr or Goulven Prud'homme - gprudhomme@nke.fr

• Provor and Arvor profiling subsurface floats (ARGO project): CTD, dissolved oxygen, BGC, deep; Argos and Iridium transmission.

• Drifting surface buoys with temperature and GPS receiver for Surface velocity project. Contact: Nathalie Le Bris - nlebris@nke.fr or Jérôme Sagot - jsagot@nke.fr

### RBR

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Website: www.rbr-global.com



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

### ROMOR OCEAN SOLUTIONS

41 Martha Avenue  
Mount Uniacke, NS Canada  
B0N 1Z0  
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Website: www.romor.ca  
Contact: Darrin Verge, President & CEO



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

**SEA-BIRD SCIENTIFIC**  
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Fax: +1 425 643 9954  
E-mail: info@sea-birdscientific.com  
Website: www.sea-birdscientific.com  
Contact: Calvin Lwin, Sales



Sea-Bird Scientific combines the capabilities of Sea-Bird Electronics, WET Labs, and Satlantic to provide best-of-class sensors and systems for oceanographic research and environmental water quality monitoring of physical and biogeochemical properties. Sea-Bird Scientific is the leader in accurate, stable ocean instruments for measuring conductivity (salinity), temperature, pressure, oxygen, pH, chlorophyll, CDOM, turbidity, beam attenuation, irradiance, radiance, PAR, nitrate, and phosphate. Our CTD profilers, water samplers, moored CT recorders, wave/tide recorders, DO sensors, and optical sensors are used by research institutes, ocean observing programs, government agencies, and navies globally.

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



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

## ROV SUPPLIES/TOOLS

**ROVSCO, INC.**  
5263 Barker Cypress Road, Suite 600  
Houston, TX 77084 USA  
Tel: +1 281 858 6333  
Fax: +1 281 858 6363  
E-mail: sales@rovoco.com  
Website: www.rovoco.com  
Contact: Jessica McKenney



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

We also manufacture tooling items which include ROV quick release shackles (11 ton to 250 ton), hydraulic compensators (1/2 liter to 2.5 gallon), video cameras & led lights, and 'SNOKOTE' for umbilical anti-corrosive protection.

## SMART TELEMETRY

**OCEANWISE LTD**  
Dovedale House, 16 Butts Road  
Alton, Hants, GU341NB, UK  
Tel : +44 (0)1420 768262  
Fax : +44 (0) 872 115 0560  
Email : info@oceanwise.eu  
Website: www.oceanwise.eu  
Contact : john.pepper@oceanwise.eu



Monitoring and measuring environmental data is not enough! You need to manage it so you get the right data in the right place at the right time. Our Port-Log.net Environmental Data Sharing and Publishing service gets the most out of your investment in data monitoring.

- Easy and inexpensive viewing and sharing of real-time data
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## SONAR SYSTEMS

**EDGETECH**  
4 Little Brook Rd.  
West Wareham, MA 02576  
Tel: +1 508-291-0057  
E-mail: info@edgetech.com  
Website: www.edgetech.com  
Contact: Amy LaRose



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

**MARINE SONIC TECHNOLOGY**  
120 Newsome Dr. Suite H, PO Box 1309  
Yorktown VA 23692-1309  
Toll Free: +1 800 447 4804  
E-mail: Regan.Lipinski@na-atlas.com  
Website: www.marinesonic.com



Marine Sonic Technology builds high quality, high resolution side scan sonar systems. Located in Yorktown, Virginia, Marine Sonic has been in business for more than 25 years. Our towed systems are rugged, easy to deploy and simple to operate. We also offer highly efficient AUV/ROV embedded systems, which occupy minimal space and low power consumption.

## SOUND VELOCITY PROBES/CTDS

**SAIV A/S**  
Nygardsviken 1, 5164  
Laksevag, Norway  
Tel: +47 56 11 30 66,  
Fax: +47 56 11 30 69  
E-mail: info@saivas.no  
Website: www.saivas.no  
Contact: Gunnar Sagstad

**SAIV A/S**  
*Environmental Sensors & Systems*

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

**NEW INDUSTRIES**  
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.

# OCEAN INDUSTRY DIRECTORY

## SUBSEA TECHNOLOGY

KONGSBERG MARITIME AS – SUBSEA DIVISION  
(DIVISION OF KONGSBERG GROUP)  
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NO-3183 Horten  
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Kongsberg Maritime is a marine technology company providing innovative solutions for all marine industry sectors including merchant, offshore, subsea, naval and fisheries. The company delivers systems that cover diverse maritime applications. Within subsea, Kongsberg Maritime's sonars, Sub-bottom profilers, multibeam and single beam echo sounders, cameras, positioning and underwater communication & monitoring systems, instruments, software and Marine Robotics are used in survey and inspection operations worldwide. Working closely with customers to develop technology that pushes the limits in subsea applications, Kongsberg Maritime is also dedicated to developing innovative environmental monitoring solutions such as the K-Lander system in addition to cutting-edge Marine Robotic platforms such as the futuristic Eelume vehicle.

## UNDERWATER VEHICLES/AUVS

HYDROID, INC.  
a subsidiary of Kongsberg Maritime  
1 Henry Drive  
Pocasset, MA 02559  
Tel: +1 508 563 6565  
Fax: +1 508 563 3445  
E-mail: [glester@hydroid.com](mailto:glester@hydroid.com)  
Website: [www.hydroid.com](http://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.

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Website: [www.iver-auv.com](http://www.iver-auv.com)  
Contact: Jim Kirk



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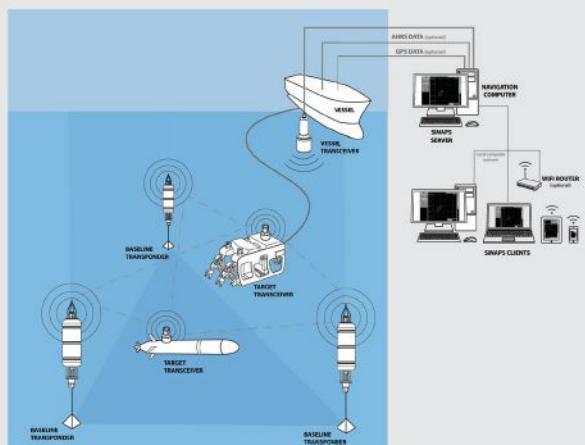
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