ROV PLANET

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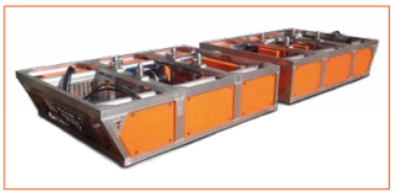

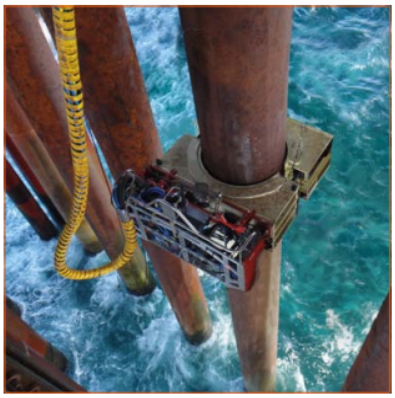

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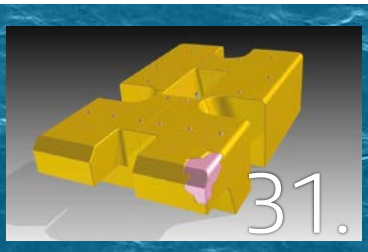
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WELCOME TO ROV PLANET

My name is Richie Enzmann, and allow me to welcome you all to the latest issue of ROV Planet!

Dear Reader,

The offshore industry is finding its way towards the digital future to increase efficiency and reduce costs. This is being spearheaded by leading technology subsea companies such as Oceaneering International. Rod Larson has a great vision for the future of ROV operations that includes big data analytics, machine vision & learning, communications & automation, augmented & virtual realities, and automation & robotics. These are just some of the things that Oceaneering are becoming pioneers and experts within the subsea sector.

This article leads us onto our theme of advanced technologies, communications, and control followed by the Technology Focus on Subsea Lights. Don Pickering talks about the automation of robotic control and draws parallels to space applications. With all these robotics we have an exciting future ahead of us!

Recently I have completed the high voltage and electronics modules of my training course that took me another step closer in becoming an IMCA certified ROV Pilot Technician at the QSTAR ROV Pilot Training Center in Las Palmas. You can read about the course contents and the experiences of other ROV students in case you might want to take the course yourself – if you haven't already done so.

Finally, we are working on our brand new ROV/AUV parts and equipment directory scheduled to be launched in January 2018. This will be printed in 4,000 copies and available online, so please feel free to get in touch if you would like your company to be listed!

Best regards,
Richie Enzmann

UPCOMING EVENTS

5–8 September, 2017 – SPE Offshore Europe'17 – Aberdeen, UK
The largest oil and gas sector trade show in Europe.

18–21 September, 2017 – MTS/IEEE Oceans'17 – Anchorage, AK, USA
World class technical event focusing on marine science and ocean technology.

24 October, 2017 –Underwater Vehicles Conference – Aberdeen, UK
Subsea UK's annual Underwater Vehicles Conference.

1–3 November, 2017 – Oceanology International – Qingdao, China
The event provides domestic and international suppliers the opportunity to capitalise on China's rapidly developing offshore energy and marine industries.

13–16 November, 2017 – ADIPEC Offshore & Marine – Abu Dhabi, UAE
The Abu Dhabi international petroleum exhibition and conference.

30–31 January, 2018 – Undersea Defence Technology (UDT) Asia – Singapore
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FURTHER INTO DIGITAL FUTURE

Rod Larson, President and CEO, Oceaneering International, Inc.

As technological innovations continue to change the world, it is apparent that change happens faster than we thought it would, and that these advancements often steer us in unexpected directions.

In the 1870s, Alexander Graham Bell invented the telephone to improve communication. In 1973, Motorola was the first to produce a handheld mobile phone. Everything changed again when Steve Jobs announced the first iPhone in 2007, and now, just a few years later, iPhones offer access to e-mail, Web browsing, a camera, music, and video. Not only did this industry undergo a rapid pace of change, but it also took us to a place that we couldn't have predicted just a few years earlier.

Courtesy of Oceaneering International

Similarly, there have been seismic changes in the oil industry. The Summerland oil field offshore California, drilled in 1896, was the location of the world's first offshore oil wells. These wells were actually drilled from piers, and the total depth of the wells was approximately 450 feet (137 meters). This field was the launch of our industry into the offshore business.

In 1978, offshore production was conducted in up to 984 feet (300 meters) of water. Twenty years later, production was occurring in 3,937 feet (1,200 meters) of water. Currently, the operating water depth for the Stones field in the Gulf of Mexico is around 9,500 feet (2,900 meters). What will the next 100 years look like?

The only thing we know for sure is that there will be change—and that Oceaneering will be at the forefront of technological innovations that will continue to bring about phenomenal advancements.

BIG DATA AND ANALYTICS

It is expected that, by the year 2020, 1.7 MB of data will be generated per second per every person on the planet— and that only 0.5% of that data will actually be analyzed and used. With this amount of data, finding specific information can be like finding a needle in a haystack. In 2013, Oceaneering formed a group called Global Data Solutions, which focuses on, among other things, gathering data and compiling them in a searchable, user-friendly format. Global Data Solutions has partnered with Microsoft Azure to help our customers move their businesses forward. From the oil field to the boardroom, subsea to satellite, and upstream to downstream, Oceaneering has the data, technology, and subject matter experts to help our customers accomplish their missions.

MACHINE VISION AND LEARNING

Oceaneering is a leader in sub-automation technology for remotely operated vehicles (ROVs), providing remote piloting and autonomous functions. Additionally, machine learning includes such actions as monitoring traffic patterns outside a port and being able to predict traffic congestion. In 2014, Oceaneering acquired AIRSIS Inc., a provider of remote asset management software services to enhance our asset tracking service offered on offshore drilling rigs and vessels engaged in subsea activities. Asset tracking information is used by customers to establish a common operating picture, which improves operational efficiency and enables incident and emergency response collaboration and reporting. This picture collects and displays real-time data associated with an offshore operation, including rig or vessel position, metocean conditions, ROV video, and subsea survey information. Oceaneering's signature service, PortVision®, provides web-based location reporting on commercial vessels.

COMMUNICATIONS AND AUTOMATION

Oceaneering delivers turnkey solutions for networking, video, and voice. With 50 years of marine and offshore experience, Oceaneering provides our customers with the technology and personnel to accomplish the most complex goals in the harshest environments. Our Global Data Solutions team offers communications and IT services worldwide, both onshore and in the most remote offshore environments. We provide real-time data solutions that link rigs, platforms, and vessels with global operations centers. We deliver satellite, cellular, and mesh technologies to ensure that data gets to the right people and machines at the right time. Whether your need is for broadband internet on a rig, or the backhauling of video from vessels, ROVs, platforms, and refineries, our comprehensive solutions enable customers to accomplish their most complex missions.

AUGMENTED AND VIRTUAL REALITIES

In the oil field, augmented and virtual realities are used for planning missions that will include ROVs. By using 3D models of the oil field, along with 3D overlays, operators are able to reduce uncertainties, especially in low-visibility environments. As innovators in the subsea world, we were first in the industry to provide high-definition (HD) video, which provides a complete, easy, and affordable solution for undersea imaging by delivering high-resolution color, video, and digital sound. Operators are able to see their ROV manipulators and the entire work site without panning, allowing pilots to complete tasks more accurately. Now we are taking this technology even further and offering 4K video through our ROV systems, which is taking video detail to a whole new level. With four times the resolution of standard HD video, 4K video provides stunning footage with an incredible degree of detail, and also features higher image definition quality, a much more detailed picture, and better fast-action and larger-projection surface visibility.

AUTOMATION AND ROBOTICS

Our autonomous guided vehicle (AGV) systems provide automated material handling solutions for a wide range of industries and logistics processes. Our AGV systems move work pieces around factory floors or facilities, such as in automotive plants or hospitals; and also move passengers through trackless amusement park rides that we have designed. Our autonomous underwater vehicle (AUV) surveys provide high-resolution geohazard surveys, inspection surveys, archaeological assessments, and government and academic surveys in water depths up to 14,764 feet (4,500 meters). Additionally, we are moving toward next-generation technologies, such as hybrid ROVs that can go on tetherless excursions. There are great things coming with automation and robotics.

Ultimately, cutting-edge technologies have to be effective, reliable, and safe. Oceaneering provides these technologies, along with the support and training to ensure that all of our technologies and services work seamlessly with the other technologies in our customers' portfolios.

While it is hard to predict what the future holds for subsea operations, it is certain that the pace for technological change will be high. Whatever direction this industry heads into, Oceaneering will be there and will play a major role in shaping that future.

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JANUS

THE FIRST DIGITAL UNDERWATER COMMUNICATIONS STANDARD

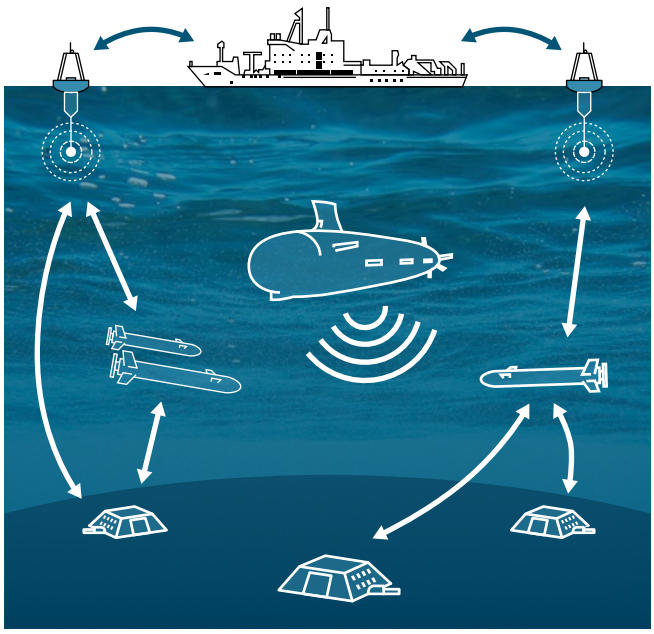
**Dr. John Potter, Principal Strategic Development Officer,
NATO STO Centre for Maritime Research and Experimentation.**

Finally, after 70 years' with only the familiar old 'Gertrude' analogue standard, the support of NATO Allied Command Transformation (ACT) has allowed the NATO STO Centre for Maritime Research and Experimentation (CMRE) to develop 'JANUS'; an open, digital standard. It is sometimes hard to get excited about standards, but they are critical enablers for interoperability, and with this new standard in underwater digital communications, we take the first step towards the underwater version of the smartphone and the Internet of Underwater Things (IoUT). The formal acceptance of JANUS as a standard, by NATO and its 29 nations, comes at the end of a 10-year process of research, development, negotiation, campaigning, testing and refinement to achieve the alignment of key stakeholders in the user, research and industrial communities. While initially established as a NATO standard, JANUS is open and intended to serve both military and civilian applications internationally.

JANUS is not simply a point-to-point communications protocol; it allows the dynamic discovery and integration of underwater nodes into an ad-hoc network, providing a bootstrapping mechanism to create an IoUT. It is deliberately simple and robust, minimising demands on devices, thus maximising backwards compatibility with existing assets. Yet JANUS also allows manufacturers to develop sophisticated decoding algorithms if their devices have the computational and energetic capacity, maximising performance and providing a means to monetise integration of this open standard into communications equipment.

JANUS is the Greek and Roman god of doorways, openings and gateways, and so the JANUS communication standard opens gateways between assets from different suppliers, providing a 'Lingua Franca' with which to communicate. JANUS is also extremely flexible in application, with 256 defined user classes, each of whom can determine up to 64 different templates for data encoding, with optional data trains of arbitrary length, seamlessly appended to the basic 64-bit header. The JANUS Medium Access Control (MAC) mechanism provides a means to 'reserve' the acoustic channel, to allow other (perhaps more optimised or faster) acoustic exchanges to be conducted without interference. Data can be encrypted and application templates need not be published, protecting sensitive information.

JANUS thus opens up exciting new possibilities in the market place, as happened with WiFi in the terrestrial portable devices market. As the first international standard of its type, JANUS has the potential to tame the 'Tower of Babel' in underwater communications, in which each modem manufacturer currently employs proprietary protocols that cannot communicate with devices from a different supplier. It is now possible to develop a wide range of applications, from distributing underwater AIS pictures of vessel traffic and surface meteorological conditions to the co-ordination of heterogeneous autonomous and remotely-controlled vehicles working on a subsea installation, and enabling error-corrected communications with distressed submarines.



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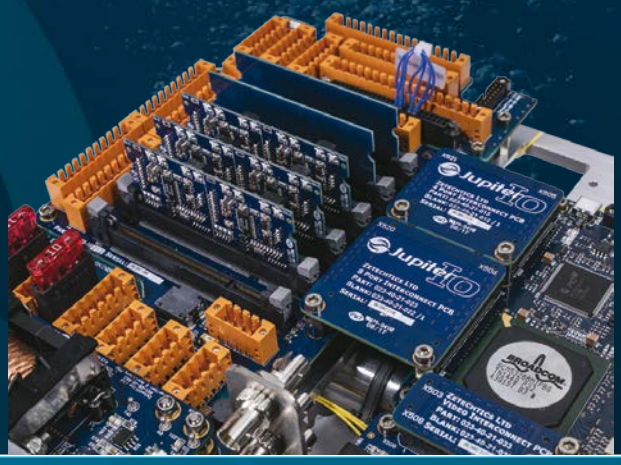

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NEW TECHNOLOGIES DRIVE GREATER ROV CONTROL AND AUTOMATION

by Don Pickering

The offshore energy industry has been a leader in the application of teleoperated robots, specifically ROVs, for remote construction, intervention and manipulation. Routinely using robots to go where humans can't or shouldn't go, subsea services companies and their clients have invested billions of dollars in acquiring and operating costly machinery to support their subsea operations.

Yet despite large investments and the truly mission-critical nature of their operations, ROV operations have changed little in the last decade and today are mostly manual in execution. ROV pilots have to contend with and synthesize a large volume of data on the fly for situational awareness. 3D data, if available, is typically low in resolution. Video data is routinely the most dominant sensor but lacks ranging capability to affect control. The proliferation of higher resolution and lower cost sensors only compounds the problem, burdening pilots with even more data to contend with. The result is subsea operations that are not only error prone but unpredictable and expensive to execute.

The good news is that several technologies have emerged in the last five years that can be leveraged to move beyond manual control – enabling the use of algorithms and sensor data to support the pilot and the robots for safer, more efficient operations. BluHaptics' soon-to-be released DexOS software is the first step of an exciting new era in subsea and teleoperated robotics that has both control and operational benefits over the legacy system. Using only positional data from the arm's sensors, our software enables a novel control framework that is both easier to learn for new pilots and uses mixed levels of automation for increased efficiency and safety. In contrast with the legacy controller that requires joint-by-joint control, DexOS allows the pilot to directly control the movement of the manipulator jaws using a gamepad, a device already familiar to any young pilot with video game experience. The automation features allow the pilot to perform tasks more precisely by, for example, locking movements in a plane, and more efficiently by using positional memory to move elegantly between two important work areas. The superior user interface yields better situational awareness, as well as a visual interface for setting joint limits. The gamepad allows for rapid feature selec-

tion and function adjustments (e.g., speeds). Joint usage times are logged to identify opportunities for preventative maintenance.

Future versions of DexOS will leverage our real-time modeling and machine learning capabilities, and can extend beyond manipulator control to coordinated ROV control as well. GPUs (graphical processing unit) developed for video games will deliver near instantaneous rendering of high-resolution models of the workspace. The end result is a more accurate model of the robot's workspace – and the ability to use that information to support humans in safer and more precise operations, including active avoidance and guidance capabilities.

These assistive technologies will do more than help the pilots execute current work more efficiently and predictably; it will transform how we train and monitor pilot performance and plan and execute missions. But the technology will also change fundamentally how and where ROV operations are conducted, unlocking critical capabilities that will usher in the next area of ROV operations – RROV or resident ROVs.

The cost of putting ships and people at sea is extraordinary: working at sea costs more than 17 times per hour per employee than working onshore. The concept of the automated platform and persistent ROV operations has been around a long time, but we now have the software and building blocks to make it a reality. Supported by augmented and eventual autonomous operations, operators will soon be able to garage ROVs on site. Humans will still oversee operations but will do so from afar, over the Internet or satellite. ROVs that can undock and run routine inspection and light duty maintenance will drive down the costs of offshore operations while providing more diligent inspection capabilities. This is an exciting new era for ROVs; the emergent technologies now being developed will increasingly transform operations while opening up entirely new ways of working under water.

While BluHaptics was initially founded to focus on modernizing subsea robotics operations, there has already been strong interest in leveraging our software in other domains. Earlier this year, BluHaptics won a Phase I SBIR grant with NASA to use our manipulator control software for NASA's portfolio of robotic arms – ones currently in use on the International Space Station and those to be used in future missions on lunar and Mars missions. The same conceptual technology to support subsea pilots will help astronauts more intuitively control and collaborate with robots for everything from remote assembly to satellite repair and systems testing.

The early but growing private space-to-space services industry will change how and what we can do in space – and in many ways will parallel the subsea industry in its use of teleoperated robots for mission execution and sup-

BluHaptics' DexOS control system supports safe and efficient intervention through its intuitive user interface and assistive automation features. (Courtesy of BluHaptics)

port. Space tugs will "tow" satellites to new or corrected altitudes for proper orbital positioning. Space "shipyards" will catch and repair satellites for repair and upgrades, or will assemble components in space to build infrastructure. Drones with manipulators will play the role of ROVs, catching up to and grabbing structures with one arm while performing tasks with the other. And while these capabilities may seem out of this world, the foundations can be seen in our daily operations subsea. Large-scale investment and positioning to build the space-to-space services market is already underway.

These emergent technologies will benefit other industries as well. Nuclear waste mitigation can be more robust and precise. IED and bomb squad robots will become more capable. Manipulation will even make its way to aerial drones, eventually helping in everything from window washing to stringing power lines or painting bridges. Broader adoption and investment in teleoperated robotics will have an exponential effect on human-robot collaboration in many mission-critical activities and bring us ever-closer to full automation.

Don Pickering is the CEO of BluHaptics, a software company based in Seattle using real-time sensor data and algorithms to increase the safety and efficiency of subsea operations.

For more information, please visit www.bluhaptics.com

Courtesy of BluHaptics

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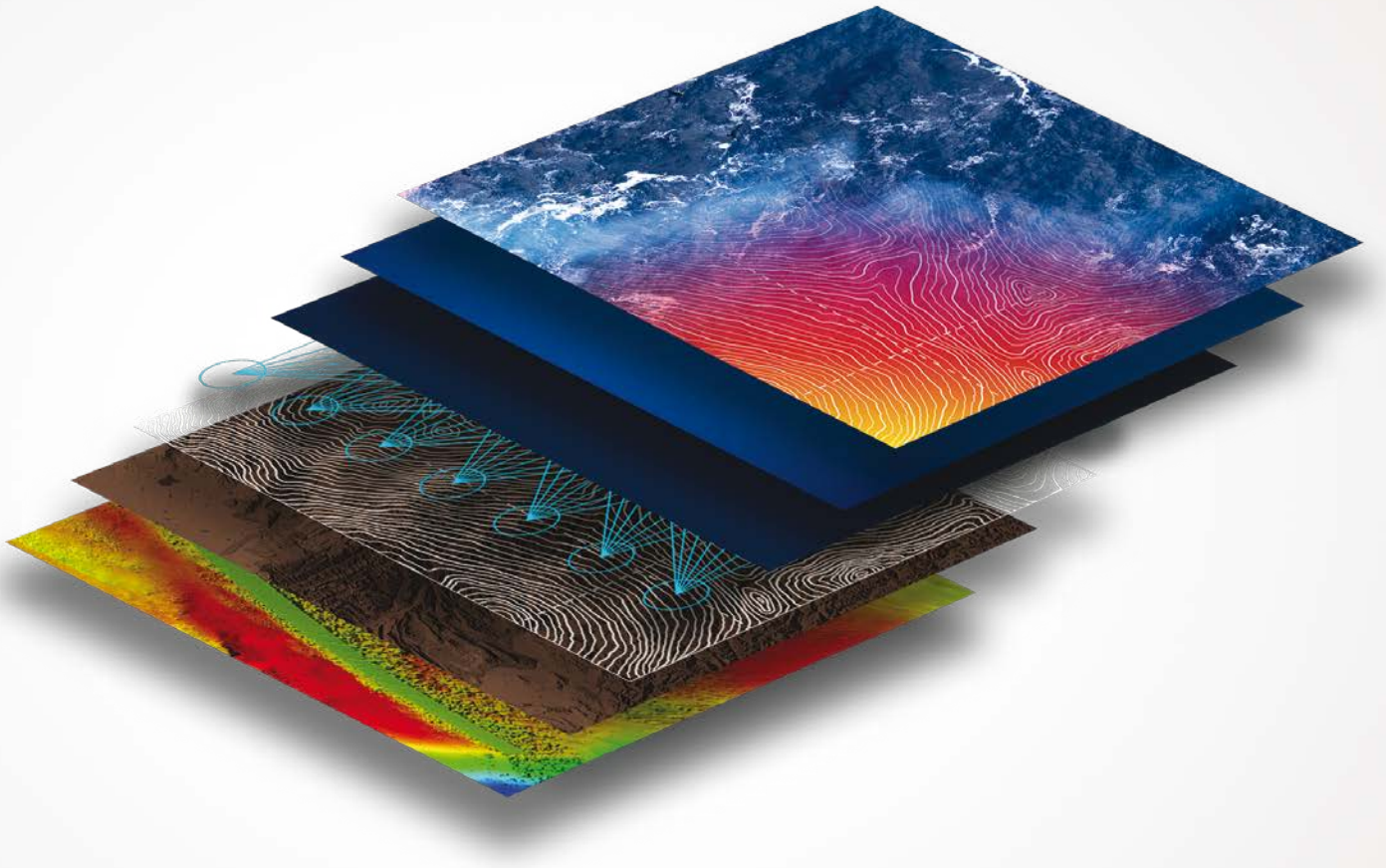

Developed with government and industry associations, in its fifth year, Oceanology International China continues through its structured networking programmes to link Western suppliers with Chinese buyers, enabling them to build relationships and develop business.

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- Networking opportunities with over 5,000 industry players in charge of fast-forwarding the development and exploitation of Chinese marine resources
- An international conference, which is developed with government and industry associations, will connect the latest marine science and ocean technology solutions with China's Blue Market development ambitions

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SMD ATOM FOR SUBMARINE RESCUE OPERATIONS

Soil Machine Dynamics (SMD) Ltd has been awarded a contract to supply 1000m Atom Mk1 work class ROV systems to JFD Ltd, a world-leading subsea operations and manufacturing company. The vehicles are optimised for submarine rescue operations and will be utilised as part of the Intervention element of the 3rd Generation Submarine Rescue System. They are scheduled for delivery late 2017.

As the most compact true work class ROV system available, Atom epitomises a 'less is more' approach. It is an interesting option for those looking for added value as changing market conditions require more cost effective ROV solutions.

To date, convention has dictated that only electric ROVs can have a small on-deck footprint and that a work class vehicle requires far more space. Atom breaks this convention as its deck spread is compact and comparative in size to an electric ROV. Atom retains its work class DNA of toughness and uses a lightweight metal space-frame construction. Vehicles of similar size tend to use less rigid plastic construction. Atom also retains work class performance allowing the operator to carry out tasks in a wider range of sea conditions and operate a wider range of tools. This gives customers the best of both worlds - small size and high performance in one cost effective package. The small size and lightweight design of Atom is demonstrated by this recent contract from JFD which requires the entire system to be air transportable.

Although small, Atom is able to carry a large payload within the vehicle frame, which is important for performance when compared to ROVs that need additional underslung skids. For JFD this payload will be three emergency life support pods (for delivery to a submarine) as well as jetting tools

Courtesy of SMD

and cutters. This ability is especially important when a vehicle needs to operate in all conditions and pertinent to sectors where high current operational ability is important such as defence and renewables.

Tooling power is also abundantly available with 75kW (100hp) on tap if required. As a result this little vehicle can operate all but the most powerful underwater tools with it being especially good at running power hungry jetters and dredge pumps. Atom uses well established Curvetech® components which have recently been successfully tested to prove operational reliability up to 6000m.

For the recent JFD order, SMD will be using its 64 cubic metre in-house test tank which is used for pre-delivery test and acceptance. SMD will be demonstrating Atom's impressive thrust capability to the client as part of its testing.

The vehicle has established a good reputation in a range of markets and has been used for salvage, drill support, survey and construction projects. Showcasing its versatility, Atom has been able to withstand challenging operational environments, varying from very shallow waters and high currents to scorching temperatures, all of which can cause significant problems for work class ROVs.

Sistac, a key player in the oil and gas market for inspection, maintenance and repair services in Brazil, stated: "Overall Atom has performed well, it is a robust vehicle which requires very little maintenance and it is reliable and watertight. Our client Petrobras is very pleased with Atom's ability to operate in high temperature shallow water, which is a feature we have not seen on a WROV vehicle previously."

Given Atom's unique profile and the operational benefits it provides, SMD is working hard to dispel preconceived ideas that exist in a market that attaches ROV size and power to capability. As things change in the subsea market, interest in smaller vehicles such as Atom is on the increase.

SMD realises that providing reliable hardware is only half the story and that customers also expect the very best support. SMD Services was established in response to customer support demands in a changing market place. Set up to deliver outstanding global service centred around the customer's needs, the Services business has grown rapidly in its first year of operation.

SMD Services ensures that customers enjoy optimised asset performance and maximum utilisation, providing the maximum return on the investment initially made in an SMD asset. Proactive technical support activities and the provision of a full range of asset life cycle services are core to this offering. The services offered include asset management; refurbishment, maintenance and upgrade services; project and design engineering support; offshore support; 24/7 technical support; intelligent spares support mission planning and training.

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Scott McLay, Sales Director, Tritech International Limited

In an ideal world, ROV operators would have unlimited access to ocean conditions which allow for expedited ROV tasks and procedures. However, the unfortunate reality is that water conditions are generally dismal, murky, and indeed unpredictable. Whilst an ROV equipped with a mechanical imaging sonar can operate satisfactorily in unfavourable conditions, this type of equipment occasionally has technical limitations.

Multibeam sonars afford contractors a more sophisticated alternative when faced with challenging environmental conditions. Thus, Tritech's Gemini multibeam sonar offers a superb technical solution with regards to inclement conditions, and is an enhanced alternative to conventional sonar systems. Already widely used by a wide range of commercial operators, the Gemini sonar provides ROV systems with improved imaging performance to get tasks done safely and quickly in unfavourable conditions.

Classed as a mechanical scanning sonar, Tritech's Super Seaking sonar requires that the acoustic pulse reaches the maximum distance being scanned and waits for a return before the transducer can rotate to the next position (Fig 1).

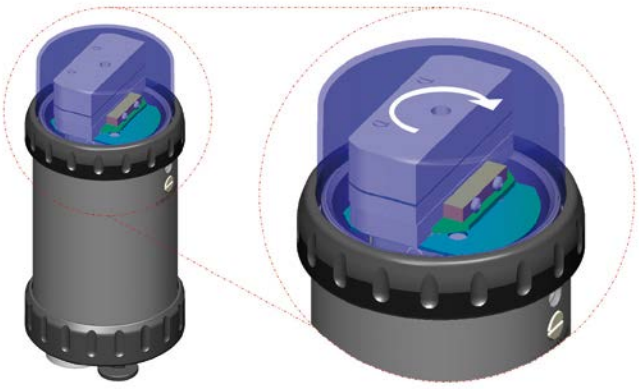


Fig.1: Mechanical scanning sonar. (Courtesy of Tritech)

The interval time allows for the production of a high quality detailed Sonar image in front of the ROV. Approximately 8 seconds is required to generate a detailed picture from a 50m range, covering a 120-degree field of view. A multibeam sonar can update this full 120-degree scan in less than 1/10th of a second. Hence, when ROV operators encounter difficult conditions the multibeam sonar quickly generates far more data which can give a clearer view of the task at hand, as well as the course of the ROV system.

To recap, the features of a multibeam sonar are hugely beneficial on a moving platform, such as an ROV, where sea conditions can alter dramatically. In addition, the rapid update rate capability of multibeam technology allows these sonars to be used for a multitude of supplementary tasks, not just ROV operations. The significantly higher update rate achievable from a single acoustic transmission covering a wide sector thus enables users to use the multibeam sonar for object recognition and/or tracking operations.

MUTIBEAM SONAR BEAMWIDTH

Multibeam sonars such as the Tritech Gemini use a transmitter to convert electrical energy into sound energy when located in the water and over a wide sector (transmission). A separate receiver is formed as a linear array of multiple elements, and is used to convert sound energy from the same wide sector back to electrical energy (reception). The transmitter is curved over an arc of angle 'A' and with a height 'H' (Fig 2) which determines the horizontal and vertical acoustic beamwidth for a specific frequency.

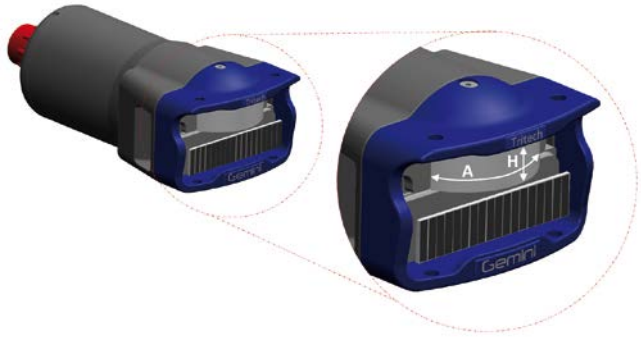


Fig.2: Multibeam transmitter. (Courtesy of Tritech)

The horizontal beamwidth is significantly larger than the vertical beamwidth; during transmission electrical energy is converted into a wide fan of sound energy in the water, in a direction normal to the front face of the centre of the transmitter.
The receiver is a linear array containing multiple elements. Each element has a width 'W' and height 'H' that determines the horizontal and vertical acoustic beamwidth, for a given frequency of that element (Fig 3).

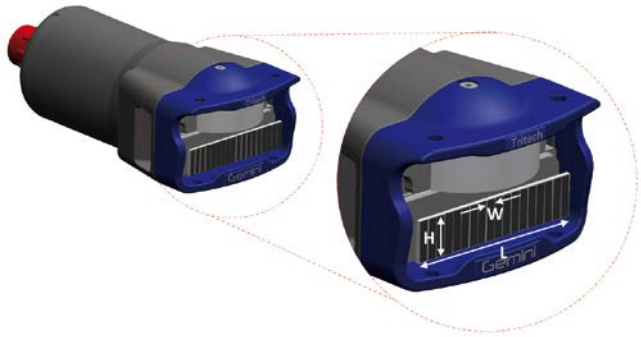


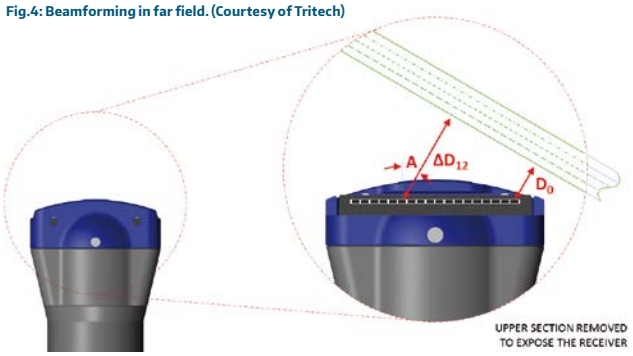
Fig.3: Multibeam receiver. (Courtesy of Tritech)

The vertical beamwidth of the receiver typically matches the vertical beamwidth of the transmitter to maximise overall sensitivity. All the elements are identical, and when positioned side by side the overall length of the array 'L' determines the horizontal acoustic beamwidth for a given frequency of the receiver. To obtain a reduced horizontal acoustic beamwidth the array would have to be increased in length.
By transmitting sound energy over a wide fan, any sound energy originating from targets within the wide fan will be converted into electrical energy. This is performed by each element in the linear receive array.

FAR FIELD BEAM FORMING

The sound energy in the far field emanating from a target normal to the receiver (an echo of what was transmitted) will be received by every element in the array at practically the same time. Much in the same way a mechanically scanning sonar works – by timing how long it takes for sound energy to be received and knowing the speed of sound in water – the spatial distance of a return from a target can be calculated. The strength of the return from a target can also be calculated by observing the magnitude of the sound energy received, and compensating for any losses as the sound travels through the water.
The beam normal to the receiver is formed by the accumulation of the sound energy across all elements in the array. The beamwidth of this beam is determined by the length 'L' of the array for a given frequency. All other beams, not normal to the receiver, are formed individually by the accumulation of the sound energy across all elements in the array. These are delayed depending on the angle 'A' of the beam with the delay applied to each element determined by the extra distance 'ΔD' travelled to that element (Fig 4).

Fig.4: Beamforming in far field. (Courtesy of Tritech)



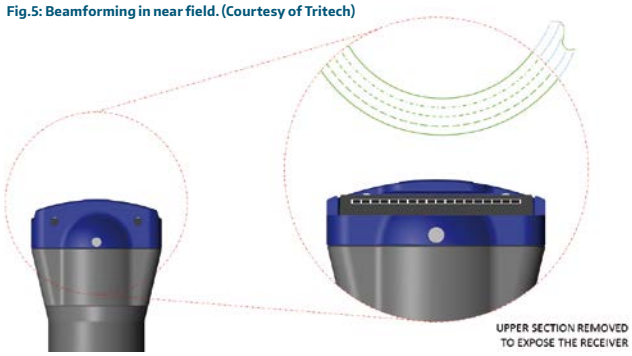
Knowing the speed of sound in water, the delay can be expressed in time rather than distance. Built in speed of sound sensors on the Gemini multibeam accurately and continuously, ensure that the delays applied generate the most representative image. Thus, Tritech's imaging multibeam sonars provide true Time Delay Beamforming (TDB).

NEAR FIELD BEAMFORMING

The sound energy in the near field from a target normal to the receiver (an echo of what was transmitted) will be received by every element in the array at different times. This is because sound energy emanating from a single point travels in an arc of ever increasing diameter. Indeed, an echo from a target in the far field also generates an arc of sound energy. However, once the distance is significantly great, the portion of the arc that ensonifies the receiver can be considered planar, and therefore treated as a straight line.
Forming beams from an arc of sound energy in the near field follows the same process as that of the far field. However, in this case the delay applied to each element is determined by the curvature of the arc as well as the angle of the beam. The curvature of the arc changes with distance from the receiver

and angle. By compensating for the curvature of the sound energy, Tritech's multibeam sonars with TDB provide near field focusing allowing image formation down to 0.2m range.

Fig.5: Beamforming in near field. (Courtesy of Tritech)



In order to build up an image over a sector, beams are formed simultaneously at multiple angles. This is achieved by applying a different set of delays to the elements and accumulating. The acoustic beamwidth of the array – determined by the apparent length of the array – is dominant. Therefore, whilst it is possible to form numerous beams within one steered acoustic beamwidth, forming significantly more beams does not improve the image.

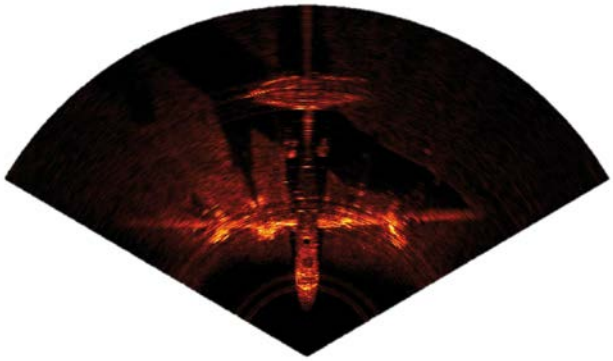


Fig.6: Example of a multibeam image. (Courtesy of Tritech)

Tritech's multibeam sonars provide high quality sonar imagery at video frame rates several orders of magnitude faster than a traditional mechanically scanning sonar. Consequently, this capability maximises the effectiveness of subsea operations and allows completion of tasks sooner, with a higher degree of safety and accuracy.

IMPROVING IMAGE QUALITY

Range resolution is defined as the ability to distinguish in range between two targets on the same beam. As sound energy transmitted into the water is typically a continuous wave pulse, a longer pulse is required to detect targets at longer ranges as this improves the signal to noise ratio. However, the length of the continuous wave pulse determines the range resolution and as a result the range resolution reduces when detecting targets at longer ranges. To overcome the limitation in resolution at longer ranges – where increase pulse length is required to overcome the sound absorption – Tritech utilises Compressed High Intensity Radar Pulse (CHIRP) techniques.

CHIRP is a swept frequency, rather than a continuous wave. Regardless of the length of the pulse the range resolution remains constant as it is determined by the bandwidth of the CHIRP signal. Tritech's latest generation of multibeam imaging sonars provide both continuous wave for short range, and CHIRP for longer range operation.

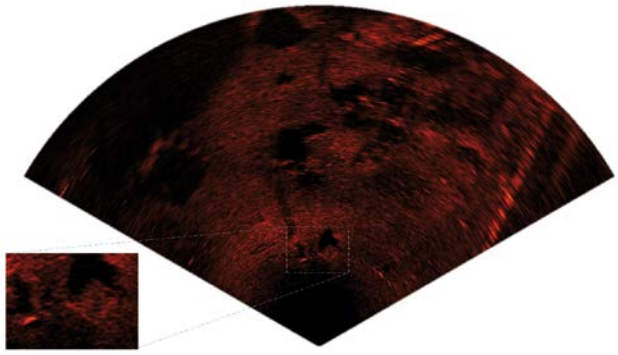


Fig.7: CHIRP zoomed in image. (Courtesy of Tritech)

ADVANCED REAL-TIME PROCESSING

With the capacity for real-time processing of high resolution data, the Tritech multibeam sonars can be utilised to continuously monitor targets and perform detection, classification, and tracking of sonar acquisitions. Accordingly, the multibeam sonar is suitable for complex tasks which in turn can be automated, removing the requirement for constant operator monitoring.

REAL TIME INTEGRITY MONITORING (RAMS®)

RAMS® – a real-time integrity monitoring system – exploits real–time multibeam processing to monitor the position and movement of targets located under Floating Production Storage and Offloading units (FPSO). By monitoring and processing the data from these targets in real-time, the multibeam analyses the data and alerts the operator to irregular movements. This advanced monitoring provides an automated early warning system regarding events which could potentially result in an environmental disaster.

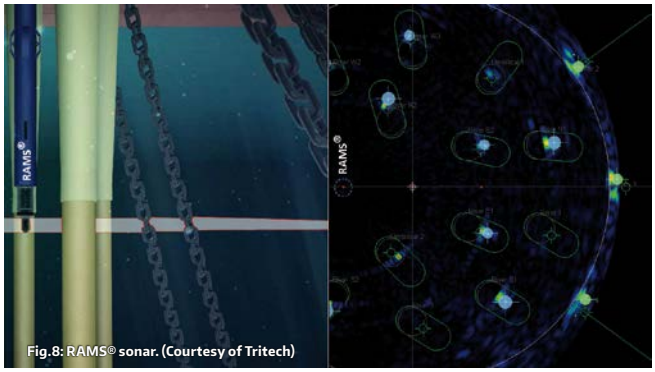


Fig.8: RAMS® sonar. (Courtesy of Tritech)

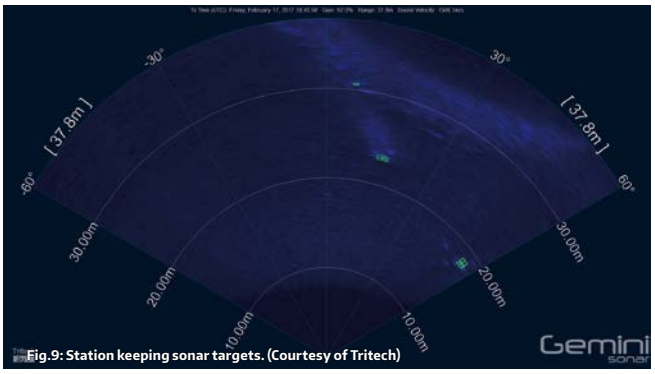


Fig.9: Station keeping sonar targets. (Courtesy of Tritech)

STATION KEEPING

Tritech's multibeam sonars with real-time processing can be used on ROVs to continuously track one or more targets and provide information about the position of the target(s). Using the Gemini software, the operator selects the target(s) of interest, which are then continuously highlighted on the display. Real-time processing is then performed, tracking the target(s) and providing position information on each target that has been selected. This information can then be used by the ROV to automatically drive thrusters and maintain a pre-defined range and/or bearing from the target. Sophisticated SeeByte® target tracking algorithms are utilised within the Tritech software, offering enhanced ROV control capability from the Gemini multibeam sonar.

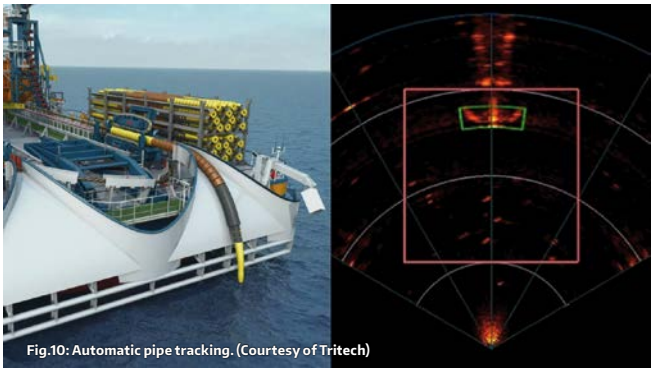


Fig.10: Automatic pipe tracking. (Courtesy of Tritech)

PROFILE TRACKING

In terms of profile tracking, the multibeam sonar is positioned to ensonify a cross section of a pipe or cables being deployed or recovered by a pipe-laying vessel. Real-time processing detects and tracks the position of the pipe relative to the sonar and provides continuous feedback to operators of the position of the pipe. It also alerts the operator if the target moves outside of a predefined target area. This information can also be presented to the operator in a simplified display, removing the need for an experienced operator to interpret the data.


Fig.11: Tidal turbine installations. (Courtesy of Tritech)

MARINE LIFE DETECTION – RENEWABLE ENERGY

Installing and operating tidal turbines results in concerns regarding the environmental impact on marine life. These concerns have been addressed by utilising advanced real-time signal processing within the Gemini multibeam, along with custom SeaTec software. The multibeam sonar performs real-time processing of all targets, classifying those which are potential targets of interest and tracking them. With this invaluable information regarding marine life activity made available to the tidal turbine operator, concerns regarding environmental impact can be readily addressed.

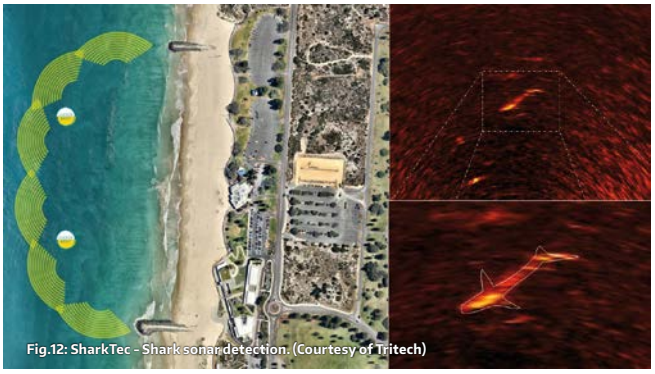


Fig.12: SharkTec - Shark sonar detection. (Courtesy of Tritech)

SHARK DETECTION – BEACH PROTECTION

The marine life detection system developed for tidal turbines has been modified by Tritech, resulting in SharkTec, which has been installed to protect beaches around Australia. The multibeam sonar based shark detection system consists of a number of sonars positioned on the seabed surveying the sea in front of them. These sonars overlap to create a virtual net, protecting the beach and enclosed water, and continuously monitor the area between two headlands to detect the presence of any sharks. Shark activity is tracked in real-time with alert information provided to the lifeguard by satellite. This allows for remedial action to be undertaken as and when is necessary.

EVENT – OCEANS'17 ABERDEEN

CONFERENCE SUMMARY

Aberdeen, Scotland – The Marine Technology Society (MTS) and the IEEE Oceanic Engineering Society (OES), cosponsored the "OCEANS '17 MTS/IEEE Aberdeen", from 19-22 June 2017, at the AECC in Aberdeen, Scotland. OCEANS Aberdeen was the 60th edition of this premier global ocean engineering and marine technology forum.

"The overall conference was a great example of local Scottish marine technology, and, at the same time, brought to Aberdeen marine science and technology experts from around the globe," said Professor John Watson, Chair for OCEANS Aberdeen. Over 25 countries were represented at the four-day conference by 775 attendees. Over 480 marine technology papers were presented during the conference. Subjects ranged from subsea engineering and operations, optical sensing, imaging and instrumentation, fisheries and aquaculture, to exciting cutting edge technologies like marine renewable energy, and unmanned underwater vehicles in defense applications.

OCEANS Aberdeen featured over 43 exhibitors, including local companies and exhibitors from as far away as Japan. The Gold Patron for OCEANS Aberdeen, was SUBSEA UK. Other supporters included the University of Aberdeen, Robert Gordon University, Visit Scotland, AECC, Visit Aberdeenshire, Kongsberg, International Oceans Systems, DECOM North Sea and ROV Planet.

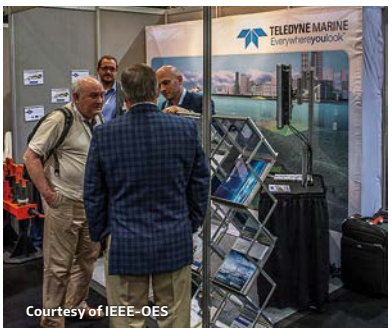
Donna Kocak, President of MTS, and Christian de Moustier, President of OES, stated jointly "We were delighted with this venue, conference, and the quality of the attendees. OCEANS has an amazing 60-year history and an equally bright future."

The Plenary speakers at the 60th Anniversary of OCEANS included: Professor Dame Anne Glover, University of Aberdeen, Dr. Gareth Davies, Aquatera, Dr. Stef Kapusniak, SMD and Dr. Eric Delory, Plocan. A robust Student Poster Competition (SPC) was also part of the OCEANS Aberdeen conference, sponsored by the U.S. Office of Naval Research (ONR) and the two sponsoring societies, MTS and OES. The winners of this year's competition were Klemen Istenic from the University of Girona (First Place), Bilal Wehbe from the DFKI Robotics Innovation Center (Second Place), and Habib Mirhedayati Rouds from Dalhousie University (Third Place). The winners of the SPC receive $3000, $2000, and $1000 prizes, respectively, and all twenty competitors' travel expenses are paid for with funding from ONR, MTS, and OES.

Courtesy of IEEE-OES

Courtesy of IEEE-OES


Courtesy of IEEE-OES



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EMBRACING NEW REALITIES

SPE Offshore Europe 2017 is taking place at a time when confidence levels are gradually climbing following the longest and most significant downturn the oil and gas industry has seen in decades.

Over four days, under the central theme Embracing New Realities: Reinventing our Industry, 65 free-to-attend technical presentations and a programme of business breakfasts and topical lunches, will provide opportunities to debate, knowledge-share and take new courses of action that will shape the future of the industry.

The 2017 conference chair, Catherine MacGregor, and her executive committee of 17 senior international industry figures, have put together a focused and hard-hitting keynote programme that will tackle the issues the industry is facing as it adjusts to the realities of the 'new normal'.

Catherine MacGregor is also president of Schlumberger Reservoir Characterization Group, said: "The industry's technical and financial performance has been challenged for some time now. Learning the lessons from the most severe downturn for the past 30 years, there is no doubt that the industry must reinvent itself. The traditional industry response to market downturns, which has included halting exploration investment, decreasing development activity, pressing for price reductions throughout the supply chain, and letting talented people go, is no longer viable."

CONFERENCE PROGRAMME

The opening plenary session promises a packed hall with the most top-level line-up of industry CEOs in several years. Ben van Beurden, CEO of Royal Dutch Shell; Bob Dudley, group chief executive of BP; Pedro Parente, CEO of Petrobras and Robin Watson, CEO of Wood Group will address the hundreds of visitors attending the opening plenary.

Eleven panel sessions will cover the gamut of topical issues that are relevant in the current climate: from people safety, big data, cyber and physical security, transformative technologies, sustainability and decommissioning to new business models for mature basins, making capital work, the talent pool, breakthroughs in supply chain effectiveness and learning from other industries.

OE & ME

SPE Offshore Europe 2017 has the strong support of leading industry figure Sir Ian Wood who has kicked off a new campaign ahead of the event to encourage visitors, exhibitors and speakers to share their experiences of OE past and present. Sir Ian was the first contributor to OE & Me, an online hub which invites people to share their stories of Offshore Europe. To contribute, visit the OE website: www.offshore-europe.co.uk/oeme

DECOMMISSIONING

A new event feature for 2017 is the Decommissioning Zone, which will include a themed exhibition hall for decommissioning technology and service providers and a conference programme that is being organised by key industry associations Decom North Sea, IMechE, ITF and SUT. Independent North Sea operator Fairfield Energy, which is in the process of decommissioning the Greater Dunlin assets, will share details of progress.
www.offshore-europe.co.uk/Decommissioning-Zone

EXHIBITION

The exhibition floor is seeing a diverse range of new companies booking space for the first time as well as the return of several of the industry's major players. A large international exhibitor presence will be present with 20 national and international pavilions booked so far including Canada, Italy, Netherlands, Nigeria and USA.

TECH TREK

Another first for 2017 is Tech Trek, which will highlight exciting new technologies, products and solutions launched within the last 12 months. Each exhibitor is invited to submit up to three products for consideration with the final selection made at the discretion of the organisers:
www.offshore-europe.co.uk/tech-trek

SPE Offshore Europe 2017 promises to be an agenda setting conference and exhibition, embracing the topics that will shape the industry for the next ten years and beyond. As Sir Ian Wood says: "If you decide not to go there, you are actually missing on probably the biggest learning opportunity in terms of changing your business."

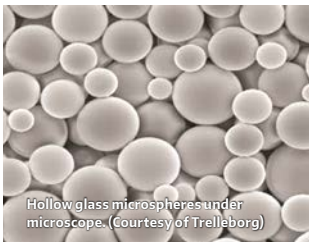
TRELLEBORG COMBINING GLASS & AIR TO CREATE CUSTOM BUOYANCY

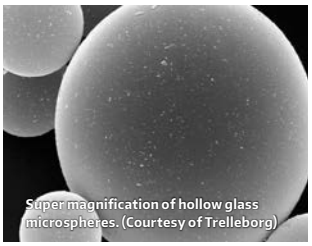
Bob Kelly, Managing Director, Trelleborg Applied Technologies

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

Through the use of high-tech Hollow Glass Microspheres (HGMS), the issue of weight for deep-sea exploration vehicles can be overcome. By combining glass and air, manufacturers can incorporate high performance microspheres into a wide range of polymer and resin systems to create composite solutions – such as subsea foam buoyancy – which meet both demanding strength and weight specifications.

Courtesy of Trelleborg


Hollow glass microspheres under microscope. (Courtesy of Trelleborg)


Super magnification of hollow glass microspheres. (Courtesy of Trelleborg)

HOLLOW GLASS MICROSPHERES

HGMS may appear to the naked eye to resemble a fine, white, free-flowing powder. However, under magnification the near perfect spherical shape of these glass bubbles is revealed. Typically they are used as alternatives to conventional fillers and additives such as silica, calcium carbonate, talc, and clay.

The key properties of low density HGMS are their light weight and strength. Incorporating them into buoyancy products allows ROV manufacturers to dramatically reduce the density and weight of a vehicle's buoyancy, while improving its dimensional stability and impact strength. HGMS have the potential to half or even quarter the weight of buoyancy, and with a proportionally higher volume compared to a solid filler, they can significantly reduce the weight of buoyancy without compromising its physical strength and integrity.

CUSTOMISED FOR DEMANDING ENVIRONMENTS

Thin walled, hollow glass microspheres can be customised via surface treatments, material chemistry selection, density specifications, or particle size distribution. This allows them to be tailored to meet demanding strength, weight and electrical specifications for customers in a variety of markets. For buoyancy applications, HGMS can be incorporated into a wide range of polymer and resin systems and replaced or combined with other materials to create composites, many of which are used in demanding offshore environments.

The unique properties of HGMS can be modified to enhance specific properties of the buoyancy package a customer is looking to achieve, for example high strength to weight ratios, specific uplift targets, or high temperature resistance. In addition, manufacturing syntactic foams with customised HGMS allows the surface chemistry of the microspheres to


ROV blocks being machined onsite at Trelleborg's Boston location. (Courtesy of Trelleborg)


Eccospheres manufactured by Trelleborg being weighed before testing. (Courtesy of Trelleborg)

be enhanced. This has shown the benefit of improved adhesion properties within the matrix, adding performance value to the composite system by simultaneously increasing the composite's moisture resistance and strength.

With this in mind, most buoyancy manufacturers will offer several grades of buoyancy for deep-sea exploration vehicles, which can be further customised to meet the specific needs of the customer.

IN-HOUSE TESTING

When choosing a supplier for buoyancy with remotely operated vehicles, manufacturers should look for a company that not only manufactures HGMS, but can also carry out in depth testing. This should include testing for density, strength, moisture content, and more, before the HGMS are incorporated into composite buoyancy systems. Following this, the finished buoyancy package should then go through its own testing to ensure the final product meets the density, weight, and strength parameters for the project.

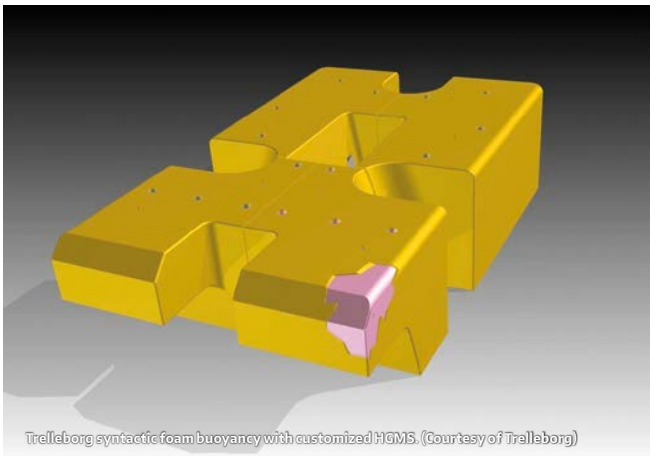
Typical buoyancy tests that should be performed on the final package include:

- 1. HYDROSTATIC TESTING of full cubic feet buoyancy blocks
- 2. CYCLE TESTING for 1,000 times
- 3. FULL TESTING to hydrostatic pressure on random samples
- 4. 10% OF MANUFACTURED BLOCKS TESTED at service pressure for 24 hours

CASE STUDY

Trelleborg's applied technologies operation recently engineered and manufactured a custom syntactic foam buoyancy package for the Schmidt Ocean Institute for use on its new ROV, SuBastian.

The Schmidt Ocean Institute underwater robotic research program includes the design and development of a 4,500 meter robotic vehicle for use on research vessel Falkor. The ROV is outfitted with a suite of sensors and scientific equipment to



Trelleborg syntactic foam buoyancy with customized HGMS. (Courtesy of Trelleborg)

Finished ROV unit being tested in the onsite buoyancy pool. (Courtesy of Trelleborg)

support data and sample collection, as well as interactive research, experimentation, and technology development. The buoyancy package on SuBastian is made from Trelleborg's Eccofloat TG30, a high performance syntactic foam.

Bob Kelly, Managing Director within Trelleborg's applied technologies operation, says: 'We are very proud to be part of this pioneering adventure and to work with Schmidt on developing a syntactic foam that met their requirements. One of the challenges with deep water syntactic foam is producing the lightest possible foam for a given depth, which translates into maximum uplift or buoyancy for the vehicle. A high strength to weight ratio means our customers get the industry's maximum uplift or buoyancy per cubic foot, allowing them to design their vehicle with a lower volume buoyancy package, reducing costs and improving vehicle performance and handling.

'We were able to create the precise buoyancy package needed for SuBastian, ensuring success for the future commercialisation of this project. The unique customisable design coupled with the selection of Trelleborg's proven Eccofloat material will provide many years of service, with the flexibility to adapt to all future equipment and mission requirements.'

The SuBastain ROV is designed to go to depths of 4,500 meters / 2.8 miles, which is deeper than the average ocean depth of 3,700 meters / 2.3 miles. Trelleborg's Eccofloat TG30 is designed for a service depth of 5,000 meters / 3.1 miles. The ROV is suitable to support high resolution seafloor mapping, photomosaicing, video and image gathering, and collections of rocks, animals, and seawater samples. It is equipped with a versatile array of power and data interfaces to enable integration of a wide range of add-on deep-sea instruments and samplers that oceanographers may need to support their deep-sea research.

AUTHOR:
BOB KELLY
MANAGING DIRECTOR, TRELLEBORG APPLIED TECHNOLOGIES

FINAL THOUGHTS

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

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

ROV SuBastian sea trials. (Courtesy of Schmidt Ocean Institute)

ROV SuBastian at sunset. (Courtesy of Schmidt Ocean Institute)

PANOLIN have been supplying high performance readily biodegradable oils into Offshore industries for many years and pride themselves as being at the forefront of this technology.

Recently Bosch Rexroth introduced their impartial test procedure RDE 90235 to reflect modern hydraulic conditions, PANOLIN are delighted to be the first eco-friendly hydraulic oil to be evaluated and listed on the RDE 90245 Fluid Rating List.

The test devised by Bosch Rexroth assesses performance up to 500 bar at both high and low temperatures to ensure that the oil meets increasingly high demands of modern hydraulic systems, such as higher working temperatures & pressures, motor speeds, shorter circulation times, smaller reservoirs and shorter rest times.

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Multiray technology equips a single LED SeaLite with two LED colors, beam patterns, or both.

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- **Multiple lights** in one fixture saves space, time, and cost
- **Less downtime** reconfiguring lights between missions
- **Flexible control** with SeaSense™ serial commands, or switch between settings with power cycling

Contact us today for more information: 1 800 487 3775 sales@deepsea.com www.deepsea.com/multiray

Courtesy of Aleron Subsea

THE GLADIATOR CONTROL SYSTEM:

DYNAMIC REFURBISHMENT THAT RETAINS QUALITY AND SAVINGS

Gary McConnell, Business Development Manager, Aleron Group

Aleron Subsea was founded in 2009 as an independent provider of ROV's and associated equipment for the global ROV market. Aleron specialise in refurbishing, servicing, and upgrading ROV systems. This has led to the development of our own in-house ROV components, including hydraulic thrusters, valve packs, compensators, and a control system package.

Courtesy of Aleron Subsea

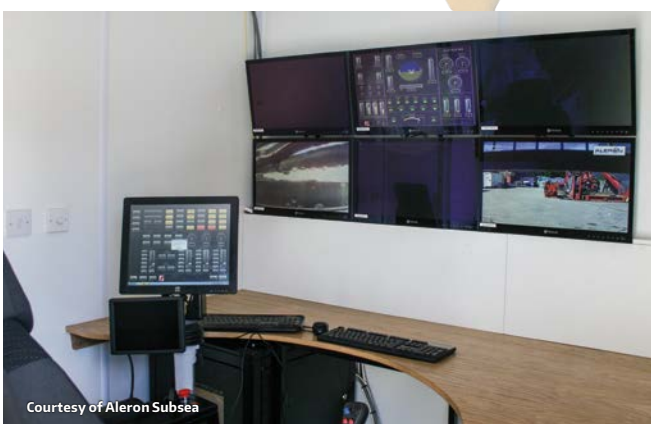
We stock a range of work class systems, winches, A-frames, and much more at our base in Aberdeen, Scotland. We also have the ability to manufacture ROV tooling through our sister company, ROVQUIP Ltd. They were established in 2014 as a complimentary company to ours, and they assist us in providing a comprehensive equipment portfolio for our subsea clients.

In 2016 Aleron Subsea developed and launched our AUXROV system. AUXROV was built for operating large underslung tools such as mass flow excavators, hydraulic grabs, shear cutters, and survey skids initially to be used in the renewables market.

This year Aleron achieved a key milestone by retrofitting our Gladiator Control System into a third party, work class ROV. A 2005 Triton XL was upgraded and renamed GXL1, with the Gladiator control system replacing all of the previous ageing electronics. The POD's were cut back from the original power, fibre, and control POD's down to just one combined unit. This combined model utilises the original control POD itself modified to accommodate the new electronics.

The ethos of the Aleron Control system is the ability to upgrade ageing ROV systems with a cost-efficient control system that utilises existing hardware wherever possible. We have designed boards that can be fitted to control existing servo valve packs. Meanwhile our main board can be used to control any cameras (Tristate and Serial) and lights (analogue and serial). Therefore the aim is to retain as much of the expensive-to-replace hardware as possible.

Our master board is a common feature throughout the system. Used in our valve packs, POD and topside rack, the master board transmits a vast amount of data through a single PCB. Also, by having a multi-function single board we reduce the amounts of spares required.



Courtesy of Aleron Subsea

Courtesy of Aleron Subsea

The number of PCB's throughout the system has been greatly reduced by keeping as much of the processing in the software as possible. This means that the software must be user friendly and easy to fault-find when components do fail. This is done by utilising our extensive diagnostics pages to aid the operator in locating and isolating the problem until the ROV can be taken back to the deck to be repaired. Custom pages can be added to the software if the client requires something project-specific, or needs the functionality to be changed slightly.

This is something we can do easily. Our main control PCB gives the operator 32 digital outputs which can control relay boards for high current sensors, as well as 8 analogue outputs, 4 camera tri state controls, 16 analogue inputs, 8 digital inputs, 2 PT temperature sensor inputs, and a built-in ground fault detection system for the low voltage sensors.

The MUX is modular and can be augmented easily; we offer 3×1 GB Ethernet, 6×SD video, and 24× serial channels as standard. There are modules available for upgrading to HD, PECL, or ArcNet, in addition to adding a RS232 or RS485 trigger board, additional serial channels, or many other optional extras. We are always pushing the limits of what technology we can utilise on our ROV's. To that end, if there are requirements that need a special MUX arrangement then we are happy to source a specific setup that works for all parties.

In an era of cost saving and cost consciousness throughout the oil and gas industry, many of our clients are examining their existing assets to see how they can be best utilised. Previously these would have been replaced as the electronics became expensive and difficult to support. Now, however, a control system upgrade can provide the perfect opportunity to overcome this issue and increase the life span of the asset at a fraction of the cost of replacement.

MULTIRAY™ LED SEALITE®:

DO MORE, SEE MORE

by DeepSea Power & Light

DeepSea Power & Light (DSPL) released the LED SeaLite in 2016 to provide high configurability and the quality that DSPL is known for at competitive pricing. The LED SeaLite incorporates compact design, high efficiency electronics, and optional SeaSense™ serial command control with a wide range of analog control options.

The LED SeaLite has many configuration combinations. Features include up to 10,000 lumens output in both AC and DC driver configurations; aluminum or titanium housings; a sapphire port with a 6,000 m or 11,000 m depth rating, or an acrylic port with 4,000 m depth rating; and wide, flood, or spot single beam angle configurations. This subsea LED light is field serviceable with no soldered wire connections or specialized tools required. DSPL's broad connector compatibility coupled with the option to fit a classic mounting collar or compact saddle bracket makes integration simple.

Three LED SeaLite models are currently available: LSL-1000, LSL-2000, and the new Multiray LSL-2025. The Multiray LSL-2025 model introduces compelling technology that configures a single luminaire with two sets of LED sources that can be operated independently or in tandem, each with its own color and beam pattern.

The LED SeaLite has many configuration options to address and adapt to market needs. (Courtesy of DeepSea Power & Light)

MULTIRAY: DESIGNED FOR VERSATILITY AND HIGH PERFORMANCE

In the LSL-2025, the light engine is divided into two arrays of LEDs. Each array can be populated with a different color of LED source, selected from: whites, blues, greens, reds, and other colors; along with ultraviolet and infrared non-visible emitters. LED arrays can be fit with a choice of optics to produce a variety of beam patterns from a 115° wide flood to a 28° narrow spot. Two different light engine configurations exist: an 8-LED and a 32-LED. In both configurations, each array occupies half of the LED positions within the light engine (Figure 1). These layouts accommodate a wide variety of LED source and optic combinations.

Each array is connected to an output channel on the internal DC-DC constant current driver through a switching circuit expansion board. Intelligent microprocessor control allows the driver to power each array, and in some configurations, both arrays simultaneously. The control design allows the driver to power each array and to manage each channel's operation (Figure 2). Three operating modes are available: channel 1, channel 2, or channels 1 and 2 combined (Figure 3).

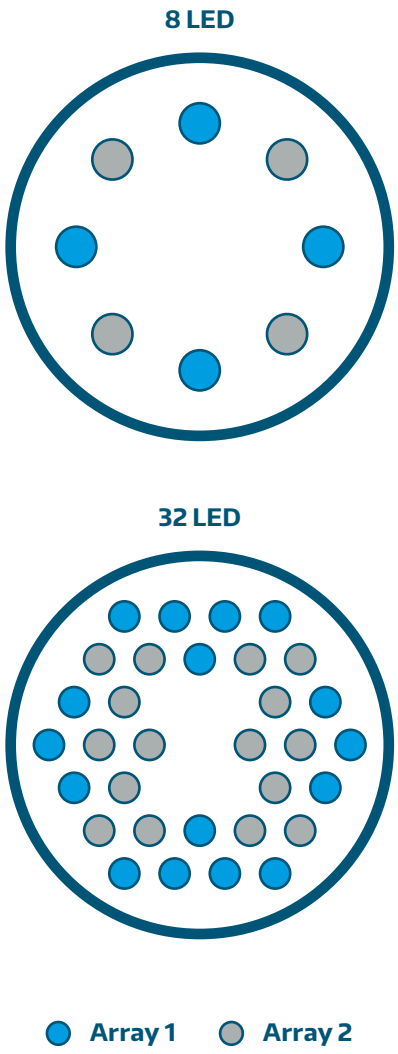
The robust control logic in the Multiray driver ensures that the LED arrays operate at maximum performance, and manage potential electrical differences in each array of LEDs. The Multiray driver adapts dynamically when switching active channels for different forward voltage or forward current characteristics. The combined operating mode is available for arrays with matching forward voltage characteristics. This mode is generally limited to white LEDs which typically have the same forward voltage characteristics independent of the color temperature or other spectral characteristics.

In cases where LEDs have a higher maximum drive current than others, the driver changes the peak drive current when switching between output channels. Full dimming and light controls are maintained for each array when switching between operating modes.

CONTROL METHODS WITH THE OPERATOR IN MIND

Two control options are available for Multiray LED SeaLites: DSPL's SeaSense serial commands and power cycling. SeaSense uses human-readable character commands and syntax for real-time control over standard EIA-485 and EIA-232 serial communication interfaces, and is available with the LED SeaLite and other select DSPL products. SeaSense provides the most flexibility for controlling Multiray driver channels. Using SeaSense allows Multiray LED lights to:

- Select an operating mode directly or cycle through enabled modes.
- Assign Multiray operating modes and dimming levels to any of the sixteen user presets.
- Change the max power limit on an operating mode and dimming level.



LED SeaLite® Multiray LED Array Layout

Fig. 1: Multiray is available with 8 or 32 LEDs in the light engine. The light engine is divided into two arrays of LEDs each of which occupies half of the available positions in a balanced layout. (Courtesy of DeepSea Power & Light)

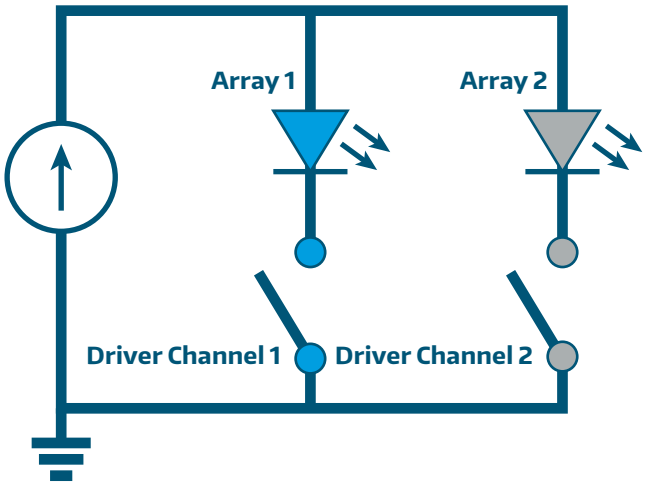


Fig. 2: Each array is controlled separately through a driver channel. The driver control switches between the color and beam pattern combinations configured in each light engine array. (Courtesy of DeepSea Power & Light)

MULTIRAY OPERATING MODES		
OPERATING MODE	**CHANNEL 1**	**CHANNEL 2**
Array 1	ON	OFF
Array 2	OFF	ON
Combined	ON	ON

Fig. 3: The arrays operate separately or combined. The combined operating mode is available in configurations where array forward voltages match. (Courtesy of DeepSea Power & Light)

For systems without serial control, the power cycling control option for Multiray is a straightforward method to change the operating mode. Power cycling is compatible with any of the analog and serial dimming control methods to make retrofitting existing systems with Multiray luminaires easy. Turning off power to an LSL-2025 and turning it back on within three seconds advances the operating mode from array 1 to array 2, then from array 2 to combined (if available), and then from combined back to array 1.

MULTIRAY IN USE

Multiray LED SeaLites can combine the functions of two fixtures in a single luminaire (see Figure 4 for common configurations). Integrating an LSL-2025 enables operators to expand vehicle capability while saving space, avoiding downtime for switching luminaires, and mitigating costs for multiple luminaires.

Multiray allows more control for optimal imaging when operators must adjust settings in changing subsea environments. While a traditional luminaire only offers the option to dim lighting, the LSL-2025, with its combined LED sources and optics, provides a range of options to minimize backscatter and optimize visibility in turbid environments. The operator might use a daylight white LED source to survey a location and switch to a warm white, color, or high CRI source to better view a biological sample or corrosion site.

A Multiray luminaire configured with monochromatic LEDs enables a system to perform more than one job function on a single deployment when different LED colors are required. A single luminaire equipped with a green LED array and a blue LED array can perform leak detection of either rhodamine or fluorescein based dyes saving time and cost.

Configuring Multiray with beam pattern combinations supports multiple observation tasks. Operators can better control where they put light with an LSL-2025 flood and spot beam pattern configuration. When used along with a zoom camera, this light combination gives the operator the ability to follow the camera's field of view and place the light where it is most needed by switching from a flood beam to a spot beam when the camera zooms onto a target.

LED SEALITE AND MULTIRAY: DO MORE WITH LESS

DeepSea Power & Light provides subsea technology that maximizes performance, durability, and value. The LED SeaLite exemplifies these traits with a robust design, performance efficiency, and affordable implementation. With a subsea Multiray LED light functioning as more than two lights combined into one, projects can count on the reliability of the LED SeaLite, realize lower overall equipment costs, minimize downtime, and gain versatility through increased luminaire flexibility and operator control.

ARRAY 1	ARRAY 2	CONFIGURATION
Daylight White 75° Flood	Daylight White 115° Wide[1]	DW00-D02
Warm White 75° Flood	Warm White 115° Wide[1]	WW00-D02
Daylight White 40° Spot	Daylight White 75° Flood	DW00-D01
Warm White 40° Spot	Warm White 75° Flood	WW00-D01
Daylight White 75° Flood	Warm White 115° Wide[1]	DC01-D02
Warm White 75° Flood	Daylight White 115° Wide[1]	DC02-D02
Daylight White 40° Spot	Warm White 75° Flood	DC01-D01
Warm White 40° Spot	Daylight White 75° Flood	DC02-D01
Daylight White 75° Flood	Green[3] 75° Flood	DC03-FLD
Daylight White 75° Flood	405nm Ultraviolet[2] 40° Spot	DC04-D01

[1] Must use acrylic port [2] Must use sapphire port [3] Contact sales for red, blue, and other color options

Fig. 4: Base Multiray configurations for the LSL-2025. Contact sales for specific configuration needs. (Courtesy of DeepSea Power & Light)

FIRST DEEP-SEA LED STROBE USING HIGH-POTENTIAL DRIVER RELEASED

ARCTIC RAYS, LLC has released Dragonfish to the wider market – a proven robust deep-sea LED Strobe light designed for imaging applications on AUVs and other underwater vehicles or platforms. Its compact size, high brightness (30,000 lumens @ 5ms, 42,000 lumens @ 200µs), and low current draw (550 mA @ 24Vdc), make it ideal for AUV-based still photography, where payload size and power budget are critical. Drive electronics, thermal protection, and intelligent microprocessor control are integral in the Dragonfish's small 1ATM, 6,000m-rated, anodized aluminum housing. External power and trigger are all that are needed to operate. The unit is easily synced to a standard TTL camera shutter, and will self-quench automatically when the shutter line is released, allowing user-controllable strobe durations up to 5ms. It can also be quenched by an alternate source using the independent quench line. Standard beams are a wide 62^0 flood, or a narrow 35^0 spot. Dragonfish is currently being used successfully on the Remus 100, 600 and 6000 AUVs. It was selected because it provides more illumination with less power consumption than competing products, in a smaller package, and at a lower cost. In addition, unlike potted LED solutions, its 1ATM housing design allows easy repair and upgrade of LED elements, electronics, and control firmware.

The compact design weighs only 318 or 420 grams in water (depending on options), and measures 70 mm in diameter and 70 mm long. Housed in a 6061-T6 AHC aluminum housing, it is available in depth ratings of 1,000 or 6,000 meters.

arctic rays

Courtesy of Arctic Rays

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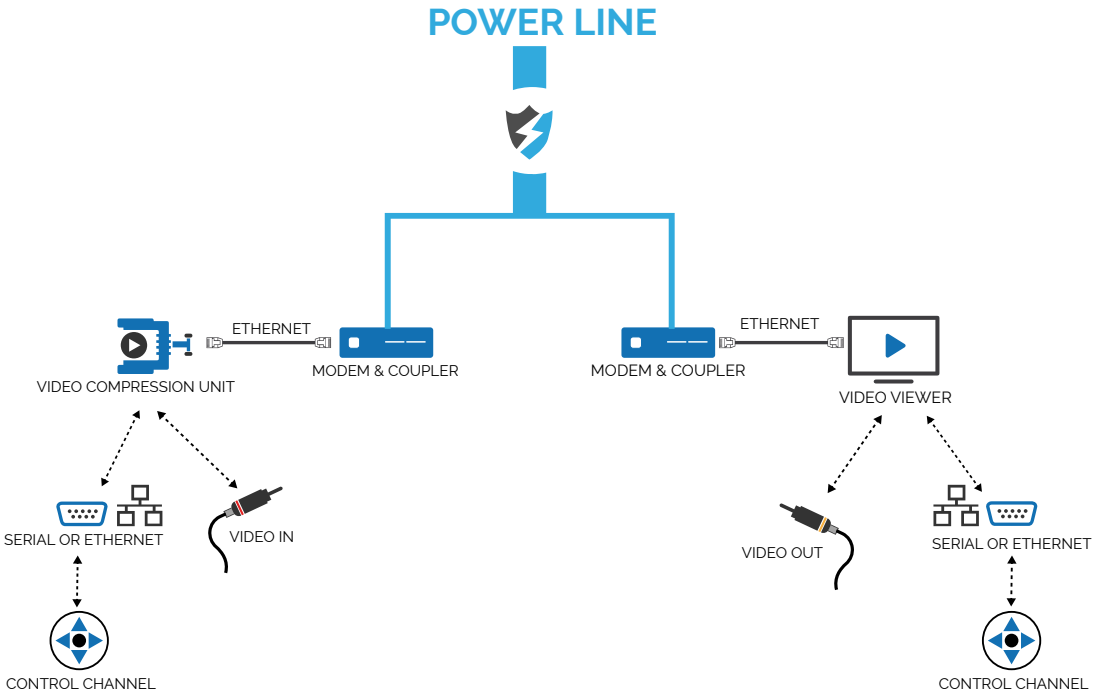
The science ROV 'Hercules' (IFE/URI/NOAA) during a launch in 2005. (Courtesy of Brennan Phillips)

ROVS USING POWERLINE COMMUNICATIONS

TO PILOT AN ROV ON THE LOSS OF FIBRE-BASED COMMUNICATIONS

Andrew Parker, Snr. Field Applications Engineer, Astute Electronics Ltd.
Michael Propp, President, Adaptive Networks



Courtesy of Astute Electronics

Remote piloting generally operates over an umbilical using fibre optics to deliver video, control, and data. This fibre-based communications system shares the umbilical with powerlines to drive the propulsion and control systems. On larger ROVs, operating to depths of up to 6000 metres, the powerlines can be powered from a source on the order of several thousand volts at a much higher than mains frequency to minimise transformer magnetics, thereby lightening the vehicle's weight.

Unfortunately, fibre-optic communications can break down, resulting in the loss of both video and data. On tethered, smaller ROVs, simply pulling the vehicle home may be sufficient. However, with larger vehicles and depending on the operations being conducted at the time, simply winching the vehicle back is not an option. Losing both video and control means either an expensive recovery operation or worse, the loss of the vehicle in its entirety.

Adaptive Networks has developed a proven solution to enable ROVs to be recovered under pilot control, through communications of compressed video and control data over the umbilical's powerline, building on proprietary products for reliable powerline communications in electrically-harsh industrial environments. This backup control solution can operate over any voltage level, single and multiphase systems. The solution simply consists of three devices—a powerline modem, a video unit (an encoder subsea and a decoder topside), and a powerline coupler—at each end.

Adaptive Networks has been advancing the state of industrial powerline communications for over three decades. Subsea oil and gas production, characterized by the intense demands of continuous 24/7 operation, is an important application where the company's products are widely deployed. Product offerings work reliably in impaired-media conditions, optimising bandwidth and network performance, and providing error-free (less than 10^{-9} BER) delivery of essential data. The company's expertise has led to the development of recognized ISO and IEC standards.

Using patented optimised signal processing and low-level network protocols with integrated intelligence at the receiver, Adaptive Networks' products adapt rapidly to changing powerline conditions, an essential feature for powerline communications for ROVs and other industrial systems. The results are unique field-proven solutions that can be tailored to the requirements of each application, exhibiting optimised network speeds, robust, continuous throughput, extended coverage, and predictable rapid response times that are essential for today's demanding industrial operations and environments.

The company's unique approach utilizes wideband modulation, adaptive equalization, rapid synchronization, error-control coding and powerline-optimized deterministic token passing protocols, all optimized for the harsh industrial powerline. This solution inherently supports multipoint networking with large node populations, including efficient network communications even with short control and monitoring frames, all under conditions of industrial powerline attenuation and noise.

Adaptive Networks' recently released, most advanced product, the AN Multi-Wideband (MWB™) modem, further enhances this powerline communications technology. In the modem's hierarchical design, each level, including modulation and demodulation, synchronization, equalization, error correction, and the link and MAC, is optimized to address the associated requirements for reliable powerline communications with sufficient data throughput and sufficiently low latency to support the ROV video and data requirements. An essential component of this enhanced approach is "on-the-fly" frequency domain equalization (FDE), providing intelligence at the receiver to enable dynamic adaptation to the time-varying powerline impairments. The essential IP is patent-protected.

The modem's powerline-optimized Multi Wideband (MWB™) modulation uses multiple overlapping wideband subchannels to optimize the achievable throughput. Support for variable frequencies with digital control of carrier frequencies and occupied frequency bands enables communications for distances up to 200 km and simultaneous operation of legacy systems.

The physical layer Multi-Wideband modulation transmits over the full available bandwidth using overlapping subchannels. By determining the optimal level of QAM modulation on each of the overlapping subchannels, the modem maximizes the use of the available bandwidth to achieve the highest throughput possible. The transmitted spectrum is determined by digital control of the carrier frequencies, the QAM modulation and the occupied frequency bands to match the transmitted spectrum to the available bandwidth determined by the cable length and characteristics.

A low-level link protocol uses segmentation and reassembly (SAR) to break up the higher level application packet into short frames, each frame consisting of a preamble, a protocol header and a variable number of data blocks. The synchronization preamble at the start of each frame is optimized to minimize overhead, allowing for the transmission of short frames, and enables synchronization even under low signal-to-noise ratios and high signal distortion. The modem supports the use of multiple synchronization preambles to maximize performance under crosstalk, enabling operation of simultaneous multiple communicating networks, each over multiple wire pairs in an umbilical.

Since powerline conditions can change within a few milliseconds, the receiver must adapt to these changing conditions. The modem's unique use of adaptive equalization, by calculating an optimal channel and noise filter on a frame-by-frame basis, optimally corrects for the frequency-dependent attenuation and noise of the channel. As part of this process, the modem calculates the channel transfer function and noise, enabling real-time channel and noise probing. As the low-level link protocol is built on short frames, the receiver can adapt on a frame basis enabling all nodes on a network to hear any transmitter.

Each frame uses both forward error-correcting codes with soft error correction and low decoding delay, and error detecting CRC codes on three levels: data blocks, frames and application packets. The error detecting codes are used in an automatic repeat request (ARQ) protocol with low latency.

A noise-immune token passing protocol provides the requisite level of deterministic transfer of control. An essential component of this MAC technology is the transfer of the token via a three-way handshake, ensuring an orderly transfer of control without loss of the token.

The modem allows firmware upgrades over the powerline in a failsafe process using redundancy with three copies of the firmware contained in the modem. Additional to this capability of reliable firmware upgrades subsea, the modem provides for remote diagnostics from the subsea modems. Seven watchdogs on the modem ensure reliable operation. High reliability hardware design supports a field life of 25+ years.

Subsea, the modem is connected to a video encoder based on H.264. The subsea video encoder provides for highly compressed video, optimised for transmission of multiple channels of live video over the powerline link, making efficient use of the available powerline network bandwidth. The video transmission protocols allow for low latency video transmission of the video streams. The digital video streams from the video encoder are transmitted by the subsea modem to the topside modem. Topside, the modem is connected to a video decoder. The video decoder allows for viewing the multiple video channels topside. Both analogue and IP video interfaces are supported. Simultaneous to the video transmission from subsea, the modems support bidirectional data communications of serial or Ethernet data to control the ROV.

The modem is connected to the powerline either with an internal coupler for lower voltages or an additional external coupler for higher voltages. The powerline couplers support communications over both low voltages (LV) and medium voltages (MV), over AC, DC, and unpowered lines. The coupler provides both isolation from the powerline voltages and signal coupling over the frequency band of the modem, through capacitors in combination with an isolation transformer, including additional multiple protective safety elements. Inductive coupling is also available.

Adding a backup communications capability to the umbilical is a technical reality. By utilising the existing copper within the umbilical, recovering from lost fibre-optic communications does not need to be a catastrophic event.

Astute Electronics Ltd is the exclusive, franchised technical partner for Adaptive Networks (www.adaptivenetworks.com). For more information, please contact anetworks@astute.co.uk or call +44 (0)1438 909909.

RUD®

ROV HOOK:

AN INNOVATIVE APPROACH TO SAFE SUBSEA LIFTING OPERATIONS

Courtesy of RUD Ketten

Lifting and lowering of loads in subsea operations is one of the most common tasks required in the whole life cycle of an offshore oil and gas field. During the drilling, field development, and production phases, everything used and deployed underwater needs to be transported, handled, installed, and – when required – removed for maintenance, repair, and replacement. Equipment and tools need to be carried down to the seabed and lifted back to the surface when the work is done. All this requires the use of reliable and safe rigging equipment, such as slings, hooks, and lifting attachments (shackles, eyebolts, pad eyes, etc.).

Normally a hook provides the immediate connection between the crane's side sling and the load. Thus, hooks play an important role in ensuring the success of any subsea lifting/lowering operation.

The history of incidents involving hooks in the offshore industry is long. There is masses of documentation available evidencing the importance of paying attention to the risks related to the use of the most common types of hooks used in today's offshore operations. The two most common types of incidents are snagging of hooks and unintentional release of rigging from the hooks (shedding). According to the Offshore Safety Division of the UK's Health & Safety Executive (HSE), the dangers arising from both the snagging of hooks and the shedding of slings/pennants when operating in an offshore environment can be potentially lethal.

Incidents were first identified in topside lifting operations, in particular in relation to crane operations when performing supply boat lifts. However, with increasing subsea operations requiring equipment to be moved to and installed on the seabed, the numbers of incidents related to hooks have also increased in this area of operations. All of the aforementioned issues and incidents involving hooks occurring topside are also applicable to subsea lifts. However, compared to the scenario where elements of the lift operation occur in air, lifting and lowering loads in a subsea environment introduces further hazards related to the same issues of snagging and shedding of loads.

SNAGGING OF HOOKS

The traditional 'single point hook' has a safety latch with a spring return safety latch. This type of hook has a protruding 'nose' on the tip of the hook that may snag on to objects such as scaffold tubes, hoses, small bore tubing or pipework, or divers' umbilicals. It can also catch any section that forms a lip such as rectangular hollow sections, channels, and flat protruding edges.

A variation on this type of hook was designed for ROV attachment and detachment. This design is commonly referred to as the 'snap hook' as loads are easily 'snapped' into the hook through the spring operated latch. This ROV operable design included an increased nose protrusion to facilitate easy attachment of slings and master links, and the ability to release rigging from the hook by upending using a lanyard that simultaneously opens the safety latch. Whilst making it easier and quicker to attach loads using an ROV, this new design also increased the potential for accidental snagging.

SHEDDING OF LOAD

When lifting loads in a dynamic offshore environment it has been evident that certain circumstances allow rigging to release from the standard 'single point' hooks, including the ROV 'snap hook' version. There are two subtly different scenarios that can cause this to happen: one when lifting in air and another when lifting in water. The in-air incidents typically occur when there is rigging on the hook, but with little or no load attached. The hook may swing around violently, and the

rigging thrown up into a position where it returns between the hook nose and the safety latch, thus releasing accidentally.

A similar release mechanism can occur subsea. In this scenario a heaving vessel may cause the load being lifted to go light and cause the rigging to slacken. This is particularly relevant to lighter loads with a larger horizontal area, and in conjunction with higher vessel heave and an increased speed of crane deployment.

There have also been reported releases of smaller synthetic round slings from self-locking 'safety hooks' where the sling has managed to slip between the tip of the hook and the locked gate due to the design not taking account of this failure mode and the manufacturing tolerance between the parts.

The snagging of hooks and accidental load detachment has been well documented and for this reason the use of the 'single point' hook – including the ROV snap hook – was identified as a significant hazard to diving operations. As a result the IMCA document recommends using self-locking or 'safety hooks' and not 'single point' hooks. This has long been established practice for diver operations. Historically there is a lack of alternative hooks for diverless operations that are as quick and easy for ROV use, and this has meant that the ROV snap hook continues to be widely used.

The risks described above have typically been tolerated for diverless operations, and there is evidence that the acceptance of incidents has often been normalised within the subsea industry.

ALTERNATIVES TO THE ROV 'SNAP HOOK'

There are alternatives to the ROV snap hook, all of which generally work well for rigging release type operations. These include the ROV shackle and other proprietary type shackles and self-locking hooks. However those alternatives sacrify the "ease of use" of the snap hook resulting in increased time for manipulation.

Jim Battersby, domain expert and Subsea 7's specialist lifting and rigging engineer explains: "in our company we have focussed on safety, and have accepted the "time penalty" and increased costs, in order to maintain safety at a high level by using slower to operate but more secure equipment (like shackles and safety hooks) for tasks where snap-hooks would have traditionally been used in the past".

The attachment of rigging using ROV's has always been a challenge and it is this design issue that has provided the impetus for Subsea 7 and RUD to work together to design a product that meets both the operational safety and speed of use requirements that are currently missing from the market.

The speed of use requirement is important as the vessel's operational cost is significantly high; any time saved on critical path ROV operations will have a cumulative saving in the long term. Over an extended period of operational use this can potentially accrue a large saving. In addition to the safety aspects and speed of use, important requirements from the users' perspective were operational robustness and reliability.

The development of the new hook was completed within two years by German chain manufacturer RUD Ketten in cooperation with Subsea 7, who provided the user requirements and validated the design in all its stages.

During the design phase the simplicity, functionality, and robustness of the hook were put into focus. According to Subsea 7 the resulting hook fulfils all demanded and formulated requirements, and will set the new standard for safe and reliable lifting hooks in subsea operations.

The RUD ROV Hook is a completely new style of hook: one that has never been seen before. It features an innovative outwards opening safety latch and a patented mechanism with only two moving parts.

"The simple but reliable functionality is based on the leveraging principle of rigid body physics to translate the movement of a trigger, when it is pressed or pulled by a lanyard into the opening of the hook's gate" says David Jaramillo, Business Development Manager for Marine/Offshore at RUD Ketten and Leader of the project.

The design was tested and proven on real life subsea operations. According to Kenny Morrison, Operations Manager UK/Canada at Subsea 7 "the new RUD hook provides a greatly enhanced degree of load security compared to traditional snap hooks, while retaining the snap hook's ease of use for both connection and disconnection tasks. The initial prototypes were enthusiastically received by our offshore teams during testing as they can be operated with a single manipulator, which can significantly speed up operations. Operational feedback also resulted in the design being further optimised for use with grabber arms as well as manipulators".

All hook main parts are manufactured from forged steel, with a safety factor 4:1 with respect to its working load limit, 100% crack-tested, and withstanding a dynamic loading of more than 20,000 load cycles according to European Standard EN 1677. The hook will be initially available as a 10t WLL capacity hook. However, other sizes are planned and will be developed based on further demand from the market.

Courtesy of QSTAR

ROV PILOT TECH TRAINING

HIGH VOLTAGE AND ELECTRONICS

By Richie Enzmann, ROV Planet

The High Voltage (HV) and Electronics modules (No.2.2 & 2.3) in my Premium ROV Pilot training were building on the knowledge from the Electricity and Electrical Systems modules previously completed at QSTAR.

The High Voltage module raised awareness of the possible hazards when operating in the HV environment within the marine/offshore operations context. The module focused onto what ROV pilots might encounter when operating such a system. The HV hazards, possible injuries, and effects on the human body explained the necessity of specific HV PPE required for operations. HV work usually involves the testing of circuits for live electricity, discharging and isolating and earthing the circuits, hence great emphasis was put on the LOTO (Lock Out/Tag Out) and the procedures need to be taken when working (maintain, repair, or test) on HV systems. Furthermore, the components of the HV protection systems, such as line insulations monitors (LIM) and residual current devices (RCD) were also explained. We had the chance to check for residual load inside a HV junction box where a controlled simulated charge was present, making use of the HV probe and us wearing all our HV electrical PPE in the workshop to implement what we have learned in the classroom earlier.


Courtesy of QSTAR

According to Cristian Gurgu, ROV Supervisor & Instructor, the HV training is more of an attitude and awareness enhancement.

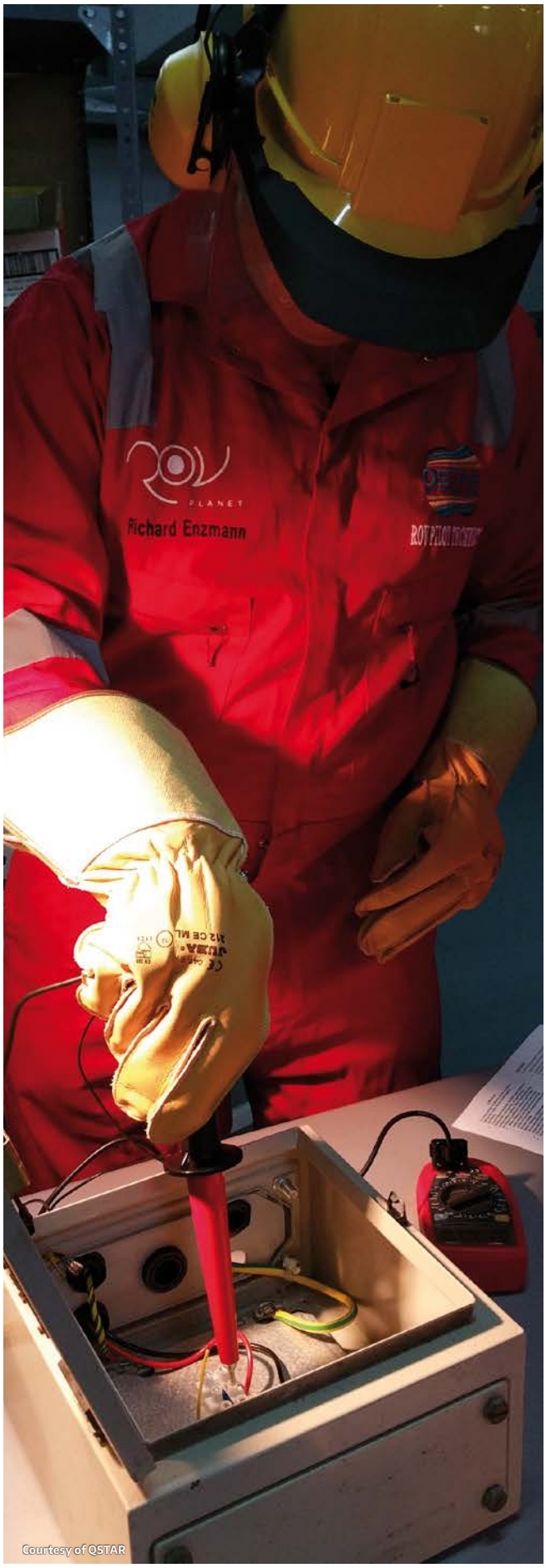
"The electrical basics required for understanding rationally have been clarified in the previous module of electrical systems. Understanding doesn't always involve Awareness. They say the worst accidents involve the best professionals. Like the HSE policies goals, we want our students to logically understand the HV systems and involved hazards, building up awareness and to be able to follow the LOTO programme."

The Electronics part of the training is where everything previously learned comes together along with new semiconductor components. Step by step from different types of diodes towards transistors and integrated circuits the course gave us the basic knowledge to understand how devices work and thereafter we were capable of troubleshooting the circuits in case of abnormal behaviours. We used the multimeter and the oscilloscope during the practice hours when we built different circuits in the workshop. One of the targets was to build a PWM (Pulse Width Modulation) circuit in order to implement controllers that are nowadays present within any equipment that allows output level adjustment – such as lights and thruster control.

"In the Electronics module, we present semiconductor devices and practical circuits that are used in ROV spreads, giving the skills for troubleshooting, maintenance and modification when needed. The practice gradually becomes more complex reaching PWM controllers. The ROV environment is team based and people will always be different, with different strengths. The students need to build circuits and for sure one will be faster than another, moment when the fastest is encouraged to support and troubleshot his team colleagues work. Different approaches help unlock new views and solutions in solving faults. At the same time someone that is helping a colleague stabilises the knowledge and gets exposed to various technical interpretations of human induced faults in circuits. We look forward to encouraging the team spirit within the training environment and making the students aware that at some point everybody will work with everybody. For this reason we all need to be good at it and capable to carry the weight." said Cristian.

One of the students, Bryan Malley has just completed an apprenticeship in Mechanical and Manufacturing Engineering, within the Automotive Industry. His interest in the offshore oil & gas industry began at a very early age, as his father was a saturation diver in the North Sea and had vivid memories of exploring the saturation chamber, diving equipment and the ROV control room.

"It has always been my goal to work in this environment and therefore, it was no surprise to my family that I wanted to train as an ROV Pilot Technician as soon as I finished my apprenticeship. I researched several training centres as to where to do my training and after many recommendations from prior students who had completed their training with



Courtesy of QSTAR

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QSTAR in Gran Canaria. I decided that this would be the best option for me. I am now halfway through the 7-week course and must commend the quality of instruction and support I have received to date, especially from Cristian Gurgu. The organisation from booking to beginning the course was very efficient and stress free. I am very impressed with the exceptionally high standard of training facilities and course content and I must admit that I am thoroughly enjoying my time here. It has exceeded my expectations and I feel that I have invested my time and money wisely to help me on my chosen career path." said Brian.

Meanwhile the other student, Alessio Gentile has discovered the world of ROVs just a year ago when he was still in Australia. He had a strong desire for a career change that he could fit perfectly with his lifestyle and ambitions. So he searched online and found the course offered by QSTAR in Las Palmas.

"The courses taught are competitive and the program is vast and ranges from electronics to hydraulics. I hope to embark on an offshore career that I will find unique and stimulating, where my piloting excellence will develop to the highest standards. I have the strong conviction that this is the right path for me, because robotics is a subject that looks into the future that can be applied in different sectors including the marine science field. And because it meets perfectly with my biggest passions that are both sea and technology!"

QSTAR Subsea Solution has also been expanding and Gianluca Belardinelli, a previous QSTAR student, has joined the company. Now, he is helping out in the workshop and getting the ROV systems ready for a subsea cable installation campaign that is scheduled for this summer within the vicinity of the islands.

"I have been an ROV Pilot for about a year. I have undertaken this career because I have always been a sea lover being born in Tarquinia, Italy, in a medieval town just a few kilometres from the sea, and I also have friends working in the offshore industry. After completing the course I worked here for four months as an ROV Pilot before returning to Italy. After a few months away, I had the chance to come back again to QSTAR as an ROV base tech and pilot for offshore work. Here, I have had the opportunity to get to know many people of different nationalities; fantastic people who in turn have taught me much about life and work."

During my stay at the QSTAR headquarters I have witnessed the reception of their new Ageotec Perseo GTV ROV coming from Lighthouse – L3 in Italy. The Perseo GTV is capable of reaching 1500m and comes with full setup, modular mobile surface equipment, tether winch and the vehicle that is a an enhanced Class 2 – Observation - Light Work Class. The ROV is capable of relevant payloads as skids for extra sensors or tooling, providing an auxiliary 3 phase power line dedicated for that.

The system has returned from the manufacturer after an upgrade for installing a Fibre Optic by-pass link for auxiliary instruments, in this case dedicated for a HD camera, allowing live HD signal to be sent back to the surface for recording and control. We did a function check in the workshop and the commissioning time was impressively short. In about 2 hours we had everything running and live!

"QSTAR would like to thank Lighthouse Geo for their excellent support given for the upgrade of our Perseo GTV ROV. We found very important the customer and after sales services quality giving by a manufacturer & supplier when buying a new ROV system." said Victor Sepúlveda, QSTAR Managing Director.

"One of the most recent projects that QSTAR was involved in was the National Geographic documentary "Atlantis Rising" produced by Oscar-winning legend and executive producer James Cameron and the three-time Emmy-winning film-maker Simcha Jacobovici, where they go on an adventure to find the lost city of Atlantis. QSTAR Subsea Solutions supported the documentary with their research vessel "Atlantic Explorer" crossing 2000 nautical miles and giving support to the ROV operations, Side Scan Sonar and permits on-site."

"In the course of the expedition they discovered ancient anchors in an unlikely place that could rewrite the history of human travel in the Bronze Age, the possible remains of the lost civilization or a great maritime culture that the Greeks knew as Atlantis!"

Courtesy of QSTAR

QSTAR Subsea Services
Founded in 2007, QSTAR – ROV TRAINING & SUBSEA SOLUTIONS, located in the Canary Islands & Barcelona (Spain) has been operating worldwide as a subsea contractor managing all involved assets, from vessel to survey, ROV equipment including on-field personnel.

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