

04

Kit

Our latest subsea technology to help you reduce time and risk

12

Ocean Science

GyroiUSBL: Going to great lengths for towfish tracking with Odyssey

14

Corporate

A closer look at all the pieces Sonardyne has to solve your subsea puzzle

18

Construction Survey

Fusion 6G helps Total save time and money offshore West Africa

**THE CUSTOMER
MAGAZINE
FROM
SONARDYNE
ISSUE 14**

Baseline



26

Product Focus

**Ranger 2 USBL on track
across the world**

INNOVATION in products, services and techniques has always been key to achieving safe, reliable and cost-efficient subsea operations. However in the current climate, it's never been more relevant, so it is a theme throughout this issue.

In Kit and News, we introduce you to our latest subsea technologies that span inertial navigation, acoustics, optical and sonar, along the way explaining how they help you realise tangible operational savings.

Going to great lengths for clients is one of our unique offerings and that's exactly what our new GyroiUSBL transceiver has done for Odyssey Marine Exploration. The case study on page 12 charts a recent trial where this novel system was used to track a towfish beyond 7,500 metres. It could have been longer, had the water depth allowed.

The article on page 14 examines how our capabilities in custom design, engineering, manufacturing, planning and support can be pieced together to create low-risk and low-cost solutions for your subsea projects, no matter how puzzling the challenge might be.

Once you're done reading that, turn to page 18 to see how Fusion 6G helped Total and its project partners to save time and money offshore West Africa, and in the process, set new efficiency records.

But that's not the only Sonardyne technology making headlines in this issue. Ranger 2 USBL is on track around the world, helping numerous companies to track targets with pinpoint accuracy and dynamically position their vessels. We look at three examples on page 26.

As always, there's the usual round-up of news from our regions and useful hints and tips in Know How. We hope you enjoy reading this issue.



David Brown Editor



Baseline » Issue 14

Front Cover

Preparing a 6G modem dunker for over the side deployment. The unit was used to recover logged data from a network of autonomous monitoring transponders and deployed as part of a long-term seabed deformation campaign. The high-speed Wideband 2 signal protocols used by 6G technology minimises vessel delays by enabling subsea data to be harvested quickly and reliably.

In this issue...

04 Kit Taking the wraps off our latest advances in subsea technology including the first look at Compatt 6 Mega, new Fusion LBL software and free firmware to extend battery life.

08 News Subsea 7 saves vessel time with 6G and SPRINT, investments to aid product development and testing at Blackbushe and news from the field as our Syrinx DVL heads offshore with MBARI.

12 Ocean Science Examining how Odyssey Marine Exploration used the new Ranger 2 GyroiUSBL transceiver to track their deep towfish at a record-breaking 7,500 metres slant range.

14 Corporate Think you know Sonardyne? Graham Brown's article will make you think again as he pieces together our subsea engineering capabilities.

18 Construction Survey Two multi-billion dollar field developments under construction off West Africa are a step closer to first oil thanks to Fusion 6G positioning technology. Turn to page 18 to find out how.

22 News Feature When an ROV can travel 50% faster than others, you need fast position updates. Discover how SPRINT helped MMT stay on track.

24 Technology From USBL transponders offering fast position updates, to our new Syrinx DVL, when it comes to technology for ROVs, we've got it covered.

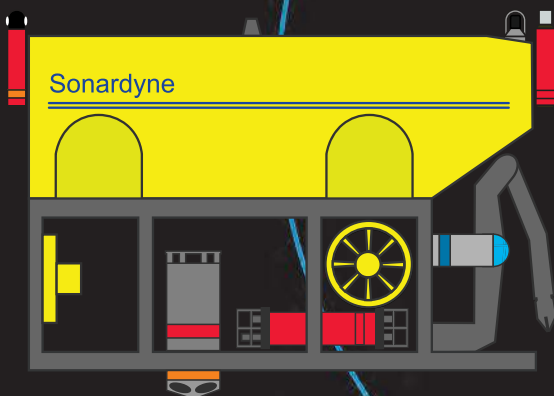
26 Product Focus Going deep with MBARI, upgrading CCC's fleet and saving time with Horizon. Examples of how Ranger 2 DP reference and tracking technology is at work delivering precision and reliability.

30 International The latest news from Sonardyne's regional offices around the world, including 10-year life PMTs for Shell and demonstrations of our integrity monitoring capabilities at NASA.

31 Know How Hints and tips on how to get the most out of your Sonardyne technology.



04



Baseline Magazine
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from Sonardyne

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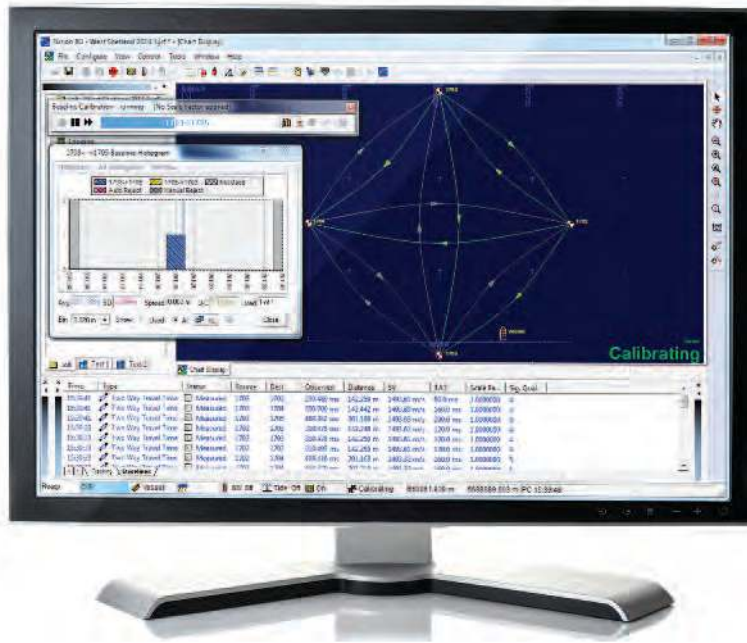
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**SOFTWARE****Introducing Fusion V1.12.02**

Fusion 6G continues to be the industry's most popular Long BaseLine (LBL) acoustic positioning system by providing the most accurate method for installing subsea structures, tracking ROVs and conducting acoustic metrology. And now with the highly anticipated release of our Fusion V1.12.02 software, the best performing tool for subsea construction survey just got even better. Major developments include support for multi-user transponder arrays, full commanding of the new Mini-ROVNav 6 LBL transceiver (pictured above)

– including battery disconnect, and Windows 7 compatibility. There are also more ways to connect transceivers via a MUX, and integration with Marksman LUSBL and Ranger 2 USBL systems has been improved. If you already own a copy of Fusion V1.12.01, then you will be able to get this important upgrade free of charge.

Simply get in touch with support@sonardyne.com or contact your local Sonardyne office. They will be happy to give you more details.

TRANSPONDER FIRMWARE**Free upgrade extends battery life**

Looking to get more performance from your 6G transponders? Well now you can thanks to our recently released firmware – V3.05.07.09. Available for products including Compatt 6, AMT and DPT 6, the free upgrade extends transponder battery life by up to 30%, depending on your operational scenario. It also supports high data rate telemetry, easier interfacing with external devices such as ADCPs, and multi-user subscription capability. To obtain a copy of the new firmware, drop our customer support team an email at: support@sonardyne.com and they will send you a link to download it and instructions on how to install it.

**INTEGRITY ASSURANCE**

360°

**SENTRY IMS
AUTOMATICALLY MONITORS
FOR HYDROCARBONS IN
MORE THAN ONE BILLION
CUBIC FEET OF SEAWATER,
WITH 360° OF COVERAGE
FROM A SINGLE SENSOR
LOCATION. IT OPERATES
WITHOUT THE NEED FOR
SKILLED SONAR OPERATORS
TO MONITOR THE SYSTEM.**



ASSET MONITORING

Get SMARTer with your data

Our new Subsea Monitoring, Analysis and Reporting Transponder (SMART) has been developed as a primary (or backup) monitoring system for applications including the monitoring of subsea structures, well-heads, risers, mooring lines and pipelines – both during oil field construction and longer term. The powerful on-board processor means SMART can make the most of the integrated acoustic link, logging large data sets and intelligently reducing them to provide near real-time updates of the critical information needed by end-users.

SMART is highly configurable and can be interfaced with a wide range of internal and external sensors and other data sources, utilising standard or tailored data analysis algorithms. Robust acoustic performance in all environments is assured with our proven Wideband 2 signal architecture. And speaking of robust, SMART is available in a range of materials from Aluminium through to Aluminium Bronze and Super Duplex Stainless Steel for the highest corrosion resistance. Just ask us how SMART we can make your monitoring system!

**SOFTWARE**

Adopt a new ViewPoint



Our simple navigation and guidance software package, ViewPoint, allows users to share position data from a Ranger USBL system with different users onboard vessels. New features include the ability to create a route from a series of chart points, an enhanced guidance tool with floating guidance window, and the ability to capture a vehicle track log and waypoints list and export them to a CSV file. Search Sonardyne ViewPoint for more.

DP AND DRILLING

Be prepared with the Ranger 2 DP Simulator

Our new Ranger 2 DP Simulator forms a 'one-box' solution that authentically replicates the operation of a vessel-installed Ranger 2 USBL acoustic position reference system without leaving the classroom. The rack mountable purpose-built PC is pre-installed with Sonardyne's bespoke Acoustic Simulator and Generate 2 software applications, allowing users to create new USBL scenarios, add and configure virtual instruments and output industry-standard DP strings to full bridge simulators. Developed for DP schools and other maritime training establishments to enhance DPO training, the simulator is available now and offers the perfect introduction to acoustic reference systems.

**SERVICING**

Maintaining equipment to maintain performance

Your Sonardyne transponders are designed and manufactured to help you save time, money and lower risk in your subsea operations. However, like any precision instrument, they should be regularly serviced and maintained to maximise performance. That's where our in-house calibration and maintenance services can help, ensuring that whether you are about to start a project or return onshore, your equipment remains within specification. Our personnel are trained and equipped to calibrate transponder sensors, upgrade firmware, check acoustic performance and replace damaged parts. Book a service today by contacting your local Sonardyne office.



» KIT

Our latest subsea technology

DYNAMIC POSITIONING

Compatt 6 Mega – 3x the battery life, lower OPEX costs

We know that you rely on our transponders to supply your vessel's dynamic positioning system with consistently accurate and fast acoustic reference updates. But, we also know that recovering units to change their battery costs you time and money. That's why we've developed a transponder that is geared to really go the distance.

The new unit is called Compatt 6 Mega and is a high integrity, long life transponder that is designed to spend more time on the seabed supporting critical DP applications.

Compact and robust, the unit is particularly suited for use by drilling and production vessels which require fast acoustic updates to stay on location. Inside its 12,000 feet depth rated housing, Compatt 6 Mega is powered by three battery packs (alkaline or lithium) for three times longer operating life than a standard



unit. So whether your rig's DP system needs position updates every second, or you're planning a multi-user campaign, Compatt 6 Mega keeps you working for longer. For efficient spares stock holding, the battery packs are the same design as you will find in a standard Compatt 6.

But a longer operating life is not its only outstanding feature. Compatt 6 Mega is also incredibly easy to deploy and service. That is because we have taken the complexity out of deploying the unit, allowing it to be placed into transponder frames or directly onto the seabed using a mud mat. Plus, it's compact and rugged design means it can be installed using an ROV or crane depending on your vessel's setup.

When the time comes to recover Compatt 6 Mega for servicing, convenient access to the unit's battery compartment allows you to get the job done quickly and efficiently.

COMMUNICATIONS

UPTO

20

 Mb/sec

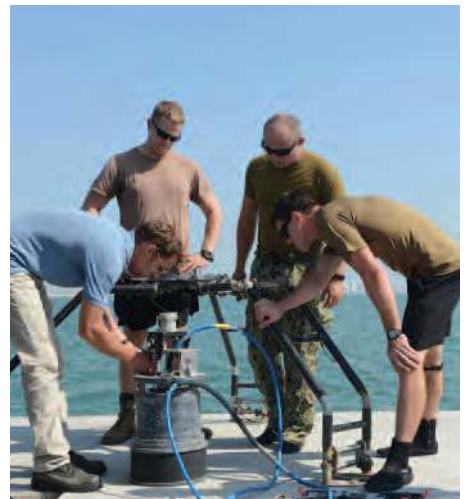
THAT'S THE SPEED THROUGH WATER BLUECOMM 5000 OPTICAL MODEMS CAN TRANSFER YOUR SENSOR DATA. THEY'RE SUITABLE FOR APPLICATIONS INCLUDING HD VIDEO AND SUBSEA VEHICLE CONTROL.



MARITIME SECURITY

Sentinel IDS – Now more portable protection

The world's most widely deployed underwater intruder detection system, Sentinel, is now more compact and portable. Improvements to the surface hardware that detects, tracks and classifies underwater intruders approaching a protected location, mean that only one Sonar Processor is now required for each sonar head, halving the previous number needed. This means that the system comfortably meets the requirements of a Portable Diver Detection System (PDDS).



INERTIAL NAVIGATION**Rent SPRINT and start saving**

SPRINT is being used by more survey companies worldwide and as such, it is rapidly becoming the de facto standard as a highly accurate and easy to use acoustically-aided inertial navigation system. If you can't buy it, you can now rent it from us, regardless of how long your job is expected to last.

SPRINT improves the speed and efficiency of subsea vehicle operations with high quality inertial measurements aided by your USBL or LBL system – even if it's from another vendor. With a high update rate, SPRINT gives pilots greater vehicle control and is accepted as an ROV DP station keeping input.

Companies have been benefiting from SPRINT for some time now on projects ranging from out-of-straightness surveys, structure replacement and sparse LBL operations. Its versatility means that whatever your subsea operation, SPRINT will make a positive impact upon it – extending capability, saving time and reducing risk.

Rent a SPRINT from us, and you'll have the peace of mind that comes with dealing directly with inertial and acoustic specialists. The hardware supplied will be of the highest and latest standard, fully serviced and ready to get straight to work.

When you're offshore, project requirements can scale and flex, but so too will SPRINT. If you need extra capability, our customer support team are on-hand to offer you expert advice and if needed, remotely activate in-field upgrades. With SPRINT, you only ever pay for the features you need, making it the most cost-effective and low risk INS on the market. If during your rental period ownership becomes an option, pricing options that include lease to purchase are available.

We have SPRINT systems on the shelf and ready to support your next project.

**TECHNOLOGY****Syrinx Doppler Velocity Log now shipping worldwide**

After months of testing and trialling offshore, our new Syrinx 600 kHz Doppler Velocity Log (DVL) is now shipping to customers worldwide.

Designed to meet the needs of surface and subsea vehicles that require high integrity, high performance navigation aiding over a wide range of water depths and seabed types, Syrinx operates at altitudes comparable to a 300 kHz DVL, with the high resolution performance of a 1200 kHz DVL.

As you'll read on page 10, pre-production versions of Syrinx have been under intense scrutiny over the past few months, both with our own product development teams and end-users offshore. Feedback has allowed those all-important final features and specifications to be identified and implemented.

Size and weight are always important considerations for subsea instrumentation, none more so than when being fitted onto a vehicle. Syrinx is now just 195mm high, 10% less than the prototype. It's also slimmer and lighter than before, with a new housing diameter of 200mm and a weight in air that's a fraction over 12kg – a saving of 2.5kg on the original design.

Syrinx's re-shaped titanium housing has contributed to that impressive weight saving. Not only is it more streamlined, the transducers are now further recessed to offer greater protection against accidental knocks in the field.

As standard, the housing is depth rated to 4,000 metres, perfect for Work-class ROVs.

Another noticeable change is to the dual output connectors. They have been relocated from either side of the device to a side-by-side layout to allow for simpler wiring and vehicle integration.

NEWS

Subsea 7's state-of-the-art strategic pipelay and heavy lift vessel *Seven Borealis*



CONSTRUCTION SURVEY

Subsea 7 saves time with 6G and SPRINT

Subsea 7 has successfully used 6G acoustic and SPRINT inertial navigation technologies to install flowlines, risers and subsea structures at a major new deep water field development in the Gulf of Mexico.

To meet the complex positioning requirements of the project, Fred Goodloe III, Project Surveyor for Subsea 7 worked closely with our in-house Survey Support Group (SSG) to determine the optimum configuration of subsea, ROV and vessel-based equipment.

For the installation work, a high precision seabed array of Compatt 6 LBL transponders was deployed. The SSG assisted Subsea 7 in designing the array, optimising its geometry and modelling acoustic ray bending paths to ensure a robust array that met the stringent positioning requirement.

By specifying the use of our inertial navigation sensor, SPRINT, on the survey team's ROV, Subsea 7 were able to reduce the number of array transponders needed for the project, leading to a reduction in vessel time required to install, calibrate and recover the array. The tightly coupled range-aided position solution provided by

SPRINT meant that this was achieved without sacrificing positioning quality.

John Brader, Survey Manager for Subsea 7 said, "The positive results we've seen during this project and also previously during our work on the NaKika field, have demonstrated SPRINT is able to extend

"By specifying the use of our inertial navigation sensor, SPRINT, on the survey team's ROV, Subsea 7 were able to reduce the number of array transponders needed for the project, leading to a reduction in vessel time required to install, calibrate and recover the array."

the operating limits of our vessels' USBL tracking systems and improve the operational efficiency of LBL without compromising positioning integrity.

The planning work we carried out with Sonardyne's SSG team ahead of mobilising for the job meant that when we arrived on location, we could get straight to work!"

INVESTMENT

Going to great depths to design, test and build

Two major investments at our UK headquarters are set to help accelerate manufacturing lead times, improve quality and lower R&D costs.

The first is a high pressure chamber which will be used to test the integrity of products and components to full ocean depths. With an internal diameter of 760mm and internal length of 2,000mm, the chamber can accommodate our largest subsea instruments, pressurising them up to a maximum of 630bar, 9,100psi. A quick closure design allows for safe, fast loading and unloading of product



(Above) Commissioning of a new deep rated pressure chamber and 3-axis motion simulator (below).



and being fully computerised, testing regimes can be precisely controlled.

The second is a 3-axis motion simulator for evaluating and calibrating the gyroscopes and accelerometers used in our subsea inertial product range. The precision and sensitivity of the sensors we use in products like SPRINT and Lodestar, meant that the new machine had to be installed in a custom-built room, complete with a 40 tonne, seismically isolated concrete foundation.

CORPORATE

Meet Sonardyne's new Managing Director

Baseline is pleased to announce the appointment of Robin Bjorøy as Sonardyne's new Managing Director. Robin brings with him extensive operational and management experience gained over a 27 year international career with GecoPrakla, WesternGeco and Schlumberger. Commenting on the appointment, Dr Ralph Rayner, Sonardyne's



Non-Executive Chairman said, "Robin comes to us with excellent business, financial and commercial acumen. His depth of knowledge, skills and experience will strengthen the Board and leadership team as we respond to current market challenges, organise the business for an upturn in our core markets and expand into new markets." Baseline 15 will carry a full interview with Robin.

RESEARCH AND DEVELOPMENT

Plymouth sea trials centre helps expand your capabilities

The extensive resources of our Sea Trials and Training Academy in Plymouth, south-west England are now available to hire by commercial and academic organisations to support the development of new marine technologies.

Opened in 1991, *Pier House* is the base of operations, home to offices, workshops, client training facilities and accommodation for visiting engineers. It's from here that trials conducted using our research and survey vessels are planned and co-ordinated. These include our 12 metre catamaran workboats, *Sound Surveyor* and *Echo Explorer*.

Commenting on the initiative, Engineering Director, Simon Partridge said, "We have world-class product testing resources at our disposal in Plymouth. The team that runs them has decades of experience designing and executing trials plans for all manner of above and below water technologies.

They also possess unique knowledge of the waters around the region and the challenges they present. We have now taken the strategic decision to open up this centre of excellence to the wider marine community." If you're interested in finding out more, please email: training@sonardyne.com



Sonardyne's 12 metre, high specification survey vessel, *Echo Explorer* is one of the assets available to companies to support the development of new marine technologies.



CUSTOMER SUPPORT

Minimise downtime with SOS

A new scheme to help you minimise vessel downtime caused by waiting for damaged equipment to be replaced, has been launched.

Called Spares on Standby, SOS ensures you are back up and running as quickly as possible by reducing the upfront costs of holding complete spare products onboard. So, if for example, your USBL transceiver is hit by an ROV, with SOS, there will be a complete second transceiver on your vessel ready and waiting. All that's required is a call to our Customer Support Team to remotely activate the product.

At this point, the outstanding balance of the purchase price will become due.

Our regional offices have more details, including the products eligible for the scheme.

NEWS

TECHNOLOGY

Syrinx DVL heads into the deep with MBARI

The last issue of Baseline reported on the development of Syrxinx, our first ever Doppler Velocity Log.

Offering features and performance that's comparable to both a 300 kHz and 1200 kHz DVL in one unit, Syrxinx made its industry debut at the Ocean Business exhibition in Southampton, impressing visitors during daily in-water



demonstrations. By the end of the first day, an order for two units from subsea equipment rental company, STR, had already been placed.

Since then, pre-production testing and trials of Syrxinx has continued unabated. Alongside continuous in-house tank testing and dynamic testing at our facility in Plymouth, Syrxinx has been further afield, gathering data and building confidence.

This summer, development engineers joined a scientific cruise off the coast of California run by the renowned Monterey Bay Aquarium Research Institute – MBARI. They took with them a 4,000 metre rated Syrxinx DVL and installed it on their research ROV, *Ventana*, alongside the vehicle's own 1200 kHz DVL for benchmarking performance.

“The overall results were very impressive. High altitude performance was confirmed and it consistently maintained (and regained) bottom lock...”

During the trial, a large amount of online testing was performed in the type of environment and conditions that Syrxinx will typically be used in. The overall results were very impressive. High altitude performance was confirmed and it consistently maintained (and regained) bottom lock over very large variations in altitude and sea bottom types. As well as high altitude testing, low altitude testing was

also performed. Heights of just 0.4-0.5 metres were achieved, meeting specification. During each dive, Syrxinx showed reliable power management and opportunities to try out the system's web browser interface were taken.

As well as field trials, Syrxinx has been deployed in a 60 metre long tow tank featuring a carriage capable of moving along the tank at precise velocities. Use



of the facility has allowed engineers to verify the velocity readings of Syrxinx, proving the accuracy of the device against a true velocity reference.

Everything that's been learnt in recent months from these thorough testing and development trials, is now being incorporated into production ready Syrxinx units at our Blackbushe facilities, with the first customer deliveries taking place now.

Recently a Syrxinx DVL was fitted to MBARI's research ROV, *Ventana*, to benchmark its performance in deep water. The vehicle was also fitted with our new WSM 6+ USBL transponders.



INERTIAL NAVIGATION

C-Innovation ROVs on track with SPRINT

C-Innovation, an integrated marine services company whose core services and products evolve around ROVs within the oil and gas sector, has placed a major order for SPRINT acoustically aided inertial navigation systems.

SPRINT makes optimal use of acoustic aiding data from USBL and LBL positioning and other sensors such as Doppler Velocity Log (DVL) and pressure transducers to improve accuracy, precision, reliability and integrity of subsea positioning for subsea vehicles.

Working closely with C-Innovation to understand their requirements when using Schilling's UHD® ROVs in their operations, SPRINT has been fully integrated into these ROVs, including the use of specialised Seanet connectors. This resulted in a configuration that allows the system to be used as both a high performance AHRS for typical ROV guidance or as an INS that provides automatic station keeping capability for the ROV – both at the seafloor (using DVL aiding), and mid water (using USBL aiding). Dual output is a unique feature of SPRINT and further underlines Sonardyne's understanding of C-Innovation's specific requirements.

"The capabilities of the SPRINT INS system will allow us to provide clients with more detailed information on installations, surveys and many other tasks we perform for subsea operations." Richard Bourque, General Manager, C-Innovation

Malik Chibah, INS Group Manager at Sonardyne said, "As a unique manufacturer of USBL, LBL and now DVL systems whose data outputs are required for aiding of the inertial navigation solution running inside SPRINT, we were pleased to work with C-Innovation and Schilling Robotics to provide an INS system to match the specific operational requirements of their UHD ROVs." He added, "SPRINT will provide the best possible guidance and automatic station keeping capability for the UHD ROV seamlessly at any point in the water column from near surface, down to the seabed."



C-Innovation has selected SPRINT to support their ROV operations.

SURVEY

Mini-Ranger 2 proves its worth worldwide



Bibby HydroMap take delivery of the first Mini-Ranger 2 tracking system.

Following its introduction earlier this year, Mini-Ranger 2 has been in high demand. Optimised for tracking up to 10 targets in shallow water and at high elevations, the system benefits from the same Wideband acoustic technology found in our deep water USBL product line, but for significantly less cost.

Survey companies looking to save time and money on their operations, without compromising on positioning performance, have been quick to recognise its benefits. None more so than UK-based Bibby Hydromap who took delivery of a system on the day it was released for tracking their ROVs and towfish.

Gustav Petterson, Survey Manager at Bibby HydroMap said, "As a long-term Sonardyne customer, we were thrilled to be the first company to adopt Mini-Ranger 2. Innovation is key to our success as a business, and we're keen to embrace technology that helps us achieve our aim to be the seabed survey company of choice."

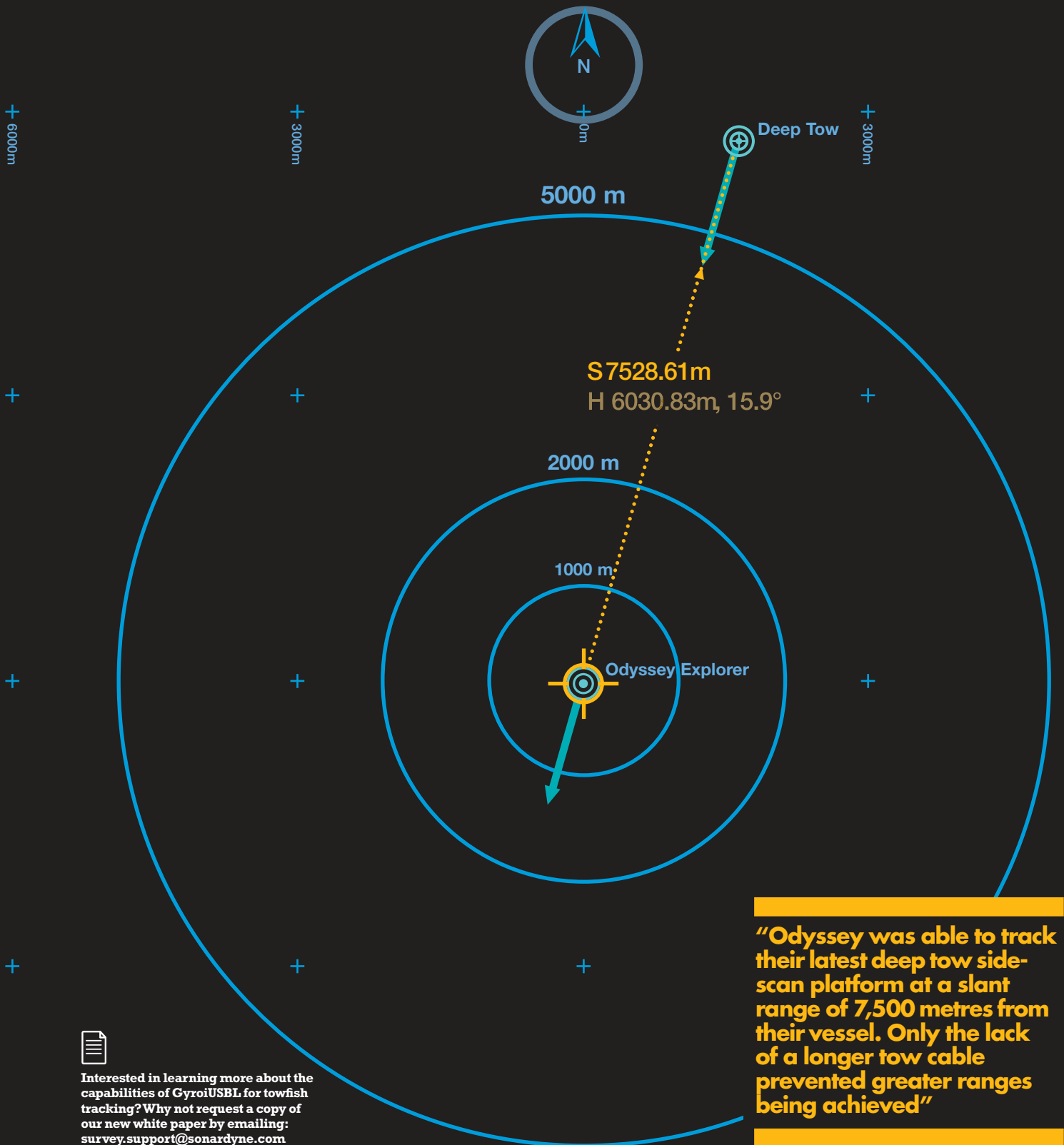
Shortly after, Abu-Dhabi based TES Survey Equipment Services LLC became the first in the Middle East to offer Mini-Ranger 2 for rental. TES's clients regularly carry out short duration surveys using divers working close to shore from vessels of opportunity.

The decision to add Sonardyne's WSM 6+ to its rental pool was a considered one for TES. Extremely portable and supporting two-way Wideband and Wideband 2 signal protocols for very fast position updates, the WSM 6+ was identified as delivering superior ranging accuracy and immunity to noise. Together with its re-designed transducer guard that offers more impact protection, the new WSM 6+ transponder/ responder is expected to be as popular as the now-outgoing WSM 6 it replaces.

Susan Murray, Managing Director at TES said, "Utilisation rates for our stock of 6G equipment are consistently high, so the decision to invest further was a straight-forward one. We see the introduction of Mini-Ranger 2 as particularly significant for our business as it bridges the gap between low cost, low performance USBLs and complex, deep water systems. We're not expecting it to be sitting on our shelves for very long."

Case Study: Long Range Towfish Tracking

Odyssey Marine Exploration goes to gr



“Odyssey was able to track their latest deep tow side-scan platform at a slant range of 7,500 metres from their vessel. Only the lack of a longer tow cable prevented greater ranges being achieved”

Interested in learning more about the capabilities of GyroUSBL for towfish tracking? Why not request a copy of our new white paper by emailing: survey.support@sonardyne.com

Great lengths with Sonardyne GyroiUSBL

New subsea technology which allows geophysical towfish to be tracked at distances far greater than current methods allow, has been successfully evaluated by Odyssey Marine Exploration during trials in the Bay of Biscay. Using our Ranger 2 GyroiUSBL system, Odyssey was able to track their latest deep tow side-scan platform at a slant range of 7,500 metres from their vessel, *Odyssey Explorer*. Only the lack of a longer tow cable prevented greater ranges being achieved.

Long layback tracking of towfish has traditionally always been a major challenge for conventional Ultra-Short BaseLine (USBL) acoustic positioning systems due to the very long slant ranges involved and vessel noise degrading performance. We first sought to address this challenge back in 2006, turning the problem on its head to create Inverted USBL (iUSBL).

In normal USBL operations, an acoustic transceiver is fitted to the survey vessel and an acoustic transponder is fitted to the target being tracked. With iUSBL, their positions are swapped; the transceiver is installed on the towfish looking up at the transponder deployed from the vessel. Because towfish are typically quiet, the signal-to-noise ratio is dramatically improved which allows long ranges and greater precision to be achieved.

The new Ranger 2 GyroiUSBL system builds on this technique by exploiting the long term accuracy and precision of acoustic positioning with the continuous availability and fast update rate of high-grade inertial navigation sensors.

"All USBL transceivers require motion compensation, whether vessel-based or installed on a towfish. Typically this requires an attitude and heading reference sensor to be co-located with the transceiver, which is both complex and time consuming to correctly align," said Tom Bennetts, Projects Manager at Sonardyne.

"Inside GyroiUSBL, we have combined the features of our sixth generation HPT



Odyssey's new deep tow platform, equipped with an upward looking GyroiUSBL, was tracked to beyond 7,500 metres during trials in the Bay of Biscay.



acoustic transceiver technology with SPRINT, a subsea INS that can result in more than 10 times improvement in positioning precision over USBL alone. Combining both instruments into a single Titanium housing depth rated to 7,000 metres, enables organisations like Odyssey to quickly and efficiently mobilise deep tow technology without having to worry about navigation sensor offsets."

Odyssey are pioneers in the salvage of historic, deep water shipwrecks and rely heavily on side-scan sonars to identify potential targets. The towfish being used during the recent trial has been designed to their exact specification to enable far deeper depths to be explored.

For the test, Odyssey used a high-powered directional Wideband Mini Transponder (WMT) in responder mode mounted to an over-the-side deployment pole from the *Odyssey Explorer*. This was interfaced via control room hardware with the GyroiUSBL transceiver mounted on the towfish. Power and communications to the

GyroiUSBL was provided through a Nexus multiplex fibre optic telemetry system.

With the towfish fully deployed, Odyssey used the GyroiUSBL to passively listen for the WMT's signal in a low noise, dynamically stable environment subsea. This meant that they were able to accurately track the position of their towfish at a previously unachievable slant range of 7,500 metres. Additionally, the acoustic transceiver component of the system incorporated Sonardyne's unique ping stacking technology to provide a tracking update rate of 2 hertz, irrespective of range and water depth.

"The trial went exactly to plan," said Tom Bennetts. "As the layback grew and grew, GyroiUSBL just kept tracking until we eventually ran out of cable. Analysis of the signal-to-noise data at the time indicated that we could have tracked to beyond 9,000 metres had the winch cable been able to extend further." He added, "Even more impressive was that these ranges were attained using the lower end of the medium frequency band. This means that the multi-beam data quality is significantly enhanced due to less in-band interference at the source."

Speaking about the positive results of the tests, Andrew Craig, Senior Project Manager at Odyssey Marine Exploration said, "The addition of the GyroiUSBL system has introduced a whole new dynamic to the positioning of towed vehicles at greater water depths and slant ranges that are not facilitated by traditional USBL. The ability to achieve accurate and precise positioning of our towfish mitigates the concerns of gaps in search blocks, unknown offsets from currents, and the influences of catenary in the cable that were by-products of traditional layback calculations. As a result, the positions acquired via the GyroiUSBL system have allowed for a great reduction in operational time spent locating and inspecting subsea targets. We look forward to pushing the capabilities of the system to its limits during future projects."

+ 6000m

+

+

+

Corporate



EQUIPPED WITH ALL THE PIECES TO COMPLETE YOUR SUBSEA PUZZLE

Step inside Sonardyne's global headquarters, 40 miles south-west of London, and any preconceived ideas you may have about the company and what it does will be quickly dispelled. You will of course see plenty of products such as acoustic transponders, inertial navigation systems, DVLs and transceivers on the production line, but sitting alongside them will be custom designed equipment destined for one-off subsea projects. Reporting for Baseline, Divisional Director for Oil and Gas, **Dr Graham Brown**, examines how Sonardyne has assembled all of the pieces needed to meet the challenges of its clients' engineering puzzles.

Custom subsea engineering



“

DIDN'T KNOW YOU did all that" and "I didn't appreciate the detail involved." These are regular comments that I hear from customers who see our design and manufacturing processes for the first time whilst walking around our factory.

While Sonardyne is well known within the offshore oil and gas industry as a designer and manufacturer of Long Baseline (LBL) positioning transponders, something we are less known for is that throughout our history, we have engaged in special projects developing custom engineering solutions.

Custom Engineering

Acoustics is indeed a very large part of what we do – it's in our DNA. But long ago, we realised that not all subsea challenges can be solved using standard, off-the-shelf products and hence the core of many of our known products are based around a few high reliability technology platforms. This reliability has increasingly led to our clients coming to us and asking if we can apply our learning and technologies to help solve their problems.

So for the last decade we have continually invested in developing and transforming our capabilities and methods of working in system engineering, product design and custom solution delivery. Sonardyne is now an agile organisation and all parts of the company have been touched by this process, from how we capture users' requirements to

through-life project management, materials control and custom manufacture. The result? A team of experienced people who have tried and tested technologies at their fingertips, with a proven portfolio of hardware and software pieces that can be fitted together seamlessly to build custom engineered systems that meet your needs.

Vertically integrated

Our ability to react quickly to integrate new technologies and deliver custom engineered subsea solutions is enabled by Sonardyne's vertical integration. So how does vertical integration give us that ability?

In simple terms it is about having skilled people, with the right tools and processes which is fully integrated with manufacturing, compliance, test and offshore operations. By investing in people, specialised design software, prototyping and test equipment, adding substantial in-house manufacturing capabilities and adding a vetted and developed supply chain (with whom we have long term relationships), makes us a more agile and cost-effective organisation. This is something that can be further improved upon with sophisticated manufacturing control, keeping safety stocks of key raw materials, sensors and integrated circuits together with stocks of piece parts. Not only does this allow us to quickly assemble variants of our standard products, it also enables us to design, develop and manufacture customised systems or products, efficiently and within budget.

Of course as no two subsea engineering challenges are ever quite the same, the pieces in the Sonardyne puzzle can blend together old

Corporate

Custom subsea engineering



and new ideas, designs and components, which can be rapidly reconfigured almost without limitation. To make this clearer, let's look at a practical example. An oil company comes to us needing a set of subsea instruments for long term integrity monitoring. How do we approach the task?

At the very heart of this process is robust systems engineering. Firstly, we capture requirements by addressing obvious questions, the who, the what, the where and the when's of the project. This includes how deep it will be used, where will it be deployed and for how long? Then we address the more complex requirements such as what sensing is actually required, how does the data need to be processed and what compromises need to be considered between reliability and availability, durability and cost? Thereafter, we can work with the project team to draft, review and agree a specification. Answering these (and many more) questions will highlight the less obvious ones. Those being the questions that only experience teaches you to ask.

Once we have formed this clear picture of what needs to be done, technology trade-offs can be performed, what is the best sensor for the application or what is the best material? At this point, the solution will be starting to form and take a much firmer shape based on a clearer understanding of the requirements, constraints, key components, defined interfaces and Concept of Operations.

Candidate designs can be evaluated, down selected and detailed design commenced. Detailed design encompasses the hundreds of tiny, but critical decisions – each carrying knock-on considerations. For example, choosing the heat treatment for the pressure housing to minimise corrosion risk, selecting a capacitor that will survive the shock load, routing the PCB tracking to reduce electromagnetic susceptibility or implementing an algorithm to process the data faster and save battery life. Our experienced team of engineers reduce clients' product risk with each of these decisions.

Following client design review, we can rapidly implement and manufacture the custom solution in-house and start the testing process.

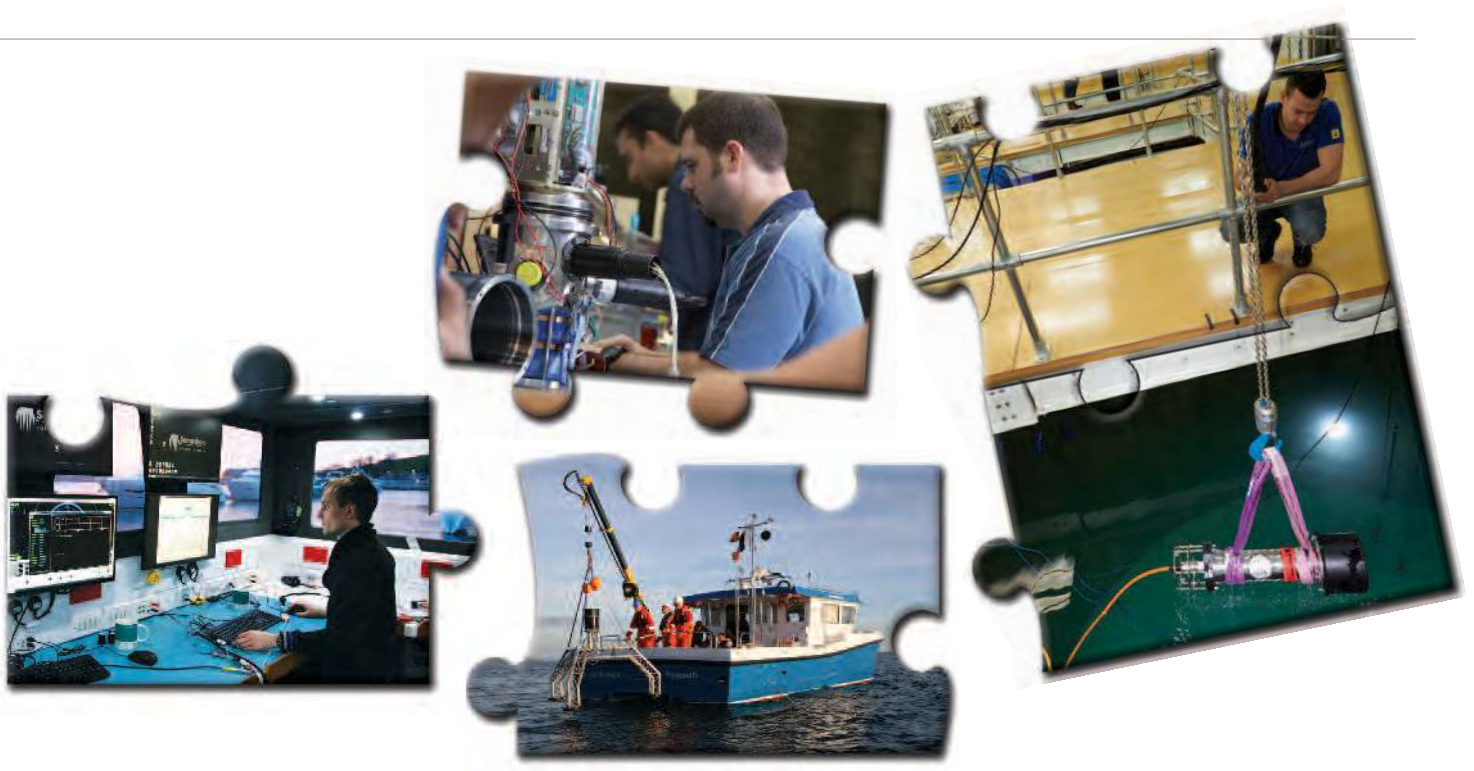
This entails working from bare PCB or software modules through many levels of assemblies, to full product level and finally production system level acceptance in test tanks at our Blackbushe campus.

As well as in-air and in-water functional testing, we have extensive and specialist sensor calibration equipment and product compliance testing facilities in-house. This includes high pressure testing of large assemblies up to 760mm diameter by 2 metres long and a test pressure of 630bar, to smaller chambers capable of pressures of 1200bar for simulating conditions at the bottom of the Mariana Trench. In addition, we also have access to shock and vibration testing of PCBs and chassis assemblies that meet API standards, as well as large thermal test chambers. All of these world-class facilities are now available to support custom solution development and are available for hire. So, apart from some specialised aspects of compliance testing or tests that need independent verification, nothing needs to be outsourced.

Following comprehensive factory and tank testing, in-water full system integration testing is often then first undertaken at our trials facility in Plymouth. Our website has more information on what we can do to support in-water equipment validation. After this test, there is often further testing for special projects at the client's specified location where we may integrate with other equipment vendors to test a larger system.

Finally, when it comes to taking the technology offshore for the first time, our engineers are all suitably qualified and experienced to support installation, deployment and commissioning activities. This is backed up by our regional offices that provide mobilisation, training and through-life support.

The story is similar for all of the standard products we supply ranging from the simpler acoustics beacons used in seismic surveys, through to complex positioning and well control systems supplied to drilling rigs. However, we can apply the benefits of our vertical integration and flexibility to working with you to develop custom solutions to your problems. This can range from manufacturing lightly customised versions of our existing products through to highly customised



engineered solutions, based on your requirements and our technologies, manufactured to order and perhaps even embedded inside your product.

Vertical integration allows us to be efficient, be in control of quality and costs throughout the engineering design cycle. This provides benefits that we can pass on in terms of price and risk.

A deeper understanding

Underpinning all this is, of course, our people. From a technical perspective, we have specialists across a range of subsea engineering disciplines, including 14 PhDs, providing subject matter expertise in materials, transduction and sensing, electro-mechanics, electronics, signal processing, navigation and systems engineering. Supporting them, we have an experienced design and production engineering team covering prototyping, quality, safety, product testing, manufacture and field support.

Our team of people share thousands of years of engineering and manufacturing experience between them, including knowledge of what's been done in the past, what's worked and, crucially, what hasn't. Using this knowledge within rigorous processes, allows us to efficiently determine what pieces can be re-used and called upon to fit into a solution. This includes materials, housing designs, flight-safe lithium primary batteries, subsea cable assemblies, connectors, sensors, transducers, software, firmware, and deployment hardware. There are not many elements of the subsea design puzzle that haven't been encountered at some point in our history.

A trusted supplier

Sound business is in essence 'doing the right thing' as well as 'doing the thing right.' We know about the small details that have the potential to become big problems, so we are committed to ensuring our customers know about such risks in a timely manner.

We are equally committed to maintaining a safe, healthy and sustainable working environment, with a goal of zero harm. Everyone in Sonardyne is responsible for making this a reality, including complying

with our customers, partners and contractors requirements for health and safety. Our knowledge and processes for product type testing, compliance testing such as CE, or providing documentation including 'green passports,' mean that you can be sure of getting a safe and reliable product from us. This consideration also includes a design and manufacturing process that meets waste material and hazardous substance regulations.

Flexibility

We have always been, and will remain, a dynamic and flexible company, reactive to our customers' needs and the market conditions.

In the current times, we've moved quickly to help our customers reduce cost and risk in their operations. Unlocking the full potential of 6G acoustics and SPRINT inertial has achieved real cost savings, allowing subsea operations to be completed in less time, proof of which can be found throughout this issue of Baseline.

In a similar way, working with Sonardyne to provide your product design, supply chain, manufacturing and operational experience will help you save cost and control risk in developing and manufacturing subsea instrumentation for any application.

So what does all this mean for the oil company that came to us with that monitoring application? Quite simply, they got a low risk, highly reliable and fit for purpose solution delivered on time and on budget.

I started with some typical customer comments, so it would be appropriate to finish with another one. After a recent off-site project meeting I was chatting to a thought leader from one of our key customers who said to me, "We come to Sonardyne because you guys get it. It's not too much trouble to meet our requirements, you listen and you care about getting the detail right, you are enthused by the technology, you make what we need and you deliver."

In closing, if you have a subsea measurement problem, you want to take your surface product subsea, you need test or operational support, or you are looking for custom engineering and manufacturing, think Sonardyne. **BL**

Construction Survey

Case Study: Fusion 6G LBL

Total saves time and money with Fusion 6G offshore West Africa

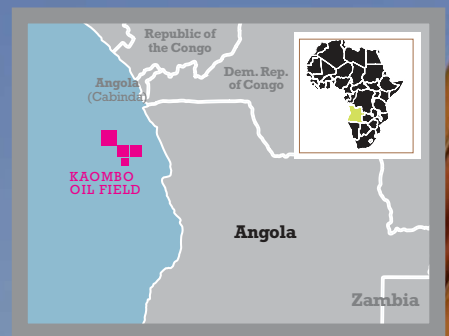
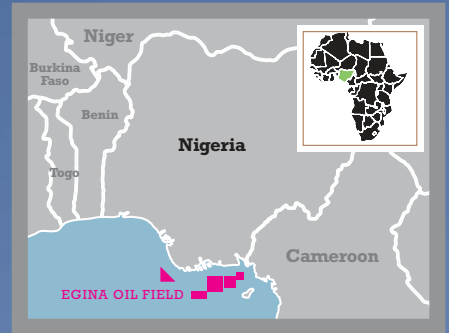
Two multi-billion dollar field developments currently under construction off the coast of West Africa, are a step closer to first oil thanks to the time saving features of Fusion 6G acoustic positioning technology. **Baseline** reports on how French oil major Total, together with its construction and survey partners, have successfully installed field-wide networks of the world's most widely deployed LBL system to support the development of the Egina and Kaombo oil fields.

Located 150 kilometres off the coast of Nigeria, in water depths of up to 1,750 metres, the Egina field covers an area of around 1,300 square kilometres. Infrastructure will include an FPSO, an oil offloading terminal and subsea production systems with 52 kilometres of oil and water injection flowlines, 12 flexible jumpers, 20 kilometres of gas export pipelines, 80 kilometres of umbilicals, and subsea manifolds. Production at the field is expected to reach 200,000 barrels per day at its peak.





Kaombo was the second major West African project where Total and its consortium partners elected to use Fusion 6G. Pictured here, are some of the Compatt 6 transponder frames being readied for deployment on the back deck. Image courtesy of Total.



Construction Survey

Case Study: Fusion 6G LBL

Planning makes perfect

The acoustic technology specified for Egina included a field-wide array of Compatt 6 seabed transponders, the essential component in any Long BaseLine (LBL) system.

Fusion 6G is Sonardyne's sixth generation LBL platform, widely considered the industry standard tool for subsea construction and survey. Using it, major tasks such as structure installation, spool-piece metrology, ROV tracking and route surveys can be completed quickly, accurately and reliably in any water depth.

Planning for Fusion's deployment at Egina had begun several months earlier and involved senior project managers and surveyors from Total and its sub-contractor, Fugro Survey BV, working closely with personnel from Sonardyne's in-house Survey Support Group (SSG).

The work undertaken by the SSG included analysing the proposed location for each of the Compatt transponders in the seabed network. This work verified that there was clear line of sight between each transponder in order that they could reliably range to each other. The SSG team also simulated acoustic coverage and calculated the expected positioning performance of the Compatts at all points of interest. The process involves specialist software and helps identify the optimum quantity of transponders that are needed to meet a project's positioning specification.

8 days ahead of schedule

At Egina, the investment in time planning acoustic operations onshore was rewarded with a highly successful offshore LBL campaign. The wide-area transponder array was deployed, installed and calibrated by Fugro, eight days ahead of schedule.

Frederic Auger, Chief Surveyor at Total E&P said, "The array installation and subsequent SURF (Subsea Umbilicals, Risers and Flowlines) campaign performed at the Egina field, has proven to be an extremely successful demonstration of Fusion's capabilities." He added, "The system's quick setup and deployment, meant that the savings in vessel time alone has more than justified our decision to trust in Sonardyne's low-risk digital technology platform."



(Above and left) A Sonardyne Compatt 6 transponder that forms part of the field-wide acoustic positioning network at the Egina oil field, is lowered to the seabed. Compatt 6 is the industry standard LBL transponder used for high precision subsea survey and construction operations in all water depths.



Ahead of the offshore campaign, the proposed location for each Compatt was carefully analysed. This verified that there was clear line of sight between each transponder so that they could reliably range to each other.

(Left) At Kaombo, a number of innovative firsts paved the way for operational success. This included the use of 'spreader bars' that allowed five transponder frames to be coupled together and lowered down on to the seabed in one crane operation, saving considerable time.

All images courtesy of Total.

Setting records at Kaombo

Encouraged by the success of Egina, Total was quick to decide that Fusion 6G would also play a significant role in their development of the larger and deeper, Kaombo oil field offshore Angola.

Covering an area of around 1,300 square kilometres, Kaombo lies in water depths up to 1,750 metres. Development of the field will involve the drilling of 59 subsea wells,



“ Besides Sonardyne’s expertise and field proven subsea technology, there were a number of innovative firsts that paved the way for quick and efficient equipment deployment at Kaombo. ”

connected by over 290 kilometres of subsea lines leading to two floating production, storage and offloading (FPSO) vessels.

The campaign to deploy, calibrate and ready the field-wide array of transponder frames was completed in just 31 days using the seabed component of a Fusion 6G system. This was half the time budgeted for, a figure that is thought to have set a new unofficial record for this scale of operation.

The exceptionally fast deployment of Fusion 6G at Kaombo has been attributed, in part, to the extensive project planning workshops hosted by project partner Technip in France. Attended by teams from Total, Technip and Fugro, together with personnel from Sonardyne’s Survey Support Group, the sessions were used to review the full scale of the operation and consider the most efficient and cost-effective configuration of the LBL transponder frame network.

Deciding the quantity, specification and location of each transponder within a seabed array is crucial to the success of any LBL project. As technical leader of the Technip and Heerema SURF Consortium, Technip conducted the LBL array planning themselves, a process that involved confirming that there was clear line of sight

between neighbouring transponders and modelling acoustic network coverage at specific locations. By using the same specialist software as the SSG, Technip’s survey team was able to then share their proposed array design with Sonardyne for verification, thereby further increasing confidence in the plan prior to mobilisation.

Speaking afterwards, Regis Mortier,



“ Starfix.Acoustics, a Fugro specific variant of Fusion 6G batched simultaneous baseline collection feature, allowed data to be gathered during deployment operations and win back vessel time. ”

Senior Survey Consultant at Technip, France said, “ Besides Sonardyne’s expertise and field proven subsea technology, there were a number of innovative firsts that paved the way for quick and efficient equipment deployment at Kaombo. The use of stackable frames optimised deck space, saving time as we only had to use one vessel and make one trip out to the field. In addition, our innovative spreader bar meant we could deploy five frames in one sequence, thereby speeding up overall frame and Compatt deployment.”

Echoing that positive sentiment, Steven Tonneman, Project Co-ordinator at Fugro Survey B.V. said, “ The use of Technip’s two work-class ROVs operating concurrently in the field meant that we could simultaneously deploy, calibrate and move Compatts on the fly. Starfix.Acoustics, a Fugro specific variant of Fusion 6G batched simultaneous baseline collection feature, allowed data to be gathered during deployment operations and win back vessel time. Post deployment, the sound velocity data gathered by the Compatts meant that our calibration results met Total’s very stringent specifications.”

Total’s Frederic Auger added, “ We can’t fault the preparation and professionalism displayed by all personnel involved with this

massive project. With future time savings gained from not having to deploy many individual transponder arrays, the cost of installing a field-wide LBL permanent frame network that can be scaled from high accuracy metrology to LBL aided inertial and also LUSBL positioning for DP and drilling, means this investment will more than pay for itself within the first few years of the field development.”



“ We can’t fault the preparation and professionalism displayed by all personnel involved with this massive project... this investment will more than pay for itself within the first few years of the field development. ”

“ The SSG is frequently asked to assist with many different aspects of offshore survey campaigns. On this occasion we were involved in the planning stages and in the post project wash-up workshop. It’s been very rewarding to see such a well organised and executed project successfully achieve its aims and exceed expectations,” concluded Tom Bailey, Acoustics Surveyor with the SSG.

Fusion 6G: Reasons to invest

- Proven reliability track record makes Fusion the lowest-risk positioning system
- Equipment deployed can be scaled, so you only pay for the performance needed, when needed
- Optimised battery technology increases the periods between equipment recovery to change the battery
- Software Wizards ensure you’re operational, fast
- Optimised technology ensures reduced project time

News Feature

SPRINT inertial navigation for ROVs

Fastest ROV sprints with

Specialists in high-resolution marine surveys, MMT, has completed offshore integration trials of their new 2,000 metre rated high-speed remotely operated vehicle, *Surveyor Interceptor* with our SPRINT inertial navigation system.

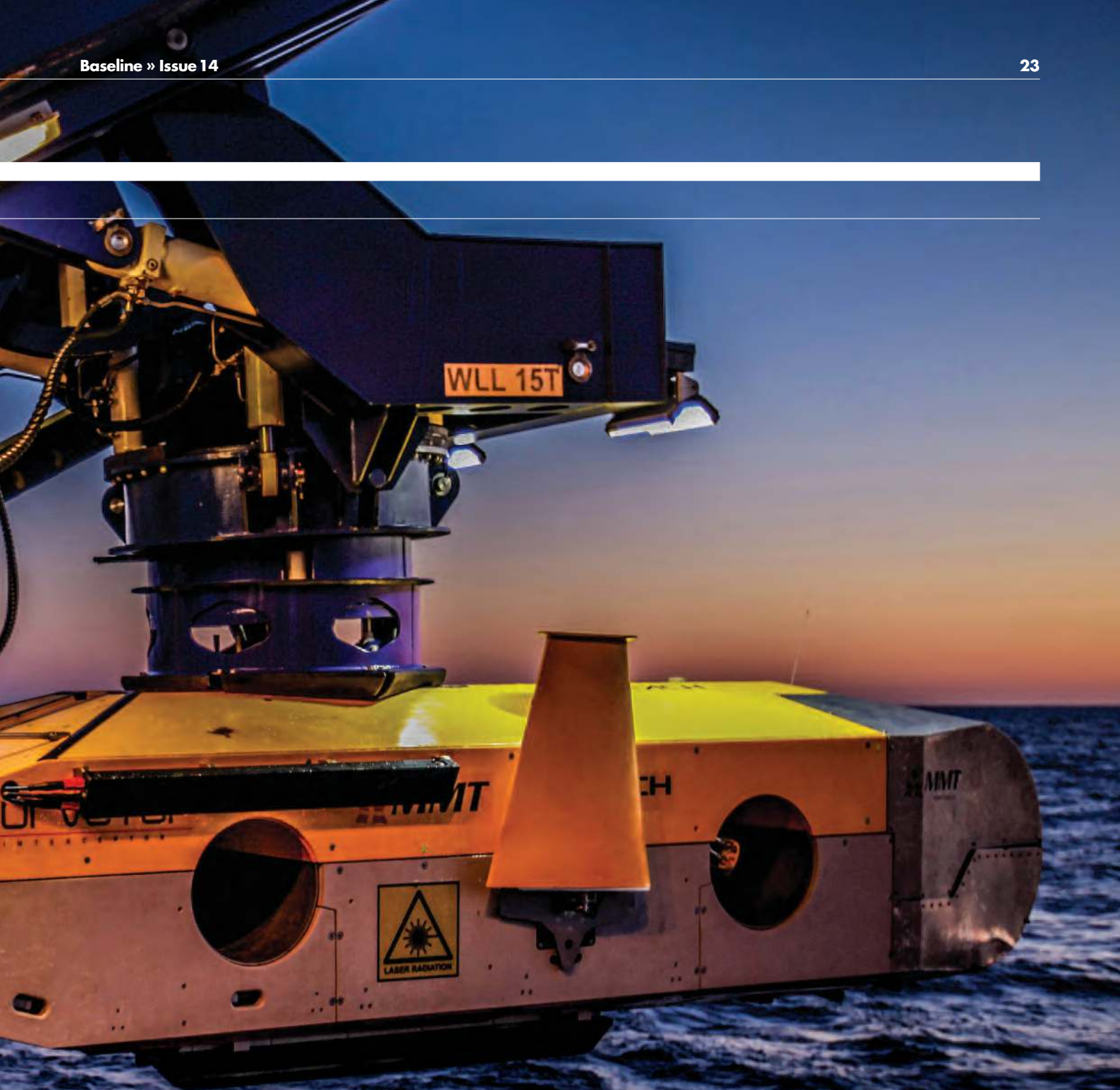
The vehicle's revolutionary design features a hydrodynamic hull and powerful drivetrain, enabling it to travel at up to six knots – around 50% faster than conventional Work-class ROVs.

The accuracy of SPRINT complements the *Surveyor Interceptor's* state-of-the-art imaging and mapping sensors, resulting in improved survey data quality and substantially reduced 'cost per kilometre' of surveys.

SPRINT has been used for over five years worldwide with great success, establishing itself as one of the most cost-effective and low-risk underwater navigation technologies on the market. It uses ring laser gyroscopes (RLG) and accelerometers developed by Honeywell

that are of the same type supplied to commercial aircraft, military vehicles and space platforms. SPRINT has a proven capability when it comes to positioning subsea targets in any water depth, over long laybacks and during challenging acoustic conditions.

To complement their SPRINT, MMT also chose to fit a Sonardyne Inverted Ultra-Short BaseLine (iUSBL) which was interfaced directly with the SPRINT unit. This provided them with a highly optimised navigation solution that



With Sonardyne SPRINT

returned position updates at a rate of up to 100 times a second.

Jonas Andersson, R&D Manager at MMT said, "When testing the new MMT Survey Interceptor ROV, we were looking for an inertial navigation solution that would deliver real-time performance with high-speed updates. By running Sonardyne's SPRINT inertial navigation system we witnessed a marked difference in the accuracy of all ROV positioning activities during the period, which in turn made a marked difference

"By running Sonardyne's SPRINT inertial navigation system we witnessed a marked difference in the accuracy of all ROV positioning activities during the period, which in turn made a marked difference to the quality of the survey data received."

to the quality of the survey data received." He went on to say, "Now that Sonardyne has also released their new Syrinx DVL, we will be looking to run further tests in the future. This will be done with a view to achieving even more precise position accuracy using a tightly integrated Syrinx DVL, SPRINT and USBL acoustics.

Turnover the page and discover how we can meet all of the subsea technology requirements of your ROVs and AUVs. >>

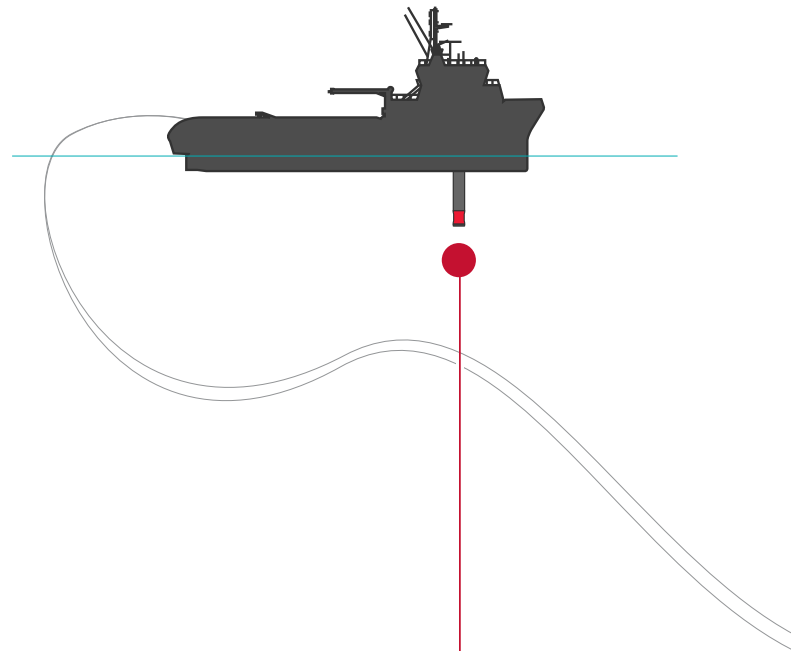
Technology

ROV Product Focus

WHEN IT COMES TO ROVS WE'VE GOT EVERYTHING COVERED



Whether you're operating an Inspection-class ROV in shallow water, or using a 4,000 metre rated Work-class vehicle to support deep water drilling and field development programmes, Sonardyne's acoustic, inertial and optical technologies are designed to keep you operational at all times. Our 6G acoustic hardware is low-risk and field proven. Tightly integrate it with SPRINT INS to extend capability and improve vehicle control. And if you hadn't already heard, we now manufacture DVLs, so you can now get more of your ROV's technology from one manufacturer.



Task: Tracking
Ranger 2 and Mini-Ranger 2

Ranger 2 is able to track multiple ROVs to ranges of 6,000 metres and beyond. At the same time, it can supply dynamic positioning systems with stable, precise and fast acoustic updates – ensuring the vessel that's tethered to your vehicle, stays where it should.

Ranger 2 boasts an extensive feature list to meet the needs of complex survey operations. It's compatible with a wide range of third party transponders, but 6G hardware such as the new Wideband Sub-Mini 6+ (see above right) provides optimal performance. Transceiver options include Inverted USBL, GyroUSBL and deep

water optimised. All support LBL and data modem operating modes.

Operating a small ROV in shallow water? Then why not consider Mini-Ranger 2? It shares many of the features of Ranger 2 but for less cost and complexity. Turn back to page 11 to read how others are using theirs.

Task: Inertial Navigation
SPRINT

SPRINT is an acoustically aided inertial navigation system for ROVs that exploits the long-term precision of acoustic positioning with the continuous availability and fast update rate of inertial sensors.

SPRINT can be aided by USBL, LBL and DVL

sources to improve position accuracy, precision, reliability and integrity, while reducing operational time and vessel costs. The additional integrity of the INS significantly reduces delays during periods of challenging subsea acoustic conditions, with the high output update rate allowing for improved ROV control. USBL aiding is vendor

independent, however peak performance is achieved when tightly coupled to Ranger 2. LBL aiding can be from a full or sparse seabed array.

SPRINT supports dual AHRS and INS algorithms, removing the need for separate units on the vehicle, saving space and cost. Depth ratings to 6,000 metres are available.

Task: Tracking
Wideband Sub-Mini 6 Plus (WSM 6+)

WSM 6+ is a mini-sized USBL beacon that when used with Ranger 2 or Mini-Ranger 2 provides high update acoustic tracking of ROVs in all operating conditions. It offers both transponder and responder operating modes and is

available in 1,000 metre and 4,000 metre depth ratings.

Compact and rugged, the WSM 6+ is based on the field proven mechanics of the WSM 6 it replaces, adding support for the latest two-way Wideband and Wideband 2 protocols for improved robustness of navigation.

A re-designed transducer guard (Omni version only) provides greater protection against accidental knocks when deployed.

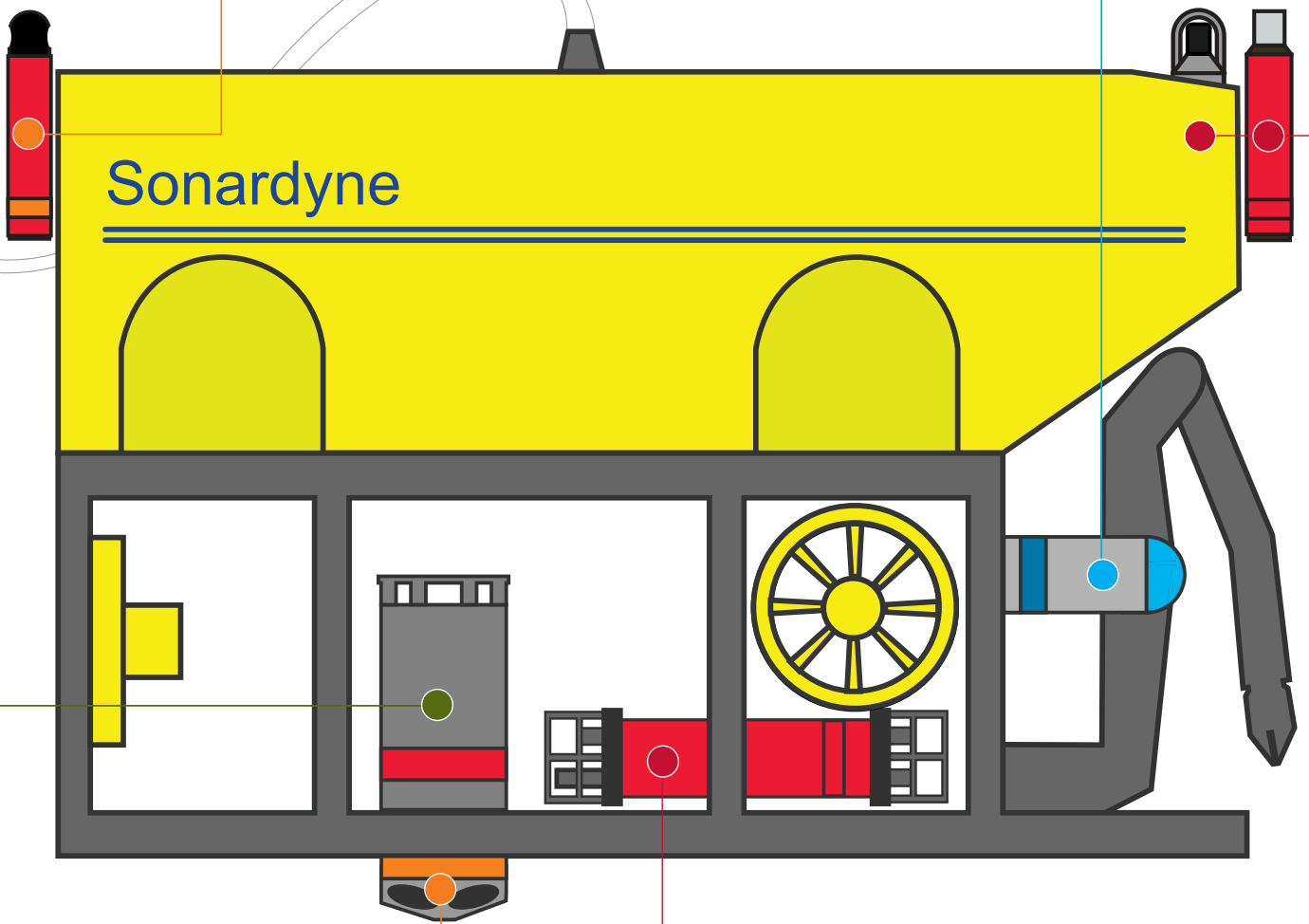
Task: Data Transfer
BlueComm

BlueComm is a wireless, high-speed optical modem platform that can be installed on an ROV to harvest data from seafloor instruments, wirelessly transfer HD video and permit tether-free vehicle control. Models are available to support vehicle

operations in all conditions including; shallow water daytime, shallow water night time and deep, dark water. Data transmission rates from 1-20 megabits per second are achievable.

BlueComm supports bi-directional communications and can be combined with a Sonardyne 6G acoustic

link for commanding, locating and waking up a seafloor instrument prior to data recovery. BlueComm is depth rated up to 6,000 metres.



Task: Navigation
Syrinx Doppler Velocity Log (DVL)

Syrinx is a 600 kHz DVL that offers the high altitude navigation capability of a 300 kHz DVL with the high resolution performance of a 1200 kHz DVL. It can be used as a standalone DVL, as part of an integrated system, or perform both functions at once thanks to its

concurrent Ethernet and Serial output capability. This means that only one DVL altitude sensor is required for both ROV control and survey, saving on cost and payload.

Syrinx can use existing instrument mounting brackets, avoiding the need for vehicles to be modified. A 4,000 metre depth rated titanium version is available to

meet the requirements of modern Work-class ROVs, with 3,000 metre and 6,000 metre models also available. Individually replaceable transducers reduce repair costs in the event of damage.

Task: Positioning
ROVNav 6 and Mini-ROVNav 6

ROVNav 6 is a high power acoustic transceiver for commanding and ranging to Long BaseLine (LBL) arrays of seabed transponders. Wideband 2 signal processing offers outstanding performance in challenging conditions such as on noisy vehicles or in multipath

environments. It is also a fully functioning USBL responder or transponder, enabling emergency vehicle location in the event of umbilical failure.

The new Mini-ROVNav 6 transceiver is significantly lighter and smaller than a standard ROVNav 6, whilst providing full 6G LBL capabilities. The 3,000 metre rated unit

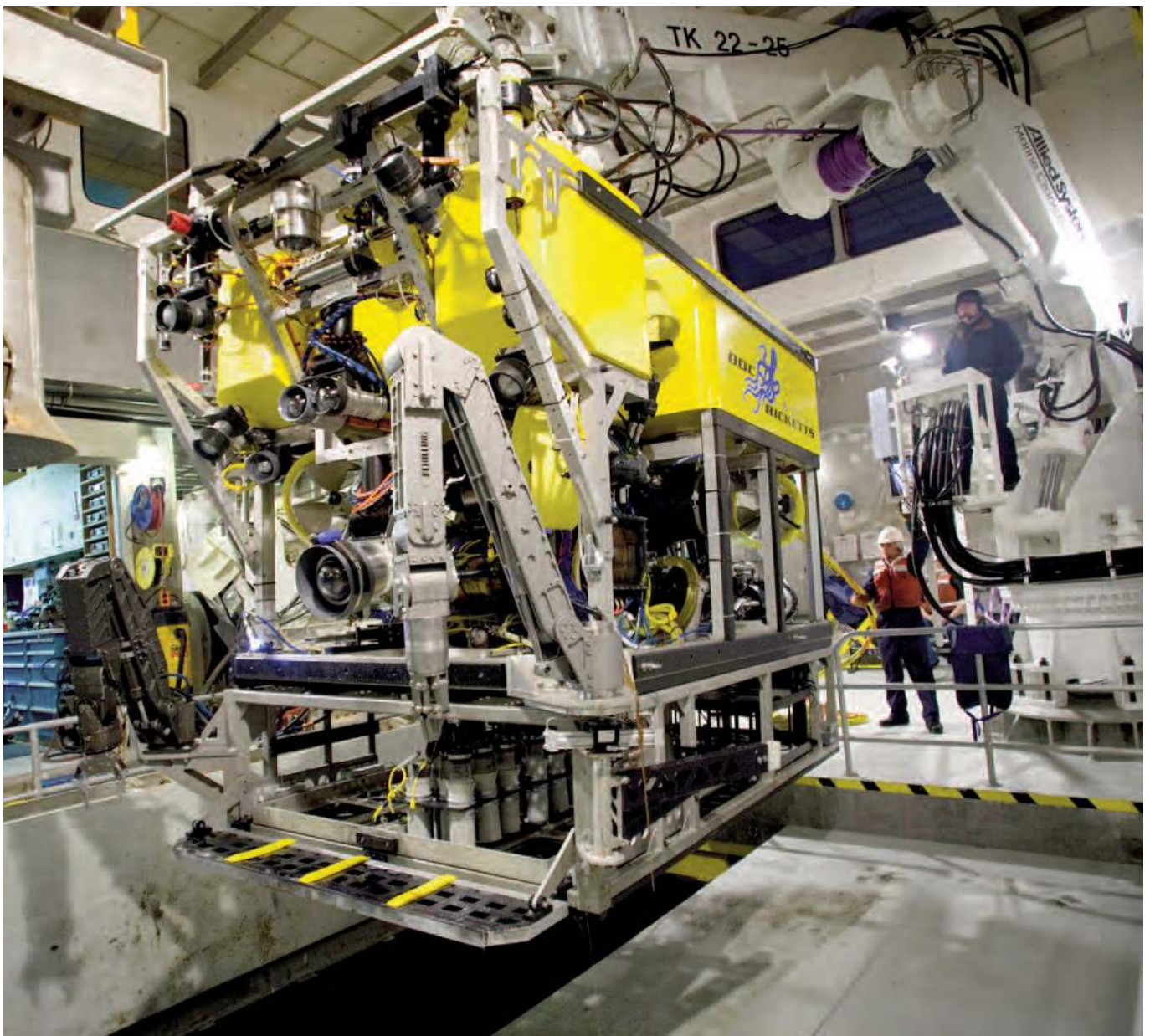
incorporates a built-in omni-directional acoustic transducer. This, together with its small size, offers the freedom to fit the unit where line of sight with LBL transponder arrays can be best maintained; at the front, at the back or even underneath the ROV. And when it comes to communications capabilities, a ROVNav can also be used for data harvesting.

Product Focus

Technology for underwater target tracking and DP reference

RANGER 2 USBL ON TRACK AROUND THE WORLD

From navigating deep water exploration ROVs, to helping dive support vessels maintain a reliable position, Sonardyne's Ranger 2 USBL acoustic technology is proven to reduce risk, save time and extend operational capability. **Baseline** takes a closer look at how three very different organisations are benefiting from the investment they have made in this technology.





Going deep with MBARI

Located in Moss Landing, California, the Monterey Bay Aquarium Research Institute (MBARI) is recognised as a world centre for advanced research and education in ocean science and technology. To support its work, it has at its disposal a wide range of marine technology and assets including;

research vessels, deep rated ROVs, several AUVs and a large inventory of scientific instruments.

Over the past 15 years, Sonardyne’s Ultra-Short Baseline (USBL) technology has supported many of MBARI’s expeditions off the California coast where water depths rapidly reach beyond 13,000 feet. However, it was noted that on occasions, multi-path signals reflecting off their twin hulled research vessel, *Western Flyer* and noise from ROV thrusters, were interfering with transponder signals coming from great depths.

“Challenging conditions like these are exactly why we developed 6G – our sixth generation acoustic positioning platform,” said Kim Swords, Senior Applications Engineer with Sonardyne. “6G systems like Ranger 2 use Wideband 2 digital signal architecture to provide robust navigation, greater precision and fast position updates in all scenarios, deep or shallow and on all types of vessel. We were confident that by upgrading the *Western Flyer* to the latest 6G standard, MBARI’s deep water vehicle operations would be faster, more accurate and more efficient.”

As part of the upgrade, the *Western Flyer* was fitted with Sonardyne’s deep water optimised HPT 7000 USBL transceiver. Co-located with it on the vessel’s deployment pole was Lodestar, Sonardyne’s premium grade motion sensor – a configuration referred to as Optimised USBL.

“During the entire length of the project in the Pescadero Basin, our acoustic tracking enabled us to return to scientific sites of interest repeatedly with three-meter accuracy, well within visual range of the ROV cameras using Sonardyne’s Ranger 2 USBL system.”

This integration achieves a tightly compensated solution and allows the positioning accuracy obtainable from Ranger 2 to be maximised.

For MBARI, proof of Ranger 2’s capabilities came during a recent expedition that ran earlier this year to study deep sea hydrothermal vents recently discovered in the Gulf of California.

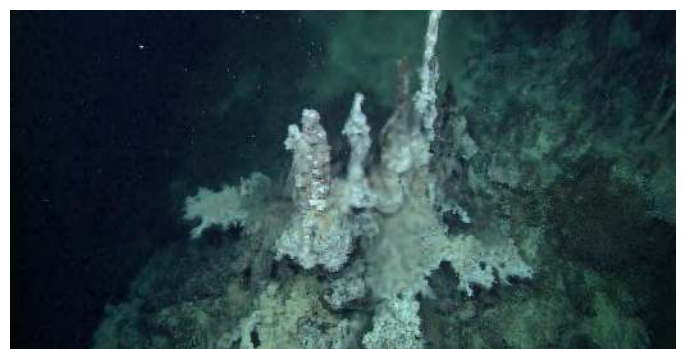
Tethered to the *Western Flyer*, their ROV *Doc Ricketts* repeatedly dived down 12,500 feet (3,800 metres) to the seafloor and flew around the Pescadero Basin vent field, collecting video and samples for analysis. Despite the challenging conditions created by the vents spewing out super-heated seawater and suspended solids, the positioning repeatability of Ranger 2 was shown to be just a few

(Opposite page) *Doc Ricketts* is MBARI’s 4,000 metre depth rated ROV and is used to support a wide range of oceanographic research assignments. Modular, mission-specific toolled packages can be changed out quickly and easily. All images courtesy of MBARI.

(Below) The research vessel *Western Flyer* is the support vessel for the ROV *Doc Ricketts* and is primarily utilised for operations

of between three and five days. The vessel is now equipped with a Ranger 2 HPT 7000 to provide accurate long-range target tracking.

(Middle and bottom) During the mission to study newly discovered hydrothermal vents, the positioning repeatability of Ranger 2 was shown to be just a few metres, performance that enabled MBARI’s ROV pilots to save time by flying directly to points of interest.



Product Focus

Technology for underwater target tracking and DP reference

metres, performance that enabled MBARI's ROV pilots to save time by flying directly to points of interest.

Commenting on the success of the project, Knute Brekke, Chief ROV Pilot for MBARI said, "During the entire length of the project in the Pescadero Basin, our acoustic tracking enabled us to return to scientific sites of interest repeatedly with three-metre accuracy, well within visual range of the ROV cameras using Sonardyne's Ranger 2 USBL system." He went on to say, "Even though we are a relatively small organisation, we appreciate the support and advice that we have received from Sonardyne on the systems we have purchased to date, and the projects we have used them for."

Upgrading CCC's fleet

Deep water tracking of ROVs is just one of the many applications for Ranger 2. It's equally effective and capable as an acoustic reference sensor for dynamic positioning systems and is installed on a global fleet of vessels. One such fleet is operated by CCC (Underwater Engineering) S.A.L, leading providers of offshore construction and subsea services in the Middle East and India.

Four multi-purpose vessels make up CCC's fleet, including two new 65 metre vessels rated for Class 2 operations. All are fitted with DP systems from GE, with their two 90 metre Dive Support Vessels,

"Ranger 2 meets our needs in every respect, offering stable and precise positioning for DP, reliable tracking in any water depth and hardware that is easy for our crews to set up and use."

the CCC *Pioneer* and the new build *Said Alethia*, equipped with dual Ranger 2 Pro systems – the highest specification available. This capability has allowed CCC to utilise their vessels on survey projects where maintaining a reliable position is a critical operational requirement.

For all of its Ranger 2 installations, CCC additionally specified Sonardyne's Optimised USBL configuration. Here, Sonardyne's premium grade Attitude and Heading Reference System (AHRS) Lodestar is interfaced directly with the Ranger 2 acoustic transceiver allowing raw range, bearing and attitude data to be simultaneously processed. This integration achieves a tightly compensated solution and allows users to meet the positioning specifications of a wide range of subsea construction and survey projects.



Four multi-purpose vessels make up CCC's fleet, including here the CCC *Pioneer* and two new 65 metre vessels rated for Class 2 operations.

Captain Derrick Green, Marine Operations Manager at CCC said, “Our vessel fleet is geared up to support all manner of complex underwater projects. Ranger 2 meets our needs in every respect, offering stable and precise positioning for DP, reliable tracking in any water depth and hardware that is easy for our crews to set up and use. We could not be happier with the results we are seeing back from the field.”

Horizon saves time with GyroUSBL

Setting up a USBL system can be time consuming, often requiring several hours of calibration checks to determine the alignment of the ship’s motion sensors to the acoustic transceiver prior to use. That’s why Sonardyne developed GyroUSBL, a transceiver that can be made operationally ready in 60 minutes from out of the box to survey use. Following its introduction, UAE-based Horizon Geosciences, were quick to realise its potential, ordering Ranger 2 systems configured with GyroUSBL for their operations. Now, after taking delivery of an additional two systems to complement those already in their inventory, Horizon is the largest user of the technology in the region.

The secret of GyroUSBL’s success comes from the integration of Sonardyne’s sixth generation acoustic transceiver technology and high grade inertial navigation sensor, Lodestar, in the same mechanical assembly. This unique combination removes many sources of USBL error

including lever arm offsets, pole bending and ship flexing. It has also been proven to exceed accuracy and precision expectations, even when deployed on a temporary pole arrangement over the side of a vessel.

“We provide precise positioning for numerous activities offshore and often have to mobilise personnel and positioning equipment at short notice. GyroUSBL fits in perfectly with the unpredictable nature of our operations without compromising standards,” said Lance Hanson, Survey Projects Director at Horizon Geosciences. He went on to say, “We witnessed performance and operational gains soon after we began using GyroUSBL, so we decided to expand our deployment of the technology.” **BL**

Ranger 2 USBL: Reasons to invest

Not all USBLs are the same – something that will be noticeable the moment you begin using Ranger 2 for the first time. It offers high performance for all applications and is packed with advanced features that come as standard. So if you’re looking to reduce risk, save time and extend your operational capability, take a closer look at Ranger 2. Search Ranger 2 USBL for more information.



Horizon noticed performance and operational gains soon after acquiring GyroUSBL. The speed with which it can be mobilised benefits their vessel operations.

International

News from our Regions Around the World

USA – Houston



Simon Reeves Senior Vice President

More PMTs for Shell

Sonardyne Inc. recently received a multi-million dollar order for a large number of Pressure Monitoring Transponders (PMTs) from Shell. These PMTs will be used to expand multiple ongoing seabed settlement monitoring projects in the Gulf of Mexico. The existing seabed network has already successfully acquired more than four years of production data. These new 'second generation' PMTs include more pressure sensors and a 10 year battery life.

Saving costs with SPRINT

We've seen a significant increase in requests for SPRINT S10 inertial units for use in sparse LBL projects such as route surveys. With less transponders to deploy, projects using SPRINT cost less to mobilise so we envisage the high utilisation rate to continue into 2016.

Into the deep with NASA

We will be presenting our capabilities at a subsea technology symposium being held at NASA's Neutral Buoyancy Lab. In-water demonstrations are planned, including use of the BlueComm optical communications system. Read more in Baseline 15. ■

Brazil – Rio das Ostras



Joao Ramos General Manager

Taking the reigns

This is my first report for Baseline since being appointed General Manager of Sonardyne's Brazilian operation. My existing legal and financial management

responsibilities have been extended to include overall accountability for the development and achievement of our annual Business Plan for the region, as well as management responsibility for the Brazil team.

Quality assured

After Stage 2 external audits by Lloyds (LRQA), Sonardyne Brasil Ltda. has been recommended for ISO9001:2008 accreditation – a great achievement. When granted, it will be used to help monitor and manage quality across our business operation, as well as benchmark consistent performance and service. All of which are designed to benefit your business and its future subsea operations.

Successful DP sensors workshops

Held in Rio and Macaé, these workshops focussed on the time-saving benefits and robustness offered by acoustically aided inertial navigation solutions, the importance of reference sensor placement for optimal performance and how best to reduce operational risk. There were also individual technical seminars on system usability and future capability. Technical demonstrations were used to validate the operational benefits of our Marksman DP-INS and Ranger 2 DP-INS acoustic position reference systems. ■

SE Asia – Singapore



Anthony Gleeson Vice President

Ocean tech in demand

In recent months, we've seen a big surge in demand from the ocean science community here in Asia for our solutions. Notable contracts have included Mini-Ranger 2 systems for the Middle East (see page 11), our first ever order for BlueComm modems and a Scout USBL tracking system for a university in Australia. Just landed, is a major order for our newly released, extremely robust and very low power WSM 6+ USBL transponder / responder for research and development projects linked to institutes in the region.

GyroUSBL heads to the ME

Our GyroUSBL continues to be the USBL transceiver of choice for marine survey and geotechnical companies operating out of the Middle East. Its easy installation and setup features make it particularly suited for short-term use on vessels of opportunity. One company has claimed the honour of being the biggest investor in GyroUSBL in the region after their recent purchase order. ■

UK – Aberdeen



Barry Cairns VP Europe and Africa

Weathering the storm

We've been experiencing challenging times in Europe and Africa, but we've been making the best of it. Working closely with our clients and enlisting the help of our SSG team, we've been able to optimise Compatt array management prior to deployment, delivering some great cost saving results in the process. In addition, Fusion V1.12.02 has some fantastic new features including support for multi-user transponder arrays. A feature already being implemented by some of our key clients in West Africa to realise significant time and consequently large cost savings.

Train to Succeed

LBL training is at its highest level ever as companies take advantage of the market slowdown to get offshore staff trained and up-to-date with the latest technologies. So if training is on your agenda over the next couple of months, get in touch and let us know what you need.

Mini-Ranger 2 big in Germany

Our first demo of Mini-Ranger 2 in Kiel, Northern Germany was successful. In very challenging conditions, the system was set to work on a research vessel with our new Wideband Sub-Mini 6 Plus (WSM 6+) beacons deployed in water depths below 10 metres. Mini-Ranger 2 tracked the beacons at update rates of up to three replies per second. Clients commented on how quickly the system could be deployed, its ease of use and fast update rates. ■

Help & Advice

THE KNOW HOW

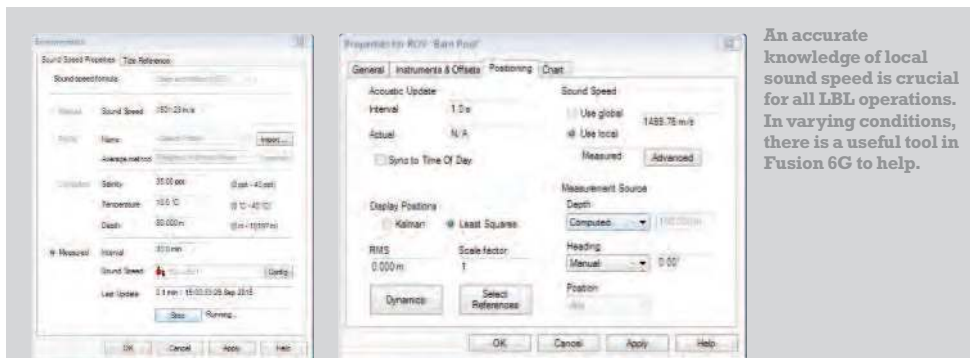
Our highly experienced product specialists are available to help you maximise the performance from your Sonardyne technology. Get in touch: support@sonardyne.com



So how sparse is a sparse LBL array?

In theory, LBL requires a minimum of three ranges and knowledge of depth to calculate a unique position. However in the real-world, it is likely that one or more ranges will be slightly in error and so with only three ranges, it is impossible to detect and identify an erroneous range. By adding more ranges, typically five or more, it becomes easier to detect outliers and compute a high integrity position. This is known as redundancy.

When we include the extra position change information obtained from an LBL system aided with an inertial sensor, such as our SPRINT, we can reduce the number of ranges required as we now have a better understanding of the actual movement of the target and can use this information to identify and reject erroneous ranges. The amount of assistance this gives in detecting bad ranges depends on the geometry of the ranges and the trajectory of the target. So how sparse to make an array therefore depends on your vehicle path, array design and the integrity required for the positioning.



An accurate knowledge of local sound speed is crucial for all LBL operations. In varying conditions, there is a useful tool in Fusion 6G to help.

Is your LBL sound speed correct?

The performance of any LBL array relies on accurate sound velocity inputs. That's why in Fusion software, there are four different options for entering your chosen SV method; manual inputs, SV Profiles, CTD probe data and measured sensor data. These are used by Fusion as the global sound speed for calibration and tracking calculations. But what if you have a variation of SV across your array, for example, when situated on a slope, and you require a frequent update? Well here's a neat trick; in Environmental, select a Compatt with SV sensor as your global source.

Now open your ROV vehicle configuration window, select the Positioning tab then select 'Use Local' and opt for 'Measured' in the Advanced options. Fusion will use the SV readings from the ROVNav SV sensor and the Global figure to provide a mean sound speed for the LBL array and apply it to all tracking calculations. Job done.

HPT 5000/7000 – More than just a USBL transceiver

The capabilities of our HPT 5000 and 7000 transceivers extend well beyond DP and target tracking. That's because as well as being a high-performance USBL transceiver, these models of HPT are also fully capable LBL dunking transceivers – meaning that your vessel is better equipped (and for less money) to meet a wider range of positioning projects. They can even be used as a high speed modem for receiving data from 6G-enabled instruments including Fetch, AMTs, SMARTs and Data Loggers.



Need an LBL array transponder with a long battery life? Take it to the Maxi

Out of the box, standard Compatt 6G LBL transponders are substantially more power efficient than previous generations thanks to low-power electronics and energy efficient Wideband 2 signal processing. However, for long term field development campaigns, the ultra-long life battery found in a Compatt 6 Maxi means it can be left in situ throughout all drilling and construction survey activities – saving you time and money. It's perfect also for multi-user scenarios as it can be shared by vessels each carrying out their own task.

Total [Choice]



From WSM 6+ to Mega, there's a 6G acoustic beacon to fit in with all of your subsea projects.

When it comes to versatility and dependability, nothing comes close to our sixth generation (6G) LBL and USBL acoustic beacons. With over 3,600 configurations available, extending from the ultra-small WSM 6+ to the new ultra-long life Mega, you are guaranteed to find the right model for your application. All are engineered around our low-risk, industry specified Wideband 2 digital architecture that ensures precise positioning, robust performance and high speed data telemetry in all conditions. Combined with low cost of ownership and global engineering support, there's never been a better time to invest in 6G technology. Discover the range at www.sonardyne.com