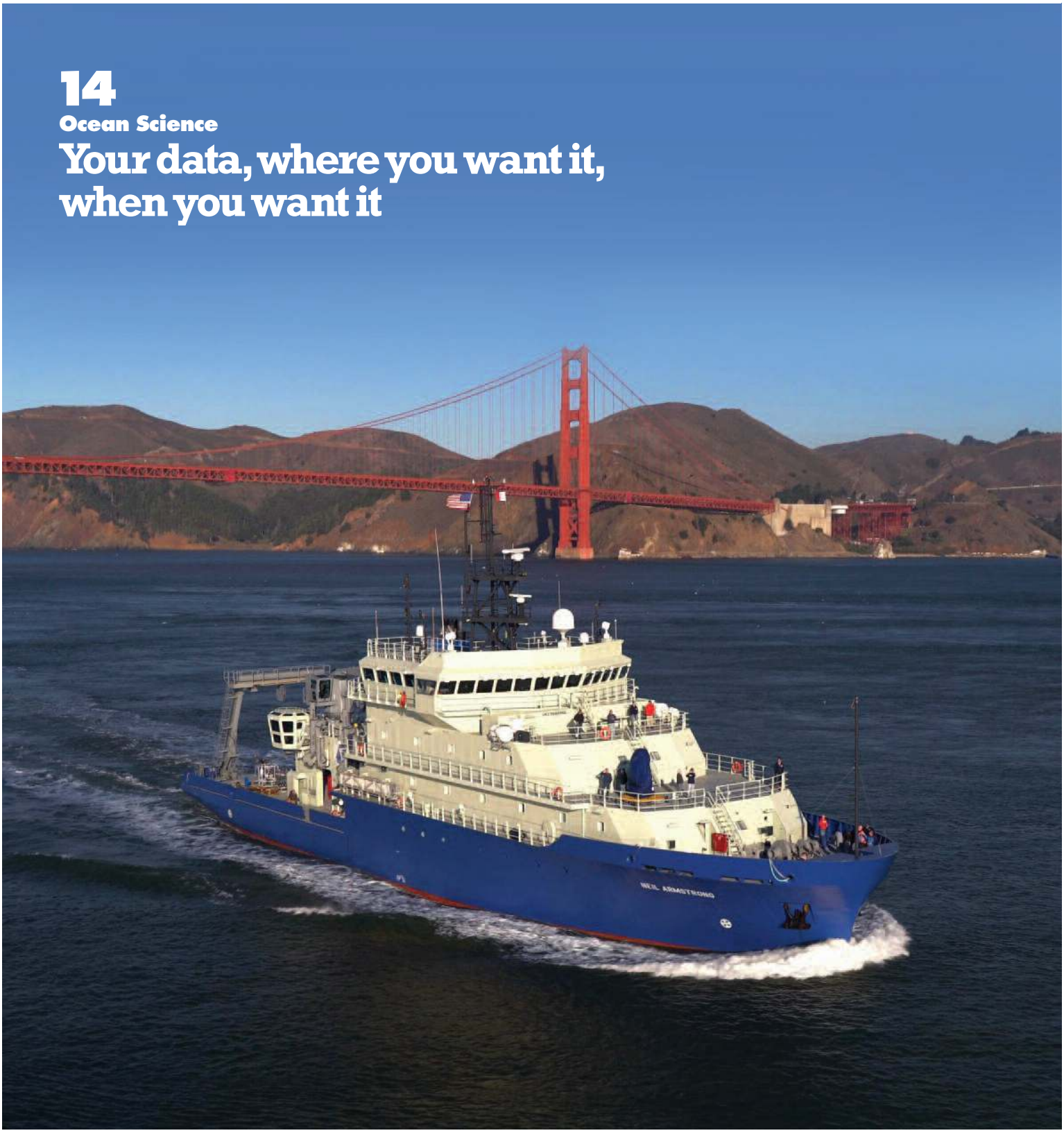
THE CUSTOMER MAGAZINE FROM SONARDYNE
ISSUE 16

Baseline



THERE'S A DISTINCT theme running throughout this issue of Baseline – subsea technology for oceanography. Whilst the global offshore energy market continues to prove challenging for the entire supply and contracting chain, there's been no shortage of good news stories emerging from the global science community.

So much so, our News section beginning on page 6 has been extended to bring you the highlights of recent major orders. These include 'all-in-one' navigation for Schmidt's *SuBastian* ROV, Syrinx DVL for Canada's free flying vehicle *ROPOS*, and Ranger 2 USBL for the US Navy's new vessel *Neil Armstrong* – the subject of our front cover.

To gain a better understanding of our capabilities, turn to the feature article on page 14, where Geraint West, formerly of the UK's NOC, delves deeper – and indeed shallower. Then read the case study on page 28 for proof that whether you are working in 1 metre or 12,000 metres, we can support your operations.

Baseline » Issue 16

Front Cover
The U.S Navy's new research vessel, *R/V Neil Armstrong*, meets the range, endurance, and technical requirements to support advanced oceanographic research in tropical and temperate oceans around the world.

Image Bay Aerial, ©Woods Hole Oceanographic Institution

In this issue...

Within oil and gas, 6G continues to play its part in lowering operational expenditure. You only have to look on page 20 to see how it helped one contractor complete 10 metrologies in just 26 hours as evidence.

Why not get in touch and find out how our solutions can save you time and money?

David Brown Editor

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Baseline Magazine
The Customer magazine from Sonardyne

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Sonardyne
SOUND IN DEPTH

SONARDYNE.COM

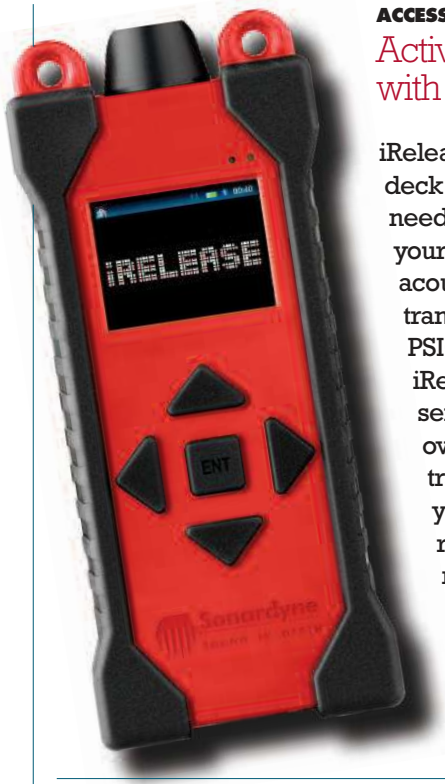
»KIT

Our latest subsea technology and services

ASSET MONITORING

Recover your down hole well data faster with 6G

Well appraisal campaigns need frequent down hole pressure and temperature readings to be logged over a number of weeks, months or indeed years. Our ROV-deployable data logger is suitable for either long or short term deployment and can be interfaced with down hole gauges from all of the major suppliers including; Baker Hughes, Halliburton, Roxar and Schlumberger. Other manufacturers' gauges can also be interfaced – just let us know what you need. A complete system comprises the 3,000 metre rated logger unit seen here and a surface transceiver 'dunked' over-the-side of a rig or vessel, or fitted to the payload of an autonomous surface vehicle such as Waveglider. Logging regimes are fully customisable and thanks to the reliable 6G wideband acoustic link, stored data files can be uploaded much faster than previous models – saving you operational expenditure. 4-way or 7-way wet-mate Tronic or ODI connectors allow you to configure the data logger as ROV-mateable or Manual-mate for connection to a jumper cable prior to deployment. Custom connectors are available on request.



ACCESSORIES

Activate your release with iRelease

iRelease is the new back-deck accessory you'll need to test and command your ORT and DORT acoustic release transponders. Like the PSION unit it replaces, iRelease connects via serial cable to your over-the-side dunking transducer enabling you to acoustically range to your seabed mooring and triggering it to 'open' when needed. It's rugged and splash proof.

UNDERWATER COMMUNICATIONS

Modem Micro – the simple way to get your sensor data

Need a reliable and cost-effective method of recovering data from current profilers, temperature and depth sensors, and custom instruments? Look no further than a pair of Modem Micros. They're compact, easy to set-up and use our wideband acoustic signals to ensure error-free performance. There's a choice of batteries to suit your needs or you can power it using your own underwater source. And if you want to take integration one step further, there's also an OEM kit.

INS AND DVL

SPRINT-Syrinx: All-in-one subsea vehicle navigation

SPRINT-Syrinx combines our class-leading inertial and Doppler velocity log technologies with a high accuracy pressure sensor in a 4,000 metre rated housing that's just 395 millimetres tall. The result? An all-in-one subsea navigation system for your ROV or AUV that's sure to save you vessel time and lower your survey costs.

SPRINT-Syrinx has been designed for robustness and ease of maintenance, with a full depth rated water block for each of the DVL's transducers. This feature means that the Syrinx DVL and pressure sensor modules can be replaced

without needing the unit to be returned to our UK factory. All current versions of SPRINT-Syrinx have recently been granted "de minimis" status by the US department of commerce which means that the unit will not require a US re-export licence for shipping, greatly reducing your logistics complexity. SPRINT-Syrinx is currently undergoing evaluation trials with selected AUV and ROV customers. Contact your local Sonardyne sales office for more information.

Need help testing and developing your kit? On page 9 read how our trials vessel was recently charted by Guidance Marine to help evaluate new technology.

TARGET TRACKING

Nano – Big interest in our smallest ever USBL beacon

Following its public debut earlier this year, the first customer deliveries of our smallest ever USBL transponder, Nano, have begun. And as you can see from the unit attached to this diver's scuba equipment, when we say small, we really do mean small. The version shown (no pressure sensor) measures just 153mm long by 55mm in diameter so can easily be fitted to any underwater target you wish to track using one of our 6G USBL systems, Ranger 2 or Mini-Ranger 2. These include small towfish, inshore ROVs, seafloor instruments and divers.

Nano's charged using wireless technology with a full charge giving you over 15 hours of continuous operation at an update rate of one ping every five seconds. What will you track with it?

NEWS

SUBSEA VEHICLES

All-in-one navigation for SOI's *SuBastian*

The international science community's newest ocean research platform, a deep-rated remotely operated vehicle (ROV) called *SuBastian*, will be positioned and navigated using our acoustic and inertial technologies.

Built by the Schmidt Ocean Institute (SOI), a private non-profit operating foundation located in California, *SuBastian* will provide scientists from around the world with new opportunities to explore and study the ocean.

It will be operated from SOI's research vessel, *Falkor*, which has been operating with our Ranger 2 USBL positioning system since 2012. During that time, the system has provided scientists with the ability to track equipment down to abyssal depths in excess of 5,000 metres.

Based on their extensive track record with Ranger 2, we worked with SOI to configure an integrated navigation solution for *SuBastian*. The vehicle's Science Advisory Group, commented that provision of the best available integrated acoustic and inertial navigation sensors underpinned the scientific value of the observations and data gathered by *SuBastian*.

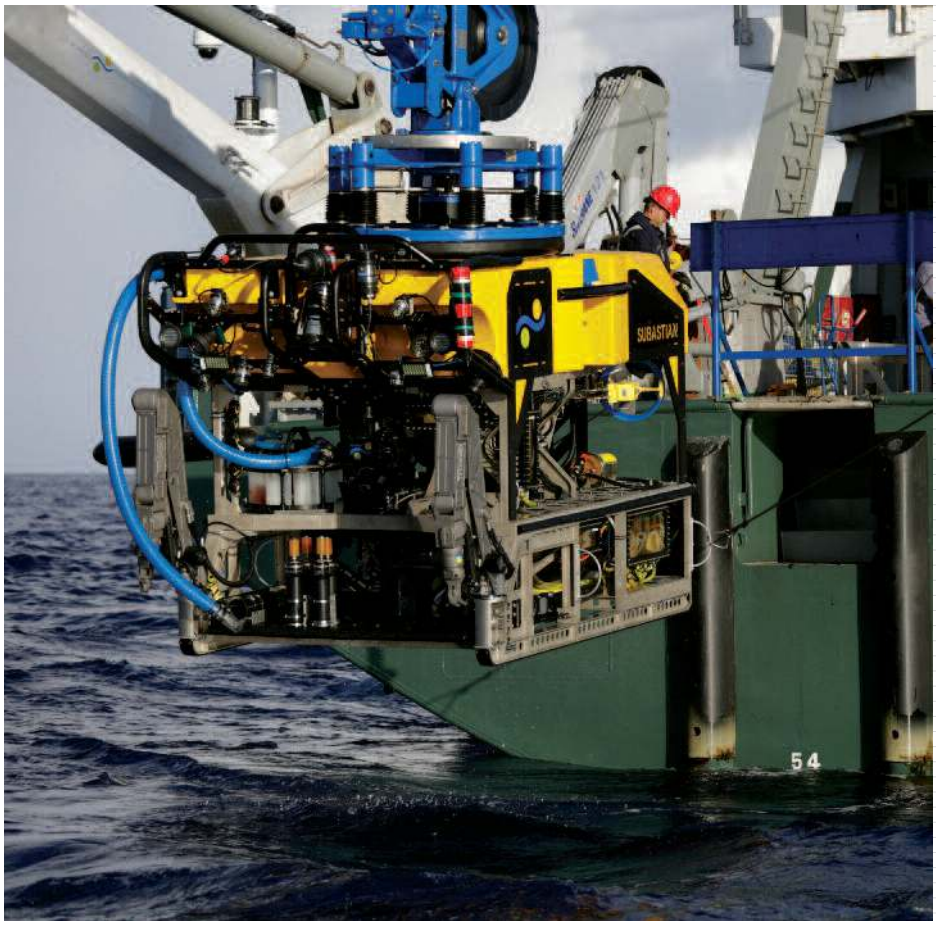
This resulted in the supply of a SPRINT Inertial Navigation System (INS), Syrinx 600 kHz Doppler Velocity Log (DVL) and a Wideband Mini Transponder (WMT), all of which is compatible with the *Falkor*'s existing Ranger 2 topside hardware.

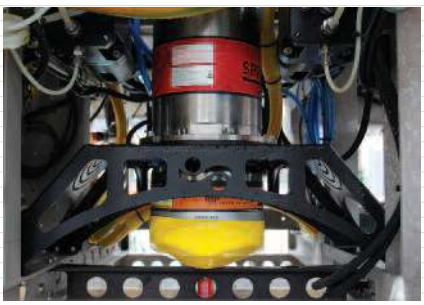
Now in its third generation, Sonardyne's SPRINT exploits the long-term precision of acoustic positioning with the continuous availability and fast update rate of inertial sensors. This combination provides robust vehicle positioning during periods of challenging acoustic conditions and helps to improve sensor data quality and vehicle control. Its new, lightweight titanium housing also provides valuable space and weight savings that can instead be used for scientific payload or samples.

SuBastian is also now one of the first research vehicles in the world to benefit from our recently introduced Syrinx DVL. Syrinx differs from other DVLs in that it offers high altitude (up to 175 metres) navigation capability normally only available from a 300 kHz DVL with the high precision and accuracy of a 1200 kHz DVL.

Completing the navigation suite for *SuBastian* is WMT, a high-power USBL transponder built upon our 6G wideband acoustic architecture that provides robust, high update rate positioning in any water depth, shallow or deep.

Capable of diving to 4,500 metres, *SuBastian's* equipment includes a reconfigurable payload skid for deploying and recovering experiments, an Ultra-High Definition camera capable of streaming live video to the surface and a comprehensive suite of scientific sampling sensors. Main image: SOI





The new vessel will join PRIC's existing fleet of polar research vessels which all use Ranger 2 to support their work. Image: PRIC

OCEAN SCIENCE

Ranger 2 for fifth polar research vessel

The Polar Research Institute of China has selected our Ranger 2 tracking technology for its new vessel currently under construction – bringing the total number of Sonardyne USBL systems operated by the organisation to five.

Entering service in 2018, the 122 metre vessel will conduct research into marine chemistry, ecology, geology, geophysics and sea ice dynamics, including determining how changes in Arctic sea ice is affecting China's climate.

Ranger 2 will allow the position of scientific equipment deployed from the ship to be precisely tracked. This will include ROVs, AUVs and seafloor landers. Supplied through our in-country agent, China ORE, Ranger 2 will also provide a position reference for the vessel's Kongsberg dynamic positioning (DP) system, allowing the ship to remain in a specific location during science operations.

Ranger 2 calculates the position of an underwater target by measuring the range and bearing from a vessel-mounted transceiver to a transponder attached to a vehicle or piece of equipment. Our exclusive wideband acoustic signal technology and 6G (sixth generation) hardware platform allows multiple targets to be simultaneously and precisely positioned in shallow and deep water.

"The Polar Research Institute of China joins a growing list of institutes who have recognised the valuable benefits of Sonardyne's Ranger 2 ..."

The equipment being supplied for the vessel includes our popular Wideband Sub-Mini 6+ (WSM 6+), a small, lightweight USBL transponder that is easy to install and has a built-in depth sensor and re-chargeable battery for added performance and convenience.

Commenting on the order, Anthony Gleeson, Vice President of Sonardyne in Singapore said, "Ranger 2 is a key enabler for research vessels and has the flexibility to meet the precise in-water and near-bottom sustained observation needs of science users working in nearshore, coastal and deep ocean waters."

Qi Zhengyu, Director of China ORE added, "The Polar Research Institute of China joins a growing list of institutes who have recognised the valuable benefits of Sonardyne's Ranger 2 acoustic technology. We looked forward to supporting them, the vessel's shipyard and crew through the delivery, installation and commissioning phases of this prestigious contract."

NEWS

WIRELESS COMMUNICATIONS

KRISO's *Crabster* cuts the tether with BlueComm

Underwater modems that enable video to be transmitted through the water and unmanned vehicles to be controlled without a tethered link to the surface, have been supplied to the Korean Research Institute of Ships and Ocean Engineering (KRISO)

The BlueComm modems will be used to stream high-definition imagery from cameras installed on seafloor sensor platforms and command *Crabster*, an autonomous walking and flying crab-like robot being developed by KRISO's ocean systems engineering department.

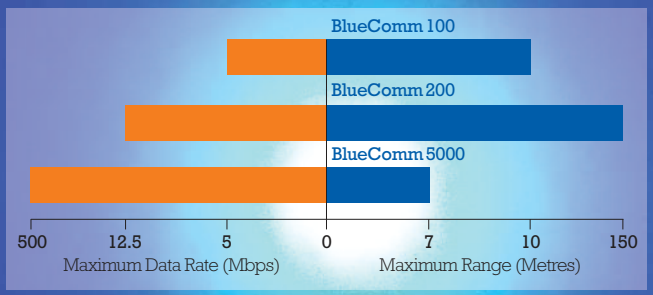
Transferring data using subsea modems provides a reliable alternative to using cables underwater which can be expensive to install and vulnerable to damage. However, unlike conventional acoustic-based devices that use pressure waves to send and receive relatively small packets of data at low bandwidths, BlueComm uses LEDs and high power lasers to deliver data at up to 500 megabits per second, latency-free.

Typical uses include harvesting data from landers using AUVs, remote video monitoring of science operations and piloting unmanned vehicles without the need for a control umbilical.

The BlueComm modem family is currently made up of three models. KRISO has selected BlueComm 100 which offers a good balance between data rate and range in all conditions, including high ambient light.

"Now that it's possible to send and receive data underwater at speeds comparable to domestic broadband, it's exciting to consider the huge range of potential applications for BlueComm," said Anthony Gleeson, VP of Sonardyne in Singapore. He added, "KRISO are the first institute in our region to invest in BlueComm and we are delighted that this unique technology will advance their pioneering ocean research."

(Above) ***Crabster*** **is an autonomous walking and flying crab-like robot being developed by KRISO's ocean systems engineering department. (Below) BlueComm data rate and range performance comparison.**



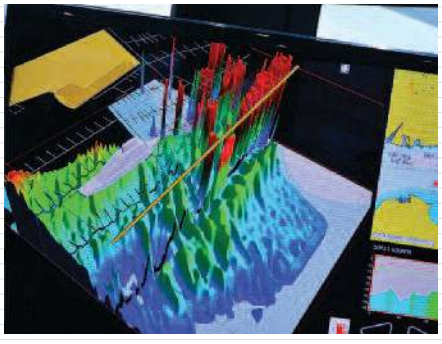
SHIP PROTECTION

First Navigation and Obstacle Avoidance Sonar delivered to large, new private vessel in Europe

The first vessel to be equipped with our new NOAS (Navigation and Obstacle Avoidance Sonar) system has been recently handed over to its new owner in Europe.

NOAS was specified for the 120 metre+ private vessel to allow it to explore remote, poorly charted places with the assurance that potentially hazardous underwater obstacles can be identified and avoided.

Integrated into the vessel's MARSS Group- supplied NiDAR command and control system (C2), NOAS images the water column over a wide field of view. This offers long range detection and mapping of the seabed, delivering reliable early warning of collision and grounding hazards.



NOAS has multiple imaging modes to suit both open water cruising and shallow water, close-in manoeuvring.

The compact design of the system makes it suitable for retro-fitting into existing vessels. It can also be serviced and maintained without the need for dry docking.

The contract also included the supply of our market-leading diver detection sonar, Sentinel. This complements NOAS, enabling the detection of underwater intruders approaching the vessel when stationary.

INSPECTION, REPAIR AND MAINTENANCE

6G tracking and DP technology for flagship Brazilian IRM vessel

Brazil's most advanced ROV support vessel (RSV), the *Fugro Aquarius*, has specified Ranger 2 acoustic positioning technology to support its subsea inspection, repair and maintenance activities in the region.

Delivered and fully commissioned by our engineers in Rio das Ostras, Ranger 2's being used to track the precise position of the vessel's Work-class ROVs in water depths of up to 3,000 metres. It is also providing the vessel's dynamic positioning (DP) system with position reference data to allow it to remain on-location whilst survey operations are underway.

Launched in 2015, the 83 metre long *Fugro Aquarius* has been designed specifically for the Brazilian market with over 60% of local content. This April, Petrobras awarded the vessel a one year contract to carry out work including subsea video and data acquisition, site investigations and asset integrity monitoring.

For their new vessel, Fugro specified that the Ranger 2 be configured with our deep water optimised GyroUSBL 7000. The unique design of GyroUSBL incorporates a USBL transceiver and high survey-grade inertial sensor in the same unit. This combination increases precision by eliminating common sources of system error such as lever arm offsets, pole bending and ship flexing.

Lowered through the hull using a Sonardyne-built deployment machine, GyroUSBL calculates the position of the vessel's two Fugro-built 150HP ROVs by measuring the range and bearing to a WMT beacon fitted to each vehicle.

Small and lightweight, WMTs offer reliable tracking performance in crowded offshore environments where multiple vessels frequently conduct simultaneous operations in close proximity to each other.

Speaking about Fugro's decision to equip with the *Fugro Aquarius* with Ranger 2, Barry Cairns, Regional Head of Sonardyne Brasil Ltda., said it demonstrates their commitment to investing in the best available subsea technology for their IRM operations, adding, "We're confident they will quickly see a return on that investment in the form of faster and more efficient survey operations and greater vessel utilisation."

The 85 metre long *Fugro Aquarius* is Brazil's most advanced IRM vessel. Image: Fugro

VESSEL CHARTER

Guidance Marine charters *Echo Explorer* for new product SAT

***Echo Explorer*, our** 12 metre survey-class catamaran, and her crew were recently hired to support sea acceptance trials being conducted by Guidance Marine, the well-known developer of local position reference sensors.

Built in 2014, *Echo Explorer* is one of four vessels we have available for charter from our trials base in Plymouth. Classrooms, an inshore ROV, workshops, client offices and onsite accommodation are also available to hire.

For Guidance Marine's trial, an Artemis Mk6 was installed on the roof of *Echo Explorer* and its performance compared to a Mk5 onshore. The Mk6 sensor has been designed to work at twice the range of a Mk5 so our team used their local knowledge to identify a spot that was high enough to provide at least 10 km line of sight at sea.

Milijan Mudrinic, Software Technologies Group Manager at Guidance Marine said that the controlled tests undertaken using *Echo Explorer* were invaluable in proving the quality of the new Mk6 sensor and its capabilities. He added, "Sonardyne's crew were instrumental in making the trial a success and we are grateful for all their help."

Interested in hiring us to support your next trial? Visit plymouth.sonardyne.com for more details.

NEWS

UNDERWATER TRACKING

Neil Armstrong explores with our USBL

As you'll read elsewhere in this issue of Baseline, the global ocean science community are increasingly turning to our low-risk acoustic, inertial, sonar and optical underwater technologies to support their important work – and the U.S Navy is no exception.

Science teams working onboard their newly commissioned vessel, *R/V Neil Armstrong*, will use our Ranger 2 USBL tracking system to precisely monitor the position of underwater targets deployed from the ship. These will include corers, vehicles, towfish and seafloor landers.

The ship is operated by the Woods Hole Oceanographic Institution (WHOI) on behalf of the Navy and replaces the recently retired *R/V Knorr vessel* which had been in operation since 1970.

Neil Armstrong is the first of two new Ocean-Class vessels ordered by the United States to fulfil national requirements for a high specification research ship based on the East Coast of the country. With an endurance of 40 days at sea and accommodation for 20 crew and 24 scientists, *Neil Armstrong* is equipped to carry out advanced mapping, sampling and sustained observation missions around the world.

WHOI has been a long-term user of our Ranger USBL technology, regularly utilising their systems to track vehicles including the manned submersible, *Alvin*, (see Baseline Issue 4) deep-rated remotely operated vehicle, Jason (see Baseline Issue 5) and autonomous underwater vehicle *Sentry*.

With an endurance of 40 days at sea, *Neil Armstrong* is equipped to carry out advanced mapping, sampling and sustained observation missions around the world.

Numerous missions have demonstrated Ranger 's ability to meet WHOI's operational requirements for USBL acoustic technology that delivers highly accurate and reliable underwater positioning in all water depths, deep or shallow.

As part of the contract, we supplied our through-hull transceiver deployment machine. USBL system performance is seriously degraded by poor transceiver mounting and deployment so we've developed a family of highly engineered deployment machines suitable for any situation and any vessel.

Validated on hundreds of projects, our through-hull hydraulic deployment machine is ideal for permanent installations and features a stiff, corrosion-resistant pole, high integrity bearing and sealing design, and reliable hydraulic actuation with safety interlocks, sea chest for access, and remote control options.

Kim Swords, Senior Applications Engineer with Sonardyne Inc. said, "We are honoured that our Ranger 2 USBL technology has been selected for the nation's most advanced research vessel. With the system now installed, we look forward to supporting WHOI's scientific teams onboard and of course, seeing the results from its first expeditions later this year."

EXPLORATION AND SURVEILLANCE

Magseis selects GyroUSBL and SSTs for Red Sea survey

This summer, Norwegian seabed seismic services company, Magseis, headed to the Red Sea equipped with Ranger 2 USBL and Small Seismic Transponders (SSTs) to begin a deep water ocean bottom seismic survey.

Working in partnership with BGP on behalf of Saudi Aramco, the S78 project is expected to last nine months and will involve Magseis' proprietary Marine Autonomous Seismic System (MASS). This uses thousands of small nodes attached to cables to create a grid pattern of receivers on the seabed.

Ranger 2 provides high quality, repeatable positioning in all water depths.

Seismic surveillance surveys conducted using stationary receivers deployed on the seabed are becoming increasingly commonplace as geophysicists generally agree that this method delivers the highest possible definition imagery.

Since it is vitally important that the cables are laid in the correct positions to meet the client's exacting standards, Magseis will attach SSTs near to the nodes at regular intervals along the cable. As the equipment descends through the water column to the seabed, each SST will be tracked in real-time using our GyroUSBL transceiver deployed through the hull of their survey vessel *Artemis Athene*.

Being small, low-cost and depth rated to 2,000 metres, SSTs are perfectly suited to withstand the demanding operational requirements of large-scale ocean bottom seismic surveys. They can even be left attached to the cables when they are recovered and reeled on to a drum, helping to minimise back deck manual handling operations.

Magseis has also ordered our Lightweight Release Transponders (LRTs) and rope canisters to enable recovery of seafloor equipment following data acquisition. When commanded to do so, LRTs float back up to the surface, enabling the equipment to which they are attached, to be hauled up.

VEHICLE NAVIGATION

CSSF acquire 4K Syrinx Doppler Velocity Log for Canadian free-flying research ROV

Our Syrinx DVL (Doppler Velocity Log) is now helping to navigate Canada's premier undersea research vehicle, *ROPOS*.

The contract was placed by the Canadian Scientific Submersible Facility (CSSF), following a trial to evaluate Syrinx's capabilities. This showed it was able to maintain, and regain bottom lock over a wide range of altitudes and seafloor terrains, including soft fine sediment and rugged steep slopes close to hydrothermal vents.

Available in depth ratings up to 6,000 metres, CSSF selected the 4,000 metre rated, corrosion resistant titanium model for *ROPOS* which makes use of existing DVL mounting arrangements on host vehicles.

Alongside its class-leading precision and accuracy, Ethernet and serial output means that Syrinx can be employed as a standalone DVL, as part of an integrated navigation system, or perform both functions at once, allowing both pilots and science teams to simultaneously share its output.

Vincent Auger, IT and Navigation Manager at CSSF said, "Our first dive with Syrinx installed on *ROPOS* was on an active hydrothermal vent site in the Indian Ocean. The bottom there is very rugged – essentially as rugged as it gets, but Syrinx coped with the challenge very well and demonstrated reliable bottom lock throughout the mission."

Kim Swords, Senior Application Engineer with Sonardyne in Houston said, "We're delighted that CSSF recognised the ownership benefits offered by our new Syrinx. It takes away the need for DVLs of different operating frequencies, it is deeper rated than its rivals and it has lower servicing costs thanks to innovations such as individually replaceable transducer capsules."

Deploying *ROPOS*, a free-flying 4,000 metre ROV. Image: © Ed McNichol

Civil Engineering

Case Study

Mini-Ranger 2 clears th

During WWII, more than 50 million bombs, shells, grenades and torpedoes were dropped in the North and Baltic Seas – equating to around 1.6 million metric tons of ammunition.

Lying dormant on the sea floor for over 70 years, the unexploded ordnance today remains a risk to fishermen, coastal leisure users, marine fauna and ecosystems.

This summer, marine salvage specialists Eggers Kampfmittelbergung GmbH (Eggers), whose team of highly trained specialists search and uncover UXO, ammunition and other weaponry, was tasked with an operation to dispose of unexploded ordnance lying off the German coast in the Baltic Sea and make it a safer place for users and inhabitants.

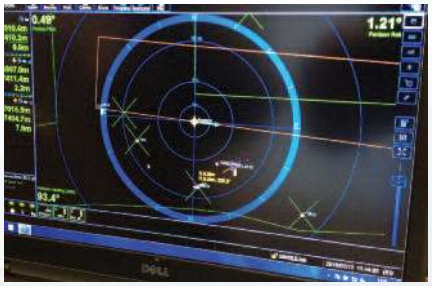
Due to the nature of their mission, Eggers took time to carefully consider the equipment it would need to carry out their duties safely, including knowing exactly where their divers are at all times. It was decided that Eggers would use the Mini-Ranger 2 USBL positioning system after comparing its capabilities against the competition.

Mini-Ranger 2 boasts a number of features that makes it ideal for nearshore operations on small, quiet vessels that need survey-grade positioning without the cost and complexity associated with a deep water USBL solution. It can simultaneously track 10 targets at very fast update rates, it is quick to install and has an operating range of 995 metres, extendable to 4,000 metres.

For its first mission using Mini-Ranger 2, Eggers deployed their USBL system from a survey barge moored 500 metres off the coast. Specialist clearance divers were each equipped with a Sonardyne WSM 6+ transponder attached to their back, whilst over the side of the barge, a HPT 3000 acoustic transceiver was deployed on a temporary pole.

In shallow water, acoustic signals being reflected off the seafloor and sea surface creates noise interference which

ne way in Baltic mission



(Left to right) HPT 3000 is our smallest 6G USBL transceiver, offering advantages for temporary installation on survey vessels and barges. Eggers used a lightweight aluminium frame to deploy theirs. A diver enters the water equipped with a WSM 6+ transponder, tracked from the survey control room.

can make reliable tracking a challenge.

Mini-Ranger 2 overcomes this problem thanks to the excellent noise rejection properties of HPT 3000 which is optimised to provide stable performance in shallow water, at high elevations as well as in deeper waters. Ethernet connectivity makes installation straightforward, whilst in-built diagnostic tools allow users to tune system performance in difficult conditions.

The system has been successfully deployed working in water depths of between just six and 15 metres. During each dive, supervisors in the control cabin on the barge used Mini-Ranger 2's software display to guide divers around the site as they inspected different targets. Once the location of each target was recorded, the divers could safely clear the area of metal objects and old ammunition. The system's Wideband digital signal processing technology enabled each diver's distance, bearing and depth relative to the barge to be updated up to three times per second, providing a valuable extra layer of safety.

"The system's Wideband digital signal processing technology enabled each diver's distance, bearing and depth, relative to the barge, to be updated up to three times per second"

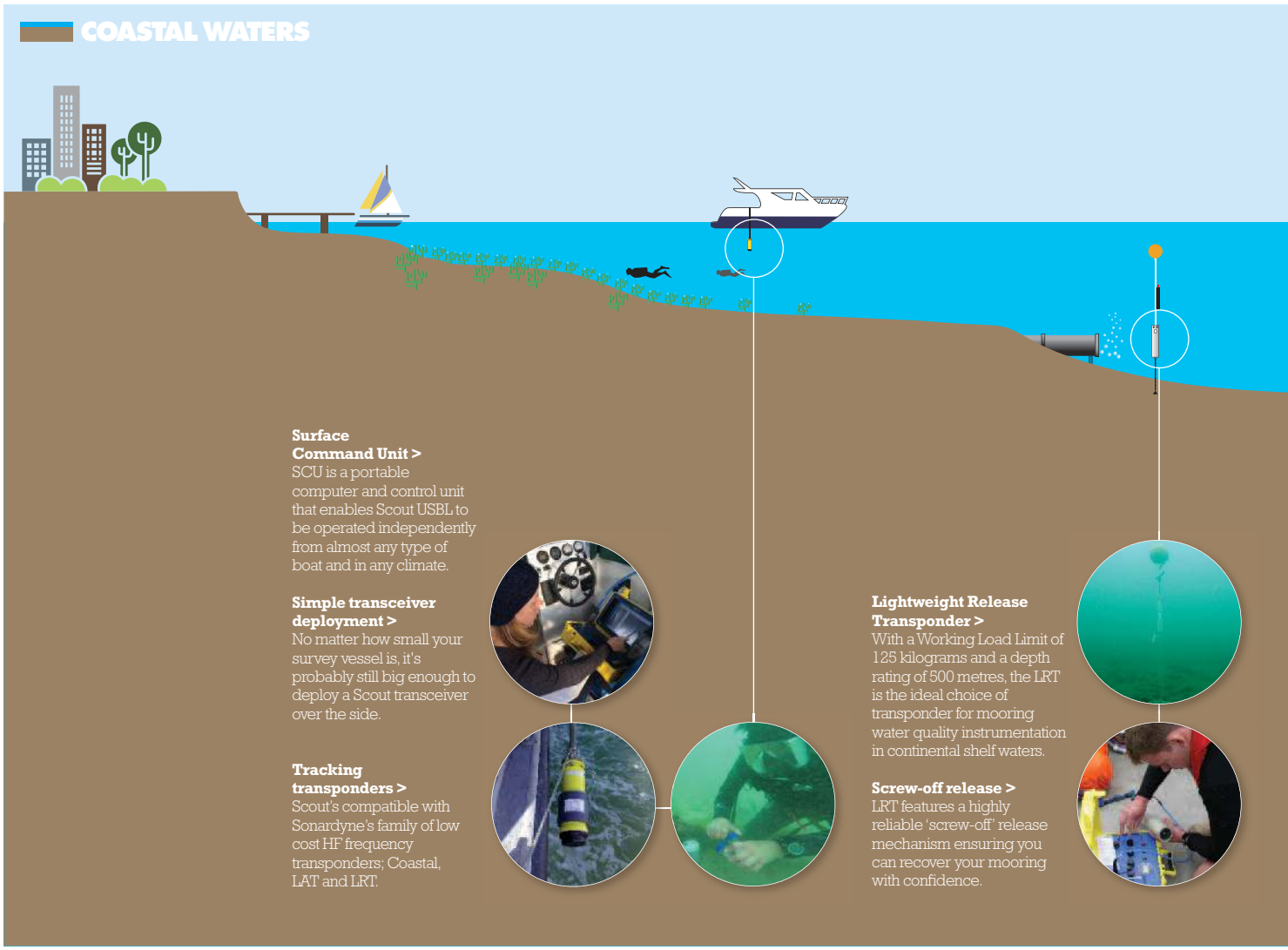
Jan Wommelsdorff, managing director at Scholz Ing.-Buero GmbH, Sonardyne's German agent, said, "Egger's decision to invest in Mini-Ranger 2 was made only after a detailed comparison of its capabilities against competing USBL technologies. Now after using it for the first time, it's clear that the system will indeed increase the speed and efficiency of Egger's operations in North Sea and Baltic Sea as well as inshore." He added, "With the Baltic mission complete, Mini-Ranger 2 is ready for its next assignment which is likely to involve tracking a towfish as well as more divers."

Ocean Science

Capability

OCEAN DATA – WHERE YOU WANT IT, WHEN YOU WANT IT

As the focus of ocean science increasingly moves towards understanding complex processes operating over basin scales and on decadal timescales, Sonardyne's technologies have evolved to meet the needs of sustained observation infrastructures. Central to this, is a company-wide focus on reliability in demanding environments and the development of solutions to meet the specific demands of the ocean science community. **Geraint West**, Global Business Manager at Sonardyne explains for Baseline. **>>**



The drivers for ocean observing systems

In 2015, G7 science ministers meeting in Germany agreed that a step change in prediction, management and mitigation of future changes in the seas, oceans and their impacts on the environment, and human societies is necessary. This focus was further emphasised by the First United Nations World Ocean Assessment (www.worldoceanassessment.org) published in January 2016. A key enabler for addressing the issues posed, is the Global Ocean Observing System – an integrated system ranging from satellite to in-situ observations, but which is increasingly reliant on autonomous systems to achieve the full range of observations required at the range of geographic and temporal scales.

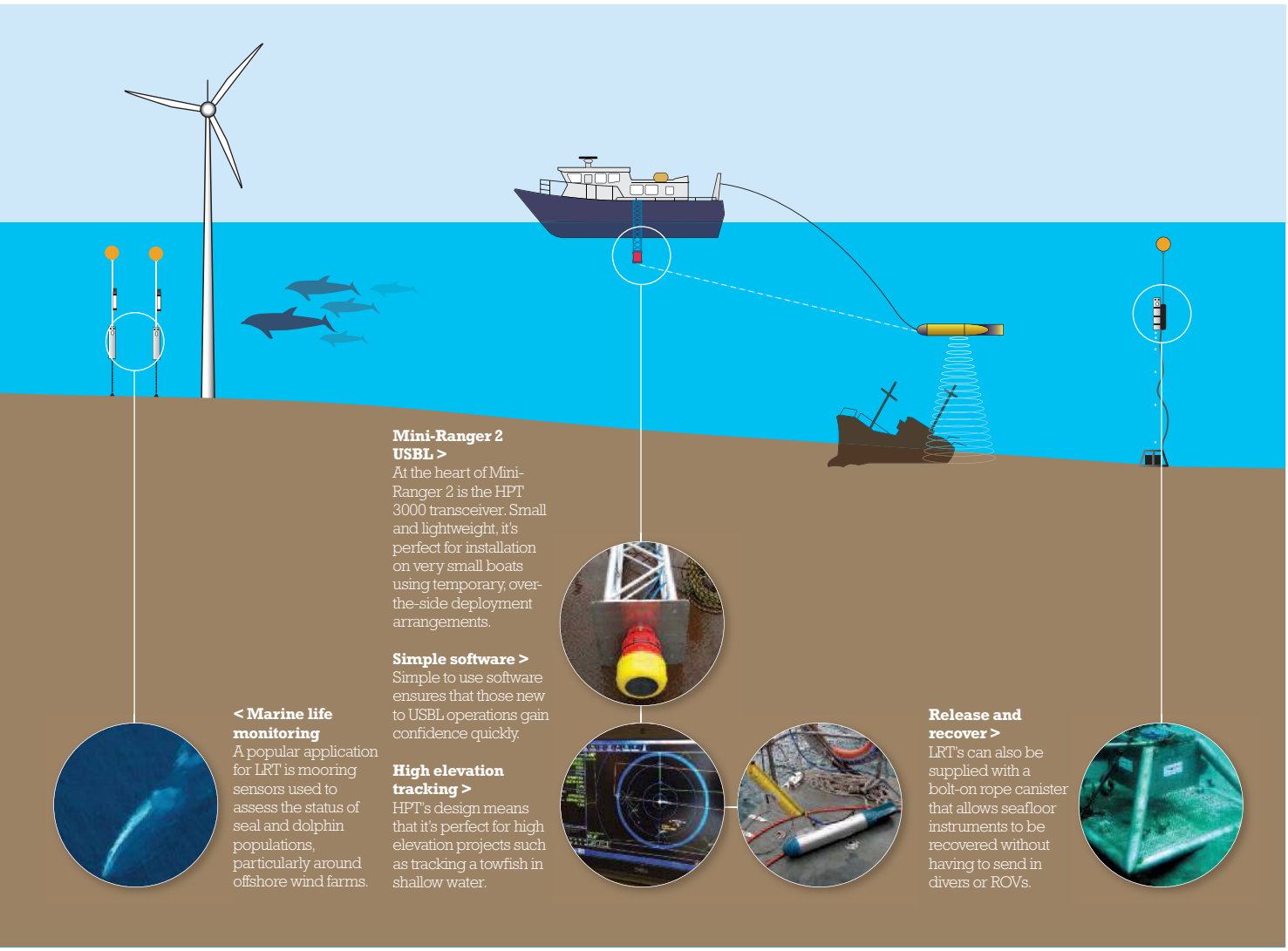
Transforming ocean observing with offshore technology

The growing emphasis on ocean observing systems is perfectly placed to access technology developments in the offshore industry where autonomous or remote monitoring of seabed infrastructure is one of our core strengths. Driven by the need to reduce costs and for improved situational awareness of offshore infrastructure, the industry has seen a drive towards the delivery of ever increasing volumes of data direct to operational decision makers' desks. Central to this has been our development of low-power sensing solutions designed for long term seabed deployment, high bandwidth acoustic and optical telemetry, and optimised communications and positioning solutions for unmanned underwater and surface vehicles.

These technologies have proven track records in the offshore industry and the following case studies illustrate how we've been working with institutes around the world to use this know-how to address their ocean observation challenges.

Optimising coastal and deep ocean observatories

Our family of acoustic release transponders are workhorses for moored instruments and have often been deployed for years at a time in water depths from 6 to 6,000 metres. The low-cost Lightweight Release Transponder (LRT) – 500 metre rated and deployable for up to four years - exemplifies this versatility. It's used to meet a range of oceanographic needs such as the deployment of seabed instrumentation



< Marine life monitoring
A popular application for LRT is mooring sensors used to assess the status of seal and dolphin populations, particularly around offshore wind farms.

Mini-Ranger 2 USBL >
At the heart of Mini-Ranger 2 is the HPT 3000 transceiver. Small and lightweight, it's perfect for installation on very small boats using temporary, over-the-side deployment arrangements.

Simple software >
Simple to use software ensures that those new to USBL operations gain confidence quickly.

High elevation tracking >
HPT's design means that it's perfect for high elevation projects such as tracking a towfish in shallow water.

Release and recover >
LRT's can also be supplied with a bolt-on rope canister that allows seafloor instruments to be recovered without having to send in divers or ROVs.

Ocean Science

Capability

including ADCP frames. They've also been used by the British Antarctic Survey to moor whale vocalisation recording equipment in the Antarctic, while Finland-based Luode Consulting have used LRTs under ice for year-round monitoring of human impacts on water quality and ice thickness in Scandinavian waters.

Our releases are complemented by a range of in-water wireless communications options, ranging from Modem Micro (see page 4), optimised for simple applications by non-expert users, through to our 6G acoustic telemetry range, which supports data transfer up to 9kbps. For high data volumes, there's the BlueComm optical system which is capable of latency-free 10 Mb/s communications over a few hundred metres and is ideally suited for 'fly-by' data harvesting by unmanned vehicles. Indeed, this has been made possible through a joint venture set up with Woods Hole Oceanographic Institute (WHOI).

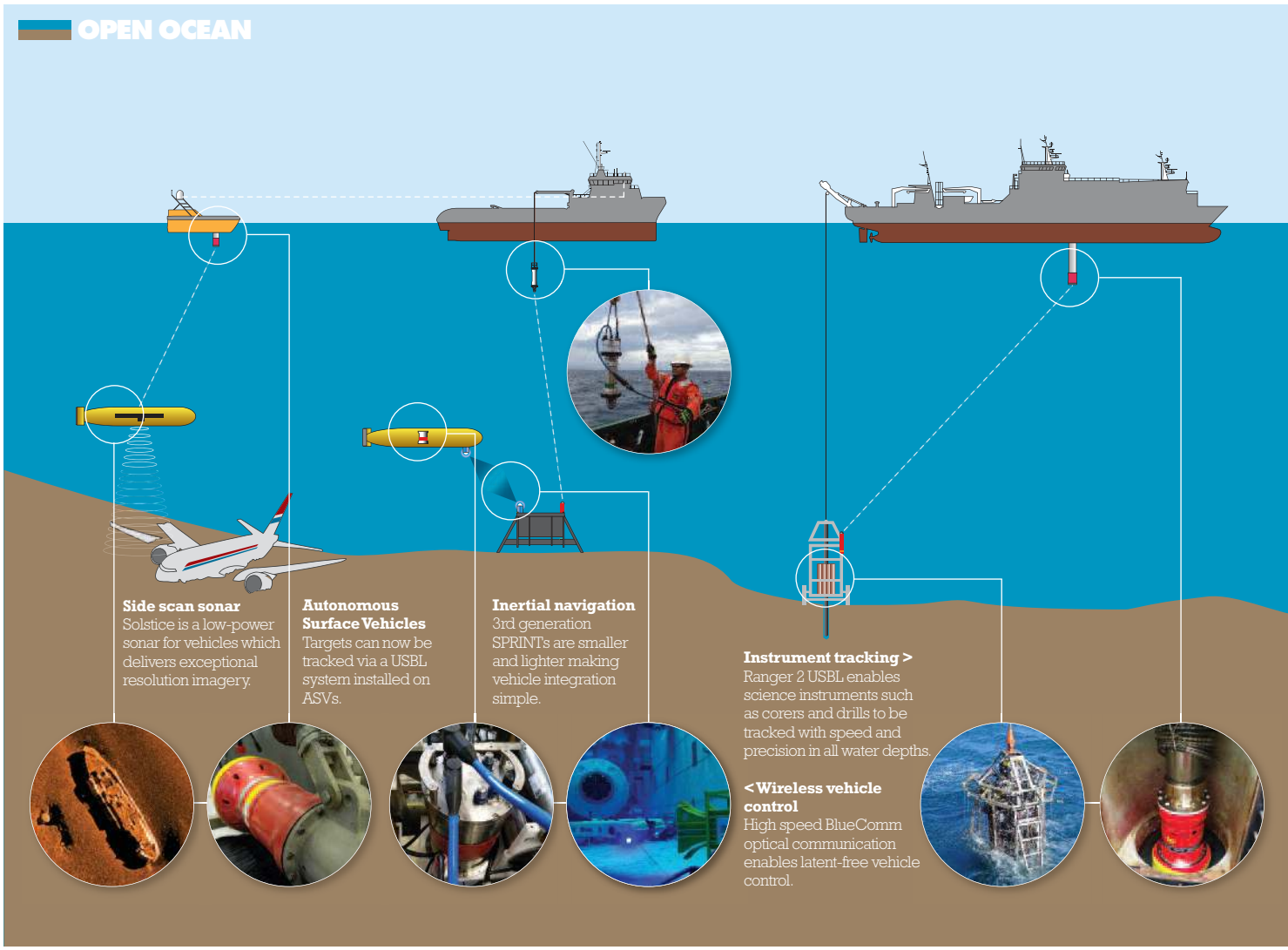
Extending endurance and capability

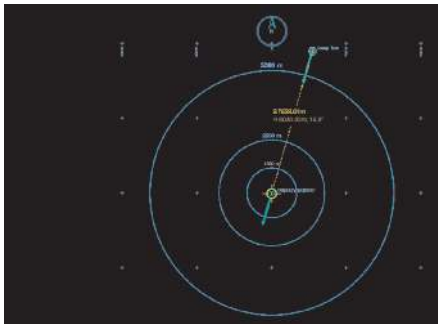
We have also been instrumental in the development of new capabilities in underwater geodesy based on existing low-risk offshore technology. Having been deployed in large arrays for multi-year monitoring of seabed structures and the seabed, Autonomous Monitoring Transponders (AMTs) are now being used to measure seabed tectonic deformation.

AMTs can measure very fine scale strain across the seabed, as well as the shift of the whole submarine tectonic plate relative the GPS reference system - typically in the order of a few centimetres per year. They also log other sensor data, including bottom pressure for up to ten years to measure fault zone shear.

During 2015, Geomar deployed an array of AMTs as part of its Geodetic Earthquake Observatory on the SEAfloor (GeoSEA), off Chile in depths down to 5,500 metres establishing it as the world's first subduction zone acoustic monitoring system. Deployed for three years, data that precisely measures the relative movements between AMTs will be periodically collected via a Waveglider. Geomar has also previously deployed AMTs in the Sea of Marmara as well as more recently on the submerged flanks of Mount Etna.

Some of our latest systems can be deployed for 10 years on battery power alone and are capable of making hundreds of millions of measurements, securely storing the data and then telemetering it on demand. The Subsea Monitoring, Analysis and Reporting Transponder (SMART) is designed to provide advanced data collection and subsea





Track a towfish, position an ROV, DP your ship, search the seabed or navigate an AUV. When you need to invest in USBL to support your science, Ranger 2 has the performance you need, at the investment level you can afford.

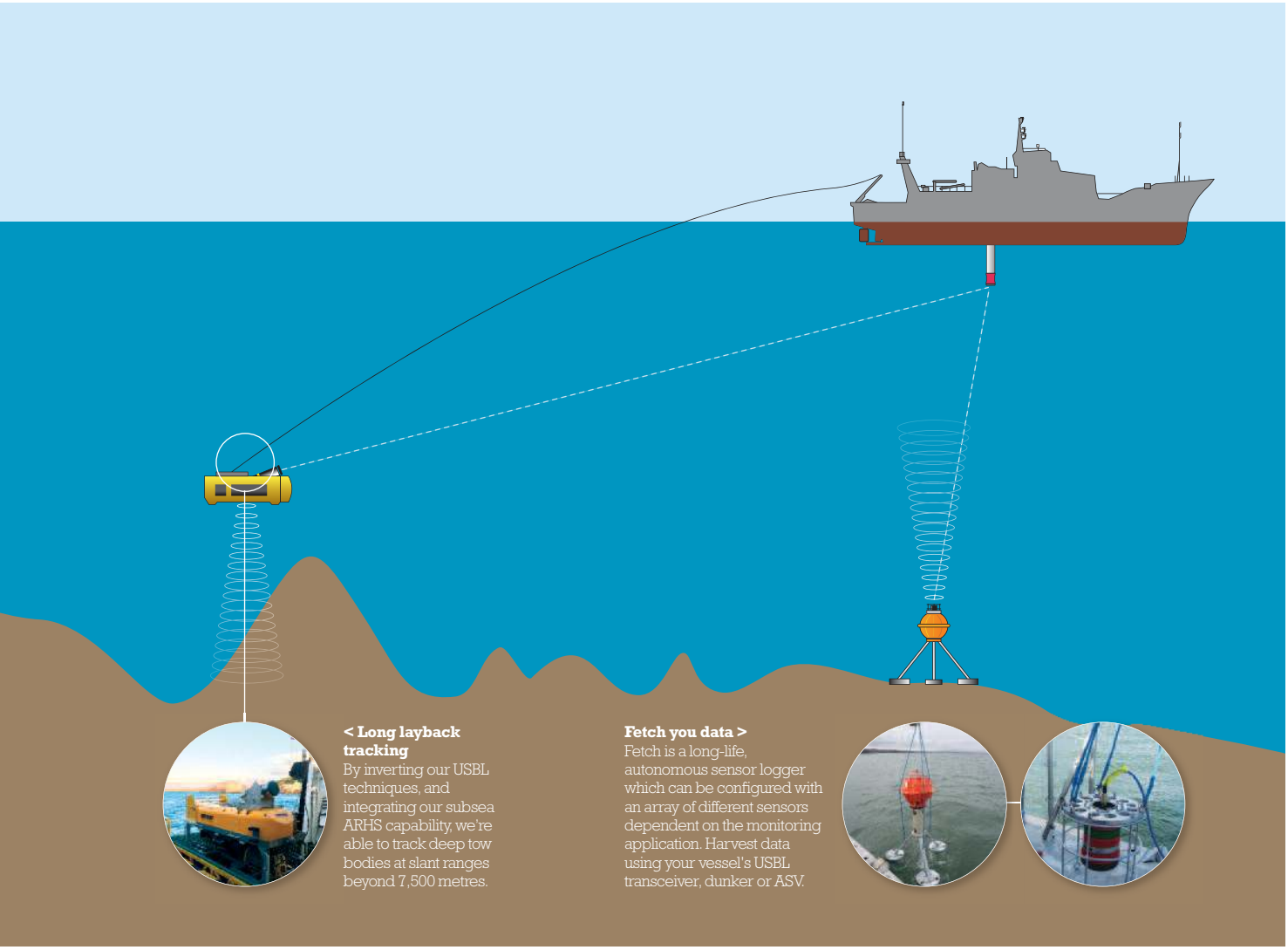
Science users rarely have the luxury of remaining on site for long, so Ranger 2 helps you maximise precious ship time.

processing. Incorporating standard sensors, it can also be interfaced with high bandwidth sensors such as accelerometers and can run sophisticated user- specified algorithms, as well as simple statistical data analyses and thresholding for critical event reporting.

Ocean hazard detection and warning

Following the Boxing Day Tsunami of 2004, we worked with the Indian National Institute of Ocean Technology (NIOT) to develop a long range warning system for the Indian Ocean. The system comprises a high resolution bottom pressure recorder (BPR), acoustically linked to a surface buoy, which in turn transmits data to a shore control centre.

Each BPR uses the US National Oceanic and Atmospheric Administration (NOAA) algorithm to detect a tsunami by comparing the measured pressure to the predicted tidal pressure calculated from the previous three hour history. Deployed in 2007, the NIOT system is made up of four stations operating in waters up to 3,500 metres, with each BPR capable of operation for up to two years between servicing. Since then, Sonardyne has supplied tsunami detection systems to Ecuador, Colombia and Greece, the latter being cabled to shore rather than acoustically telemetered to the surface.



< Long layback tracking
By inverting our USBL techniques, and integrating our subsea ARHS capability, we're able to track deep tow bodies at slant ranges beyond 7,500 metres.

Fetch you data >
Fetch is a long-life, autonomous sensor logger which can be configured with an array of different sensors dependent on the monitoring application. Harvest data using your vessel's USBL transceiver, dunker or ASV.

Ocean Science

Capability

With the latest 6G technology and optimised battery systems, there is potential to deploy instruments on the seabed for 10 years at a time. Replacing surface buoys with long endurance, low power autonomous surface vehicles can also significantly reduce maintenance costs, as shown in 2011/12 by use of a Waveglider to harvest BPR data in collaboration with NOAA's National Data Buoy Centre and Liquid Robotics.

Adding value to underwater sampling

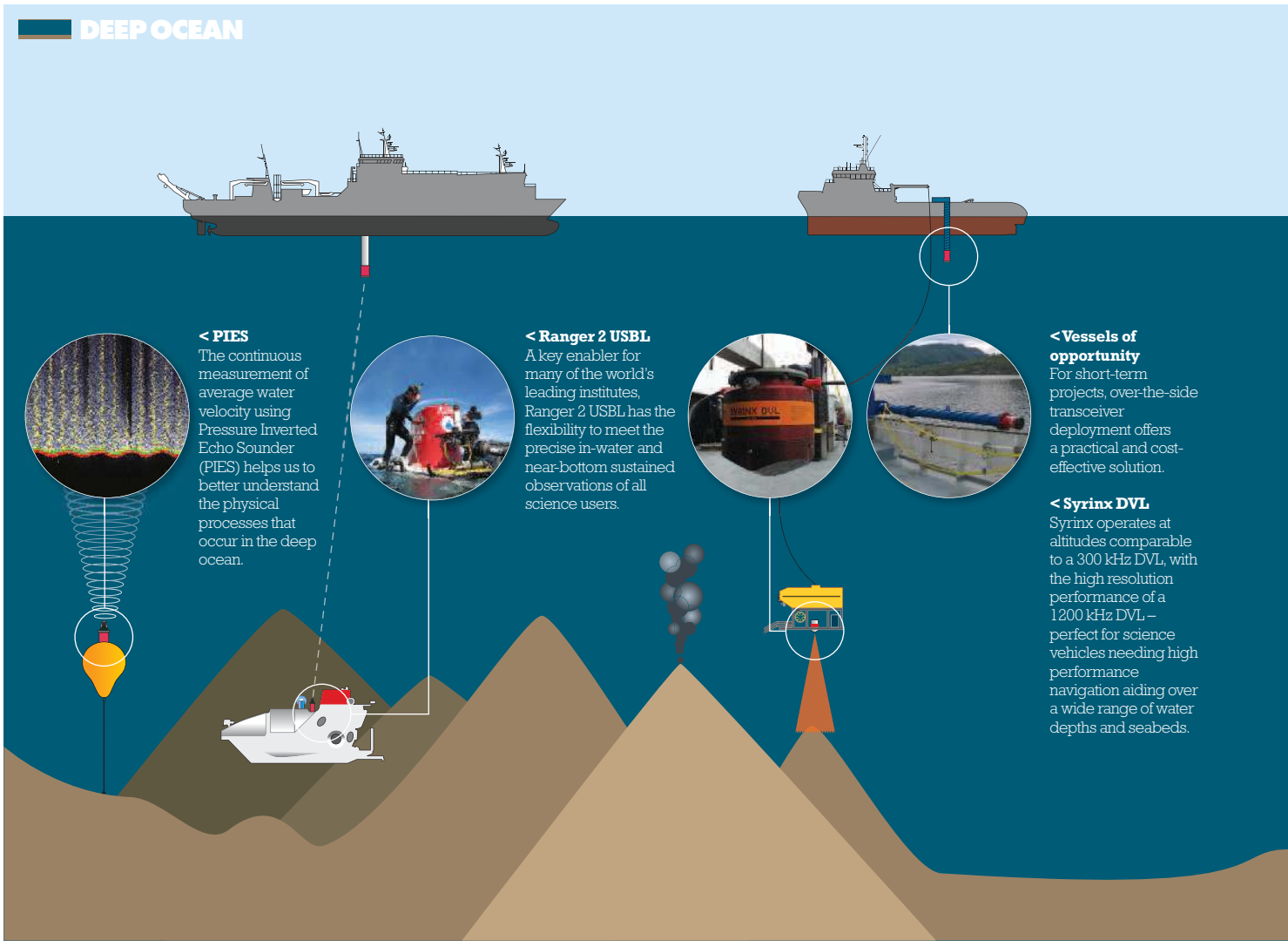
Our Ultra-Short Baseline (USBL) positioning technology has been widely adopted by ocean scientists, including WHOI's National Deep Submergence Facility, for tracking specialist scientific manned and unmanned submersibles in all water depths. While safety of operations is a primary driver, precise geolocation of samples is critical to the scientific value of a range these and other operations including seabed coring, camera platforms and towed bodies.

The National Oceanography Centre's (NOC) Hydraulic Benthic Interactive Sampler (*HyBIS*) is an example. Designed as a video guided seabed sampler, our Ranger USBL has enabled *HyBIS* to deploy instrumentation over methane hydrate and seafloor gas vents in the Arctic, as well as collect HD imagery, geological, biological, fluid, gas and other chemical samples, including from the deepest known (5,216 metres) hydrothermal vents at the Mid-Cayman Spreading Centre.

Our USBL systems are accompanied by inertial and Doppler Velocity Log (DVL) technologies making us unique in offering all-in-one subsea vehicle navigation. Recently, we worked with the Schmidt Ocean Institute to configure an integrated solution for their new deep-rated ROV *SuBastian*. We delivered a SPRINT inertial navigation system, Syrinx 600 kHz DVL and a Wideband Mini Transponder 6, to complement the Ranger 2 system installed on their research ship *Falkor*. This solution ensures robust positioning even in the most challenging acoustic and bottom topography situations, with Syrinx providing the high altitude (<175 metres) capability normally only available from a 300 kHz DVL and the high precision and accuracy of a 1200 kHz DVL. Features such as lightweight titanium housings provide valuable space and weight savings that free up scientific payload.

New solutions for new challenges

Ships and static delayed-mode data collection by moorings have traditionally been central to ocean observation. However, the rapidly rising cost of operating a vessel and the desire for real-time (or at least



When ROVs are used, Ranger 2 integrates seamlessly with our SPRINT INS and Syrinx DVL products to maximise ROV positioning performance. This minimises the number of observations required to achieve your mission's specification.

Here an LRT is readied for deployment by a field engineer working for Luode Consulting, a Finnish-based environmental monitoring company.

near-real time) data, has driven the increasing use of autonomous and remotely accessible systems to deliver data direct to the scientist's desk. These are complemented by our commitment to custom engineering innovative solutions for you, underpinning our contribution to transforming how ocean science is undertaken at sea – just as we have done in the offshore industry.

Nowhere is this crossover better illustrated than our involvement with Fugro GEOS, the NOC, the British Geological Survey, Plymouth Marine Laboratory and the University of Southampton in the Energy Technologies Institute Carbon Capture and Storage (CCS) measurement, modelling and verification project (see Baseline Issue 12). This collaboration between industry and academia is a compelling model which is integrating offshore technology with scientific know-how to deploy a highly integrated system of autonomous seabed and in-water platforms to monitor CCS storage sites.

As scientists strive to understand the oceans from the regional to basin scale on decadal as well as daily/weekly timescales, the demand for timely and distributed observational technology is only set to increase. We'll therefore continue to focus on precision and reliability, while innovating to meet the emergent challenges of ocean observation. **BL**

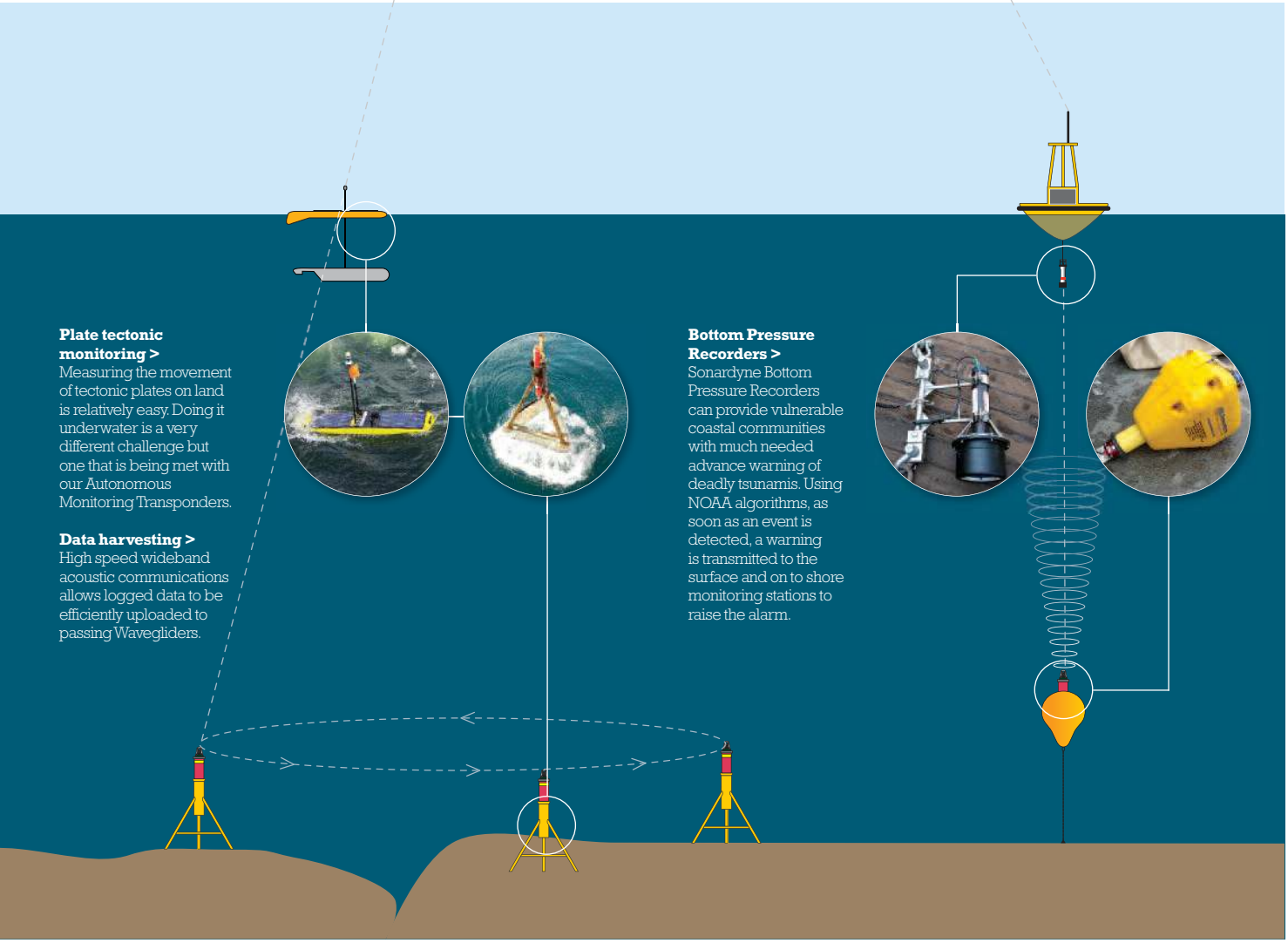


Plate tectonic monitoring >
Measuring the movement of tectonic plates on land is relatively easy. Doing it underwater is a very different challenge but one that is being met with our Autonomous Monitoring Transponders.

Data harvesting >
High speed wideband acoustic communications allows logged data to be efficiently uploaded to passing Wavegliders.

Bottom Pressure Recorders >
Sonardyne Bottom Pressure Recorders can provide vulnerable coastal communities with much needed advance warning of deadly tsunamis. Using NOAA algorithms, as soon as an event is detected, a warning is transmitted to the surface and on to shore monitoring stations to raise the alarm.

Construction Survey

Case Study

ECS connects with Connect to pe

Subsea metrology requires accurate, precise and robust measurements which are critical for successful fabrication and installation of spools and jumpers. It can take six to eight hours or longer to complete one measurement, but a recent project showed that by using our dedicated metrology software tool it's possible to significantly reduce this.

The project was led by global offshore construction company, EMAS CHIYODA Subsea (ECS), who was contracted by Apache Energy to deploy its heavy lift deep water, multi-lay *Lewek Constellation* at the Julimar natural field off the coast of Western Australia. ECS's scope of work included the installation of two manifolds, connected by five 30 metre vertical spools and five 80 metre horizontal spools.

Surveyors estimated that to complete the 10 metrologies, would take anywhere between 60 and 80 hours. So in a drive to save time and money, ECS turned to our dedicated metrology software 'Connect' to streamline the process.

"Our team were blown away with the speed in which these metrologies were undertaken – in particular the unprecedented time of 26 hours total to measure five 30 metre vertical jumpers... and five 80 metre horizontal jumpers... in 80 metres water depth."

Connect software

Developed in partnership with survey engineering company, 4D Nav, Connect reduces operator workload by introducing 'expert' settings, automated data collection and robust processing of measurements from planning to report delivery.

The work at Julimar was conducted using five Compatt 6s and three Gyro-Compatt 6 transponders. The Compatt 6 units were deployed in a braced LBL array to support positioning the manifolds during installation and subsequent metrologies. The GyroCompatts were installed in survey

The *Lewek Constellation* is fully equipped with her own permanent state-of-the-art survey equipment and utilises 4D Nav's NavView and PipelayView software.

receptacles on the various structures for the same purposes. The *Lewek Constellation's* own ROVs were used to move the Gyro-Compatts around; a task executed quickly and efficiently thanks to a manipulator-friendly handle on each unit's side and precision mechanical 'stab' on its base which, when placed in a 'survey receptacle' on each structure, precisely aligned the GyroCompatt relative to the structure's north.

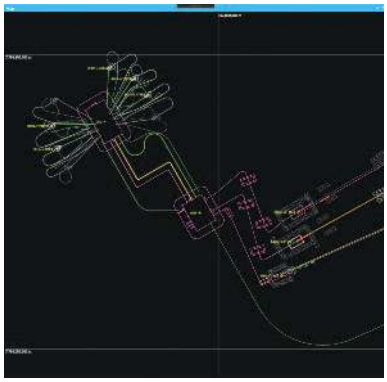
All of the metrologies were implied, no spool hubs were occupied. Data collection took advantage of Connect's capability to load and integrate the data for multiple metrologies, analyse and QC it, then apply it to process individual metrologies. The survey team collected depth loop and profile data using an ROV held digiquartz depth sensor, then heading and inclination data at each survey receptacle whilst also collecting baseline measurements. The collected data was analysed as one data set. The site's shallow water depth meant paying particular attention to sound velocity.

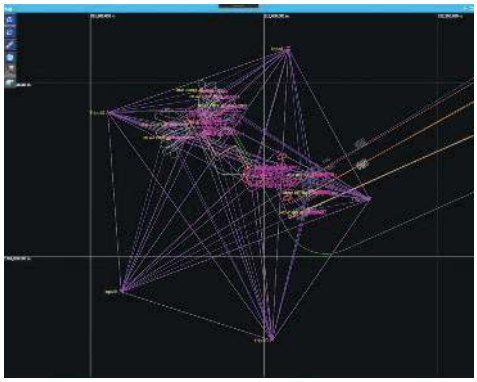
Connect's ability to edit the sound velocity applied to individual and groups of baseline observations and reprocess multiple metrologies to evaluate the effect of the changes with a few mouse clicks, proved invaluable. Once the data QC was completed, each spool metrology was processed and the final report and plot generated. The report contains a summary of the results including hub-to-hub horizontal distances, slant range, depth differences, attitudes, plus details of the calculations to support the results.

Huge time savings

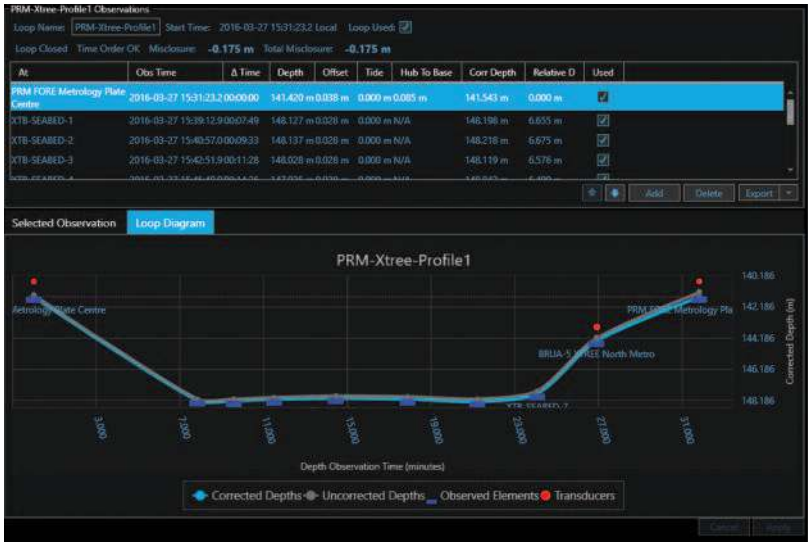
Speaking about the success of the Connect software utilised during the Julimar Project, Gerry Quinn, Survey Manager (Operations) with EMAS CHIYODA Subsea said, ''Our team were blown away with the speed in which these metrologies were undertaken – in particular the unprecedented time of 26 hours total to measure five 30 metre vertical jumpers (Manifold to Wells) and five 80 metre horizontal jumpers (Manifold to Manifold to PLEMs) in 80 metres water depth. The 4-man Survey team conducted not just the metrology, but the overall operations as smoothly and as efficiently as one.''

erform 10 metrologies in 26 hours





Connect guides the user through all the key steps of subsea metrology. Data collection is fully configurable according to the user's specific operational procedures. (Below right) Preparing a GyroCompatt for ROV deployment onto one of Julimar's manifolds.



Structure Installation

Case Study

SensorView reduces rig time at Ichthys

SensorView software allows you to stream real-time subsea sensor data direct to your desktop. Use it with your 6G Fusion and Ranger hardware or via a standalone transceiver and transponder set-up. Fast and easy to use, SensorView's perfect for all sorts of subsea data gathering applications as the case study opposite illustrates. >>

Features at a glance	
Hardware Compatibility	All 6G transponders, transceivers and iWand.
PC Compatibility	Windows XP and Windows 7 compatibility.
Display	Detachable tabs allow maximum data visibility. Data colour coded to represent time elapsed.
Features	Power and gains adjust to optimise acoustic quality. Common and custom telegram formats. Configurable alarms. Multiple reply option for fast sensor updates.
Networking	Supports Ethernet connection to HPT.

Software that enables acoustic data to be streamed in real-time from subsea structures as they are installed has helped to reduce non-production time (NPT) for independent oil and gas producer, INPEX, and its survey contractor, Neptune Geomatics, during construction of the Ichthys gas field, Western Australia.

SensorView allowed data gathered by an acoustic transponder mounted on Tubing Head Spools (THS), to be transmitted at high speed to rig personnel monitoring the installation operations. The parameters measured by the transponder's on-board sensors included heading, depth, sound velocity and inclination, and meant that delays previously incurred while aligning each THS to drilling templates, could be substantially reduced.

Located 220 kilometres off the coast, Ichthys represents the largest discovery of hydrocarbon liquids in Australia in

Real-time positioning and heading information was gathered by a GyroCompatt and streamed to SensorView on the surface.

Image: © INPEX

over 40 years. It covers an area of around 800 square kilometres and is estimated to contain 12 trillion cubic feet of gas and 500 million barrels of condensate.

The field will be developed using a semi-submersible central processing facility, the largest of its kind anywhere in the world, and an FPSO connected by 890 kilometres of gas export pipeline to an onshore processing and storage facility at Bladin Point near Darwin.

As part of a 40 month contract, INPEX contracted Neptune to provide rig positioning and survey services during the drilling and completions phase of the project, work that is being undertaken by the *Jack Bates* and *Ensco 5006* mobile drilling units.

At each of the five drill centres, Neptune installed a seabed array of our Compatt 6 Long BaseLine (LBL) acoustic transponders to accurately position the spud locations and monitor the installation of the Drilling Guide Bases (DGBs) as they were lowered from the surface. Structure-mounted Compatt 6s fitted with high resolution inclinometers and depth sensors were used to verify final DGB positions and inclinations following cementing of the conductor in the top hole section.

While trying to align each THS with the DGBs once they arrived at depth, operational delays leading to rig non-productive time were incurred. To avoid such delays, INPEX requested that Neptune gather real-time positioning and heading information on each spool as it was being manoeuvred.

The requirement was met using SensorView. It can be used in parallel with 6G acoustic positioning systems such as Fusion, or as a standalone solution for cost-effective remote monitoring and subsea data harvesting projects.

At Ichthys, SensorView was mobilised on one of the rigs and interfaced with a Dunker 6 transceiver which was deployed over the vessel's side. Subsea, a GyroCompatt 6 was temporarily mounted on each THS and attached using a customised bracket designed to allow an ROV to recover the unit after each THS was installed.

Commenting on the successful deployment of SensorView, Pat Fournier, Operations Manager for Neptune's Geomatics service line said, "During Neptune's recent Ichthys drilling and completions campaign, SensorView delivered us THS heading update rates of approximately one every three seconds. This was sufficient for our surveyors to fully understand the dynamic motion of the structures and thereby reduce the time needed to land them in the correct location." He added, "We were impressed with the ease with which we could configure SensorView to work with our LBL acoustic hardware and view the data streams we needed to see."

Customer Support

Training

Tom Rooney, a former Royal Navy Officer, manages the Sonardyne Training Centre in Plymouth.

THE TRAINING GAME

Good quality training is a key part in reducing the risks associated with any offshore project. Operators who are experienced and confident in the systems they are using, perform tasks quicker, make fewer errors and are able to confidently deal with sudden environmental changes that may affect system performance. Lead Trainer, Tom Rooney reports for Baseline from Sonardyne's Sea Trials and Training Centre in Plymouth, explaining how his team helps customers prepare for offshore operations and get the very best out their subsea technology **>>**

The Training Centre

Situated in the historic maritime the city of Plymouth, 190 miles west-south-west of London, Sonardyne's training centre is home to an impressive array of training resources, including a fully equipped training room with acoustic system simulators and three training vessels permanently equipped with a suite of LBL, USBL, inertial and optical technologies.

Our company's history with Plymouth dates back to the earliest days of Sonardyne – some 45 years ago. The city was chosen as the location to test products due its natural deep water harbour and easy access to a wide diversity of water bodies, water depths and subsea topography. Mayflower Marina, where today we provide most of our practical training, is on the mouth of an estuary where the River Tamar meets the ocean. This creates a particularly challenging environment for acoustic positioning and so serves as an excellent training arena as the local subsea environment undergoes many changes throughout the day.

Training Courses

In order to make sure our customers get the very best out of their Sonardyne equipment, it is vital for us to provide both professional and extensive training. Using our location, facilities and vessels, we're able to offer scheduled product specific training as well as bespoke training that can cover a variety of Sonardyne products and systems.

Our courses are developed using a professional framework and delivered in a collaborative and inclusive style. Our customers enjoy having the opportunity to learn on live in-water kit, leaving with much more confidence in the equipment and their ability to deal with any challenges they may face offshore.

LBL and Metrology

Fusion 6G LBL is the product of choice for the vast majority of offshore installation projects and so we offer an extensive range of courses to support this demand.

Complete newcomers start with the Fusion 6G LBL Operators course, where they learn the fundamental principles of acoustics and practice the skills to set-up, calibrate and operate the system effectively.

(Clockwise from top right) The Sonardyne Training team in Plymouth; (left to right) trainers Luke Rogers and Stuart Slade and Lead Trainer, Tom Rooney.

Trials vessel *Echo Explorer* is used for dynamic in-water training courses such as Ranger 2 USBL, PIES and SPRINT.

Safety first – equipment pre-deployment checks using the iWand being taught on *Sound Surveyor*.

Remote training – Fusion 6G LBL course in progress at our Aberdeen Office. This type of training can be delivered at any suitable venue using our mobile service.

Cat A Hydrography students from Plymouth's Marine Learning Alliance on *Sound Surveyor* for the practical elements of their course.

Customer Support

Training

Their employers, and the clients they go on to contract for, can be assured that an LBL competency certificate from us represents a successful assessment of their basic skills.

But as with any profession, technology and techniques move on so it's important to keep your knowledge up-to-date. For graduates of our Operators course, we now hold one day re-qualification courses and because offshore project commitments can change at a moment's notice, these top-up courses run weekly and can be booked at short notice.

For more experienced users such as Chief Surveyors and Project Managers, our Advanced LBL course delves deeper into complex topic areas such as the Quality Control of calibration data, array planning and design and metrology. In fact, as metrology is such a multi-faceted topic, we now also offer a specific metrology course which discusses the science behind it all, examines the various methods available, the kit you'll need and, at the end, hands-on time with our dedicated metrology software package called Connect. Read more on page 20.

USBL, LUSBL and INS Positioning

Our USBL training can be easily tailored to suit the types of operation you will be conducting. Whether you're tracking an ROV, towfish or AUV, our popular Ranger 2 and Mini-Ranger 2 USBL systems can be configured to meet your needs. And with assets such as our Falcon ROV on hand in Plymouth, there's no better way for operators to learn the skills required.

For DP Operators, our Marksman LUSBL course provides confidence in this safety-critical position reference technology and the part it plays in helping a drilling or production vessel remain in the right place.

If your subsea vehicle is fitted with our Inertial Navigation System (INS), SPRINT, our comprehensive syllabus covers the theory of INS positioning, hands-on installation and setup of the hardware (including our new 3rd generation form-factor), testing and calibrations and dynamic tracking operations using USBL, LBL or Sparse LBL as an acoustic aiding source. It also looks at the important role aiding sensors such as your DVL play in producing the optimum navigation solution.

Vessels

Our two 12 metre catamarans, *Echo Explorer* and *Sound Surveyor*, provide the venue for the dynamic elements of our courses, and when they're not engaged in teaching, they can be found supporting our product development and testing activities. Outside of these activities, the vessels, and their experienced marine crew, can be chartered to third party companies to support their own technology trials – be it above water or below water technologies.

Based in Mayflower Marina, these vessels have been specifically designed and built to operate as Survey-class vessels and certified to MCA category 2. Large back decks, spacious interiors and well thought out equipment deployment and handling arrangements, make for a very comfortable learning environment for our students.

Along with these boats, we also have *Val B*, a fully equipped floating classroom and static test facility with two permanently installed subsea transponder arrays deployed on the seafloor nearby. This unique arrangement gives us the freedom to operate realistic training whatever the weather. The arrays can even be commanded from any of our international training centres in Houston, Singapore and Brazil via a secure network link to provide remote in-water training.

Mission rehearsal and risk management

When it comes to training, one size doesn't fit all. If you need to perform a particular task or project using our equipment, we can create bespoke courses combining our in-water resources, and where necessary, using our own simulation software. With the ability to emulate as close as possible the project that is planned, relevant skills can be practised and potential problems identified in the training suite, rather than on an expensive vessel offshore. The potential savings in terms of risk and project delays, make this service a wise investment for any offshore project manager.

Workshops and other courses

Courses can be arranged on request for any of our other products including, PIES, Monitor and AMTs, Sentinel, emergency BOP control and Janus INS post-processing. And if you can't come to us in Plymouth, we can come to you. Our mobile service offers the same expert courses at any of our regional offices or at your location anywhere in the world using our own in-house simulator software.

In addition to our product related courses, we also run regular one-day workshops to allow people to learn about the techniques and get to 'have a go' at operating them. These enjoyable sessions are proving to be very popular with those hoping to get into the offshore industry.

We also offer the capability of online learning with webcast tutorials and product refresher sessions that can be enjoyed from the comfort of your desk or sofa at home. Additionally, the team have also begun producing a number of short YouTube videos containing some tips and tricks that Sonardyne customers will find useful.

Our trainers also take the time to support our local community, regularly guest lecturing on acoustic positioning techniques for Plymouth University, the Royal Navy Hydrographic School in Devonport Dockyard, the Marine Learning Alliance in Plymouth and Skill Trade in the Netherlands.

Our team

The Plymouth training team is made up of experienced engineers and hydrographic surveyors who possess and maintain the necessary skills and expertise to operate and teach our full range of software and hardware. Their professional, inclusive and personable approach to practical skill-based training consistently receives high praise and positive feedback from satisfied customers. Supported by our skilled skippers and technicians of the Plymouth facilities team, they ensure every course, workshop or bespoke training session is planned, resourced and delivered to the highest of standards.

To learn more about our training courses visit our website:
www.sonardyne.com
For further information on our Plymouth trials and training facility visit:
plymouth.sonardyne.com

Follow our LinkedIn showcase profile **Sonardyne-Training**
To book a course or discuss your training requirements email:
training@sonardyne.com
Or call **01252 872288** and ask for the Training Centre

Don't take our word for it. Here's what some of our graduates have had to say about our training courses...

"Because of my location (Australia), courses are few and far between so WebEx is a great way for me to attend courses." **(Fusion 6G LBL Refresher)**

"I would certainly recommend the LBL Operators course to my colleagues in the industry." **(Fusion 6G LBL)**

"The course was brilliant, well worth the cost. Great teacher!" **(Fusion 6G LBL)**

"One of the best tutors I've ever had the pleasure to work with." **(Ranger 2 USBL)**

"Definitely the most real-world relevant course I have attended." **(Fusion 6G LBL)**

"Great understanding and opportunity to design project." **(Bespoke Mission Rehearsal Course – SPRINT and LBL Multi-user)**

"I would just like to take this opportunity to express my sincere thanks to Sonardyne for the quality of the acoustic positioning presentations and demonstrations delivered yesterday at both our school and subsequently at the Mayflower Marina." **(From the Officer in Charge of the RN Hydrographic School)**

(From top, left to right) On board *Val B*, our static floating classroom used for in-water training courses such as Fusion LBL, Marksman LUSBL and Monitor for AMTs.

Online training available via WebEx.

Analysis of customer feedback ensures we continue to deliver top quality training.

Delivering lectures to the Royal Navy's Hydrographic School.

Deploying a training Compatt in the waters off Plymouth.

Every course attendee receives a certificate.

Ocean Science

Shallow water diver tracking

The University of New South Wales invest in USBL for shallow water habitat surveys

Scout is compatible with our family of low cost transponders which have been designed for applications where size and weight are important factors.

Image: © Peter Southwood

(Images from top) SCU is a portable computer and control unit that enables Scout USBL to be operated independently from almost any type of boat and in any climate.

Whilst carrying out their research into human impact on marine and estuarine habitats, the team of divers from UNSW operate in just a few metres of water – all tracked by Scout.

One of Australia's leading academic institutes, the University of New South Wales (UNSW), is now using our underwater positioning technology to support pioneering research into human impact on marine and estuarine habitats.

The Scout-Pro Ultra-Short BaseLine (USBL) system, purchased through our office in Singapore, allows scientists to track the position of divers whilst they collect sediment samples, underwater video transects and biota – activities that are often difficult, sometimes dangerous, and rarely precise.

UNSW began survey operations in 2015 to assess how the underwater environment changes in response to leisure activities, particularly around boat moorings. Much like on land, habitat degradation in seascapes can act to create a mosaic of habitats, each with varying suitability for the resident fauna and flora. Physical disturbance of the seafloor, nutrient and heavy metal contamination, and recreational fishing are naturally irregular and can lead to a 'hidden' layer of diversity in the ecosystem.

Quantifying these impacts and uncovering this diversity calls for precise, geo-located sampling data – a requirement that is now being met following UNSW's acquisition of the Scout-Pro acoustic positioning technology.

A complete system is made up of just three main components: a portable or rack-mounted surface command unit (SCU), acoustic transceiver and transponders. UNSW opted for the portable SCU which is an all-in-one computer, display and acoustic transceiver interface designed to allow Scout to be operated from virtually any type of size of vessel and in any climate.

At the start of a survey, each member of the dive team has one of our small, Coastal beacons attached to their scuba equipment. Once in the water, the exact position of the beacon, and therefore the diver, is continuously monitored by an acoustic transceiver suspended over the side of the dive boat. Scout software has been designed to be very easy and intuitive to operate with no previous experience of acoustic positioning systems required.

The university's vessel fleet is made up of small cabin cruisers, RIBs and even shoreline infrastructure such as wharves and jetties. The transceiver's small size and speed of setup matches these operational requirements perfectly, to the extent that the UNSW scientists only needed an hour of training to become familiar with the system when it was first delivered.

Diving operations are typically carried out in water depths of less than 10 metres, in poor visibility and around dense moorings. So in addition to precisely mapping where samples are collected from, Scout-Pro adds an extra layer of safety by tracking each diver as they traverse the potentially hazardous underwater seascape. Their distance, bearing and depth relative to the dive boat, is clearly displayed on-screen and updated in real-time.

"Scout software has been designed to be very easy and intuitive to operate with no previous experience of acoustic positioning systems required."

Commenting on the impact of Scout-Pro on its work, Dr Luke Hedge, Research Associate at UNSW said, "In the short time we've been using it, Scout has proven to be an invaluable new piece of science equipment. Being able to record the precise location of where samples are taken from, allows us to present the region's policy makers with more reliable geo-statistical models and maps that faithfully represent our impact upon native marine and estuarine ecosystems."

International

News from our Regions Around the World

Europe, Africa, S. America

Barry Cairns Vice President

Brazil

Market conditions in Brazil continue to be challenging as the country navigates its way through major political and economic changes. We remain committed to the region and remain committed to our clients, both existing and new, working with them to support the construction, survey and drilling operations that have been given the go ahead by Petrobras.

Sonardyne's offshore staff, workshop team and training school have all been working tirelessly to provide customers with the best support for their upcoming LBL, USBL, LUSBL and DP-INS campaigns. Our facility in Rio das Ostras is unique in the area because we have many of the capabilities of our manufacturing plant in the UK, plus a fully trained local Brazilian team ready to support any acoustic and inertial operation.

And talking of training, we've recently supplied equipment that simulates acoustic positioning operations on DP rigs and ships, to vessel control and automation company, GE Power Conversion for their new training school in nearby Macaé. Simulator-based training maximises equipment performance and reduces operational risk and we're delighted that GE has selected Marksman LUSBL to help train the next generation of Brazilian DPOs.

Central America

We have recently expanded our operations into Central America by providing USBL positioning for pipe inspection work in Nicaragua which is a first for the Brazil office.

Europe

Our European markets also continue to be challenging as supply chain cost cutting remains the priority for all operations. 6G continues to be the main choice for our clients as it provides the efficiency and reliability to get the job done fast and first time - essential in these market conditions. Mini-Ranger 2 USBL systems are in high demand for customers that need survey grade positioning in shallow water depths up to 1,000 metres.

Users are seeing huge cost savings from vessel time to personnel costs using our latest technologies. Subsea mobile mapping is one such example where we are providing our tightly integrated acoustic and INS solution combined with a third party laser. This gives us a metrology capable dynamic system with ultra-fast operational timeframe. Once again, this provides massive savings to our clients from traditional methods. We're committed to pushing the boundaries of our technologies to keep on top of the challenges of offshore operations whilst reducing operational expenditure. ■

Middle East, SE Asia

Anthony Gleeson Vice President

BlueComm is lighting up the region with recent demonstrations in Singapore, Korea and Japan and planned demonstrations in China and India in the coming months. Keep an eye on our news feed for dates and locations.

Likewise our Syrinx DVL is proving a hit with our customers – everyone that has used or trialled it has been impressed with its versatility, performance and ease of use. Coupled with our INS and acoustics, we're rapidly becoming the supplier of choice for turnkey subsea positioning solutions. If you need a more personal introduction, we have BlueComm 100 and Syrinx DVL equipment in our Singapore office for you to trial and demo, so let us know.

Our USBL tracking beacon, WSM 6+, has now proven itself with our shallow water users. The ability to mitigate the effects of multipath and local interference with its 2-way wideband communication protocol is proving extremely useful for high elevation tracking in shallow water and noisy environments. ■

North America

Simon Reeves Senior Vice President

Although times remain tough in the offshore sector, our major industry base in the USA, we're particularly excited about the uptake of our navigation products by several major ocean science institutions.

The Canadian Scientific Submersible Facility and Woods Hole Oceanographic Institute recently took delivery of a Syrinx DVL, whilst Schmidt's new ROV, *SuBastian*, recently completed sea trials with its all-in-one solution of Syrinx DLV, SPRINT INS and Ranger 2 USBL. Pages 6-11 have more.

Over the summer, 2G Robotics contracted us to supply our acoustic-inertial aiding kit for a dynamic laser mapping survey of *U-576*, a German U-Boat lost off North Carolina. Led by NOAA, the next issue of Baseline will have a full write-up of this exciting project.

Team

Many of you know Dan Zatezalo. I'm pleased to announce he's just moved across to our sales team and is replaced by Kyle Warren in operations. Good luck to both. ■

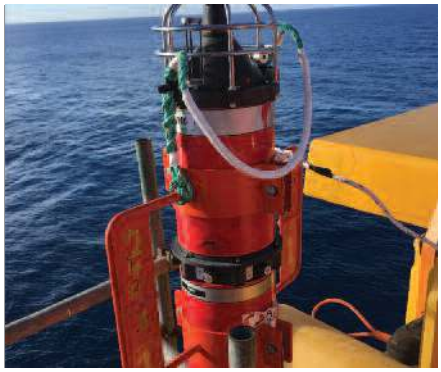
Help & Advice

Easier USBL Aiding for SPRINT

For metrology and other demanding survey applications where accuracy of absolute position is non-negotiable, SPRINT needs good quality time synchronisation – usually provided by both ZDA and 1 PPS. But for less stringent applications, such as midwater station keeping, third generation SPRINTs can be configured to use USBL observation's time-of-arrival (TOA) as the time of validity of the USBL position. In many cases this removes the need for the SPRINT system to be time synchronised, saving you time and simplifying system setup. To discuss how this feature could benefit your operations, please contact your local Sonardyne office.

Configuring GyroCompatt 6 to output MRU data

As you will have read elsewhere in this issue of Baseline, GyroCompatt 6 allows structures to be monitored during their installation, metrology to be accurately measured and spool pieces efficiently fabricated. The unit combines an LBL transponder and AHRS sensor in one and by following just five simple steps, you can configure its output for your dimensional control tasks. All you need to know is contained in a dedicated Work Instruction document that's available by emailing: **survey.support@sonardyne.com.** Each stage is covered in detail, with plenty of screenshots showing you the options you need to select and the configuration messages you can expect to see.

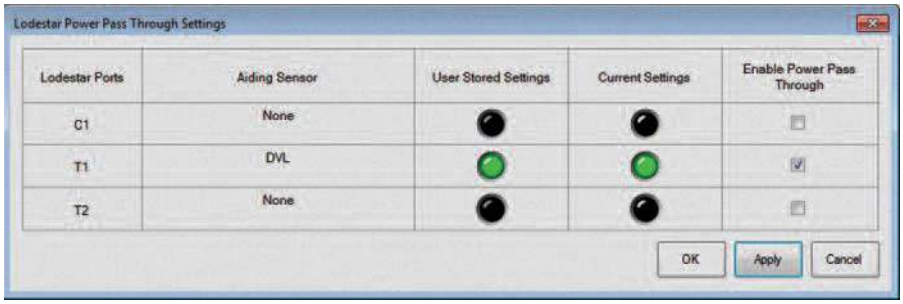


THE KNOW H?W

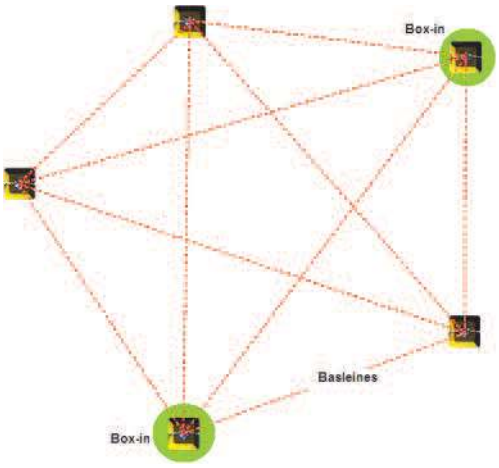
Our highly experienced product specialists are available to help you maximise the performance from your Sonardyne technology. Get in touch: support@sonardyne.com

Fewer cables with Power Pass Through

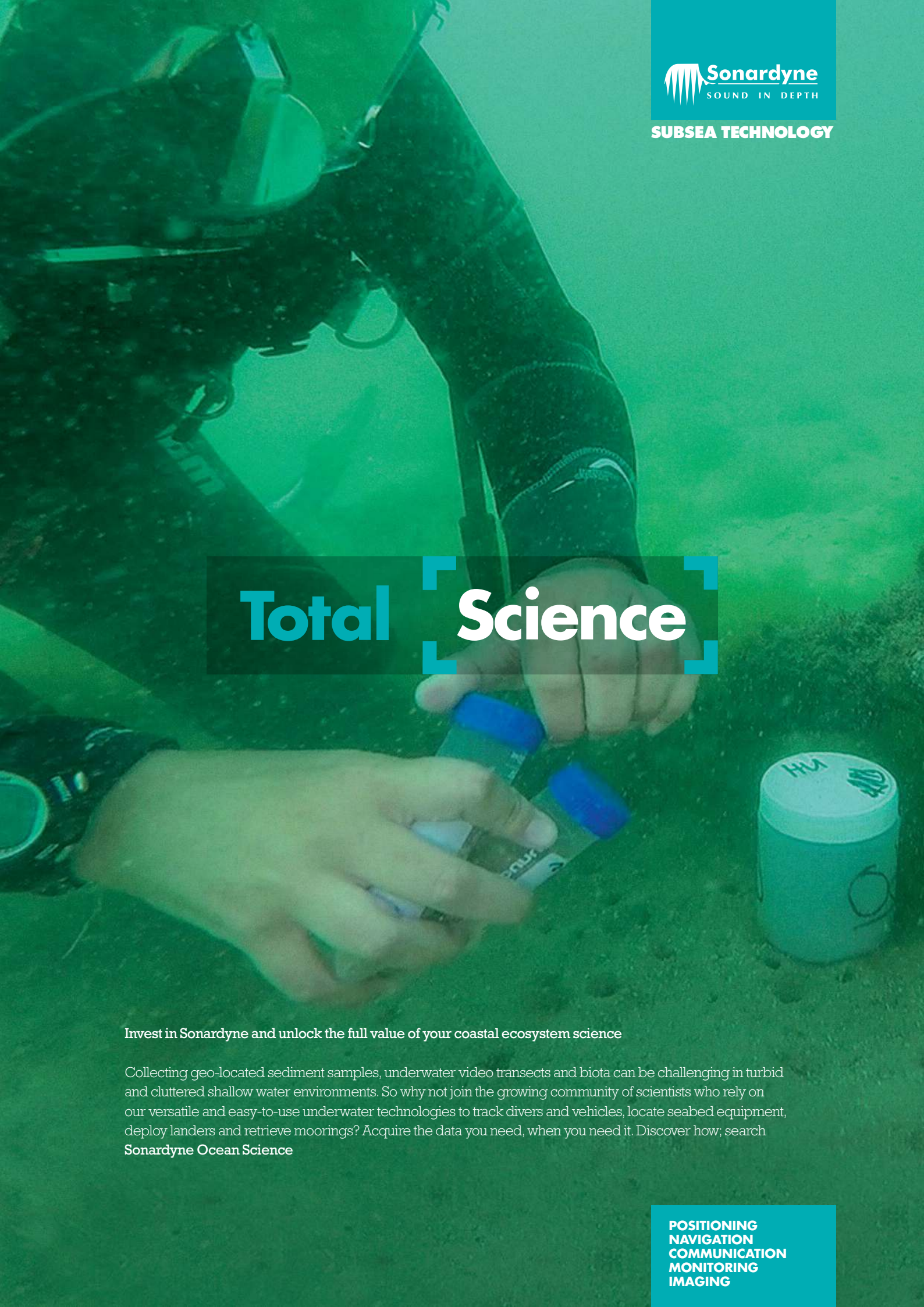
Staying with vehicle navigation, third generation Lodestar and SPRINTs (300 and 500 models), come with a standard feature called Power Pass Through. Quite simply this means these instruments can provide power to subsea sensors that are directly connected to any of its communications ports, such as a DVL, pressure sensor or LBL transceiver. This simplifies subsea cable management and reduces the risk of wiring problems. Just make sure you're running SPRINT V1.4 software or above. Email: support@sonarydne.com if you're not.



New White Paper: Overview of LBL Box-Ins



An Overview of LBL Box-Ins is the latest White Paper to be issued by our Survey Support Group (SSG). Box-Ins are performed when a subsea position is required to a higher degree of accuracy than is achievable using traditional surface to subsea methods such as USBL. USBL positions are prone to systematic errors such as gyro and MRU misalignment and incorrect offsets, while positioning quality is inversely proportional to the distance to the target – the further away the target is, the lower the quality. A Box-In on the other hand offers quality levels much less dependent on water depth and whilst there's no fixed rules, certain recommendations should be acknowledged. These, and much more information is covered in the new White Paper. Drop the team an email at **survey.support@sonardyne.com** to get hold of your free copy. And don't forget, the SSG is available to support you with any upcoming projects you may have. Their advice will help ensure your subsea operations go to plan.



Sonardyne
SOUND IN DEPTH

SUBSEA TECHNOLOGY

Total Science

Invest in Sonardyne and unlock the full value of your coastal ecosystem science

Collecting geo-located sediment samples, underwater video transects and biota can be challenging in turbid and cluttered shallow water environments. So why not join the growing community of scientists who rely on our versatile and easy-to-use underwater technologies to track divers and vehicles, locate seabed equipment, deploy landers and retrieve moorings? Acquire the data you need, when you need it. Discover how; search **Sonardyne Ocean Science**

POSITIONING
NAVIGATION
COMMUNICATION
MONITORING
IMAGING