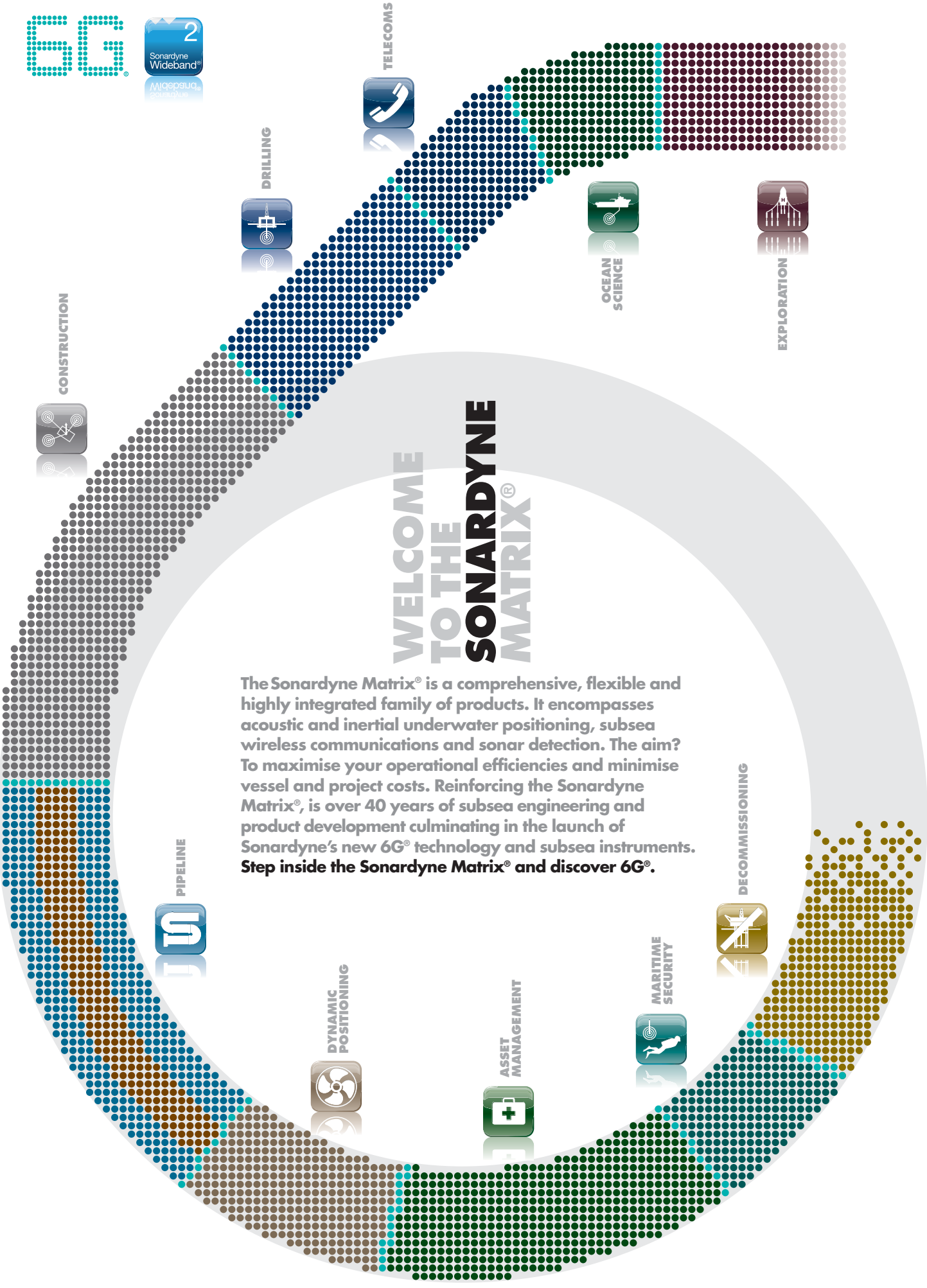
THE CUSTOMER MAGAZINE FROM SONARDYNE
ISSUE 6

Baseline


6G
2
Sonardyne
Wideband®
TELECOMS
DRILLING
OCEAN SCIENCE
EXPLORATION
CONSTRUCTION
WELCOME TO THE SONARDYNE MATRIX®
The Sonardyne Matrix® is a comprehensive, flexible and highly integrated family of products. It encompasses acoustic and inertial underwater positioning, subsea wireless communications and sonar detection. The aim? To maximise your operational efficiencies and minimise vessel and project costs. Reinforcing the Sonardyne Matrix®, is over 40 years of subsea engineering and product development culminating in the launch of Sonardyne's new 6G® technology and subsea instruments.
Step inside the Sonardyne Matrix® and discover 6G®.
PIPELINE
DECOMMISSIONING
DYNAMIC POSITIONING
ASSET MANAGEMENT
MARITIME SECURITY

CONTENTS
BASELINE
ISSUE 6

A LOT HAS HAPPENED here at Sonardyne over the past 18 months, so this issue of Baseline is dedicated to bringing you up-to-date with all the major stories.

As you'll discover, six is a recurring theme in this edition. Not only is it our sixth issue, the editorial is focused on the introduction of our sixth generation technology – 6G. On page 12, there's an interview with Simon Partridge and Richard Binks discussing the technical and commercial benefits of the new platform. 6G was launched just 12 months ago, but it has already built up an impressive track record. Page 16 provides just a glimpse.

Those that have used 6G first-hand report impressive results: time savings, trouble-free performance in difficult conditions and equipment flexibility. The case study on page 24 is a perfect example. Using 6G, an Australian team completed their metrology project in half the time they had expected.

2010 will be long-remembered for the Macondo disaster. If any positives can come out of such tragedy, it will surely be how the industry responded to find a solution. On page 8, we look back and highlight the role Sonardyne technology played.

The 6G story is more than just acoustic positioning. We present details and results using our new Lodestar aided inertial technology. You can use it to extend the reach of your USBL system or as an independent position reference for your DP system.

Elsewhere, the latest product to emerge from our investment programme in sonar has arrived; a low power, high resolution sidescan called Solstice. We believe it's a true 'game changer'; we hope you agree once you've read the feature on page 20.

2011 is already shaping up to be as busy, so until the next issue, all the best,

Rob Balloch, Strategic Development and Marketing Director

Front Cover
Compatt 6 transponders awaiting deployment offshore in South-East Asia. Once installed in the in-field construction area, the units will support the installation of all structures, the laydown of flowlines and subsequent pipeline metrology activities with the highest accuracy independent of water depth.

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Sonardyne
SOUND IN DEPTH

NEWS

DP-INS combines the complementary characteristics of the latest Sonardyne Wideband 2 acoustic signal technology with high integrity inertial measurements from the Lodestar hardware platform. Its output is independent from GPS disruptions.

DYNAMIC POSITIONING

DP-INS successfully complements acoustic and GPS reference technologies

To comply with safety regulations, many deep water drilling rigs require three independent position reference inputs for their Dynamic Positioning (DP) system. Traditionally vessels have relied upon a combination of Long and Ultra-Short BaseLine acoustics and two separate GPS systems as the source of these inputs.

However in low latitudes (the problem being particularly acute around equatorial regions and during periods of high solar activity) GPS signals are vulnerable to outages from scintillation due to ionospheric irregularities. The requirement therefore exists for a new independent reference to be made available.

DP-INS

Sonardyne's innovative DP-INS (Inertial Navigation System) addresses this need and in February 2010, extended trials of the new technology began onboard the *Petrobras P23* drilling rig operating in the Campos Basin, offshore Brasil.

DP-INS seamlessly combines the long term accuracy and precision of Sonardyne's Wideband 2 acoustic signal technology with the continuous output and fast update rate of high grade inertial sensors. The single navigation solution that is computed offers complete independence from GPS and an ability to 'ride through' acoustic problems such as aeration and noise disruptions.

In addition to operational safety improvements, DP inertial positioning delivers other key benefits. Cost efficiencies are made as there is only need to use a single transponder instead of a full seabed array. This significantly reduces the set-up time following arrival on location yet still offers the same accuracy as LUSBL (which would generally need an array of five transponders). Additionally, the DP-INS runs at a slower acoustic update rate, which saves transponder battery life. Traditionally with LUSBL, update rates are once every 1-5 seconds; with a DP-INS installed, it is once a second or faster with infrequent aiding from the seabed transponder.

Over several months, the Sonardyne DP-INS onboard the *P23* demonstrated its reliability and independence from GPS disruption and the crew operating the system quickly gained confidence in the new technology.

The simple-to-use operator interface displays both the vessel's LUSBL or USBL position and the INS position in an intuitive format alongside essential status information. The display gives the system operator access to all the information required to monitor DP-INS performance without significantly increasing their workload.

The success of this trial, and another on a drillship in the Gulf of Mexico, confirms that Sonardyne DP-INS is fit for purpose as a new independent DP reference.

SOCIAL MEDIA

Connect with Sonardyne in 2011

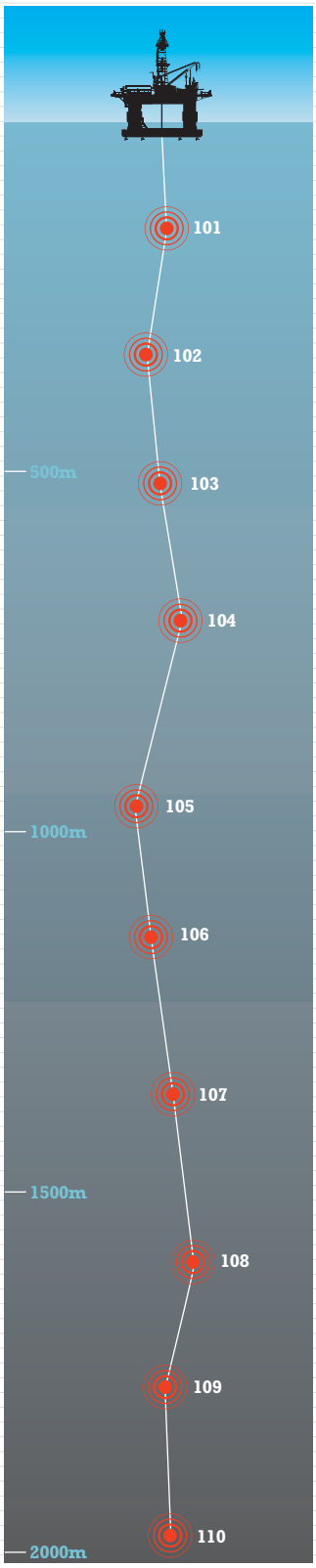
There are two new ways to keep up to date with Sonardyne's latest news, product updates, case studies and forthcoming events. 'Ping' is our new bite-sized e-newsletter; its concise format gets straight to the point and provides you with easy links to more information should you want it. Look out for it in your Inbox and make sure to add it to your 'safe senders' list. For news as it happens, why not follow us on Twitter (@sonardyne)? In 140 characters, we'll keep you informed of all the latest developments whilst you are on the go. Sign up for Ping or our Twitter feed by visiting our website.

www.sonardyne.com	@sonardyne	linkedin/sonardyne

Strategically located near Brasil's oil town, Macaé, Sonardyne's new purpose-built offices will open in Summer 2011. The 650 sqm building in Rio Das Ostras's enterprise zone will enable continued expansion of our Brasil support infrastructure and represents the company's most significant investment outside the UK. It features a four metre deep test tank to allow faster repair turnaround and calibration of equipment, and comprehensive training facilities. A future expansion area will give Sonardyne the capacity to manufacture locally for the Brasilian market, further strengthening our service to customers.

ASSET MANAGEMENT

Keeping watch of subsea risers and mooring lines



Two new acoustic monitoring systems for drilling and production vessels bring new levels of safety and awareness when operating with subsea risers, mooring lines and turret buoys. Both take advantage of features found within the new 6G family of versatile instruments and operating systems to eliminate the need for expensive umbilical cables.

The Riser Profiling System provides operators with a real-time vertical profile of current speed and direction, temperature and inclination of risers. The system can be used either stand alone or integrated with Sonardyne's Marksman LUSBL system that provides positioning for vessel's DP.

Riser sensor data is measured by multiple DPTi transponders that are clamped onto the riser during deployment or subsea using an ROV. The information is transmitted wirelessly using reliable acoustic telemetry up to a transceiver on the vessel for processing and graphical display, providing operators with instant analysis.

RiserView software operates with Sonardyne Ranger 1 or 2 USBL hardware and a custom designed catenary model of each riser and mooring line to compute tension. The software remotely interfaces to Ranger and automatically controls the interrogation of transponders installed at key points. USBL position, inclination and pressure readings are combined to allow the tension of each riser to be calculated. The transponders have a battery life of three years and can be easily removed for maintenance using an ROV.

NEWS

OCEAN SCIENCE

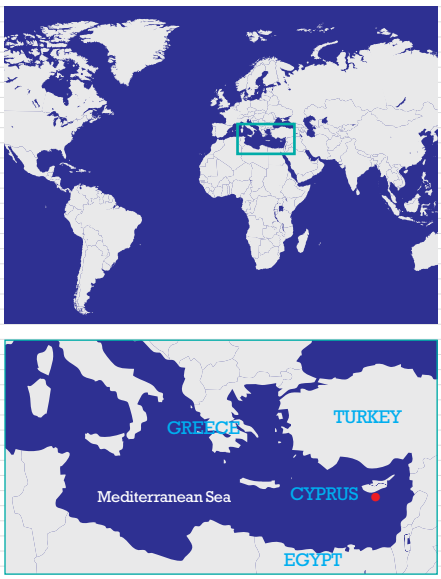
Tsunami detection sensors delivered for Mediterranean warning system

Sonardyne's specialised remote monitoring technology is once again set to play a vital role in alerting coastal communities to the threats posed by tsunami waves. CSNet of Florida and LimmasoI, is working with the Oceanography Centre of Cyprus to develop a prototype tsunami warning system to protect Cyprus and the eastern Mediterranean coastline.

Four Sonardyne tsunami detectors equipped with sensitive water pressure sensors and a NOAA software algorithm have been delivered for incorporation into the advanced warning network.

The Tsunami Warning and Early Response system for Cyprus (TWERC) will differ from other warning systems because of the relatively confined nature of the Mediterranean. The Mediterranean is seismically active and could generate a tsunami that hits the coast in less than an hour and this demands a warning system capable of rapid activation and response.

The TWERC system consists of an array of seismometers working in conjunction with pressure sensors to create an Offshore Communications Backbone (OCB) that can also support the region's emerging offshore energy industry. The OCB covers several hundred kilometres of seafloor off Cyprus's south coast and will provide real-time, continuous communications with a control centre ashore.



An OceanNet buoy moored some 80km off the southern coast of Cyprus. The buoy is one element of the Offshore Communications Backbone (OCB).

TWERC will utilise the Sonardyne sensors to detect specific changes in water pressure that can indicate a tsunami has developed. The proprietary software algorithm uses the previous three hours of data to predict the tidal change in pressure.

The unit only triggers an 'Event' alarm if two consecutive readings deviate from the predicted range by more than the preset threshold. The sensors will be hardwired to a power and communications network that provides an immediate link to the shore control centre. This will avoid the delays inherent in mid-ocean systems that use satellite communication to relay their emergency warnings.

Dr. Georgious Georgiou, director of the Oceanography Centre of Cyprus and TWERC project leader says, ''The system will include both offshore technology and capacity building on shore, including public education and outreach. Detecting the wave is only part of the solution. Transmitting that warning quickly to a population that knows what to do when they receive it is equally critical.''

Dr. Andrew Clark, president and chief executive officer of CSnet adds, ''This system will not only serve to protect citizens and visitors of Cyprus, but also all those along the entire, densely populated eastern Mediterranean coast, a very seismically active region.''

The Sonardyne sensors supplied for the TWERC system are designed to detect the subtle changes in water pressure that can indicate a tsunami has developed.

PIPELINE

Subsea 7 uses 6G for monitoring North Sea pipeline bundles

This season, Subsea 7 is using Sonardyne 6G technology to monitor the position and status of several production pipeline bundles as they are towed midwater from Subsea 7's Pipeline Bundle Fabrication site in Wick, Scotland. The first of these bundles, 7km in length, left the shore in March and was successfully delivered an oil field in the North Sea.

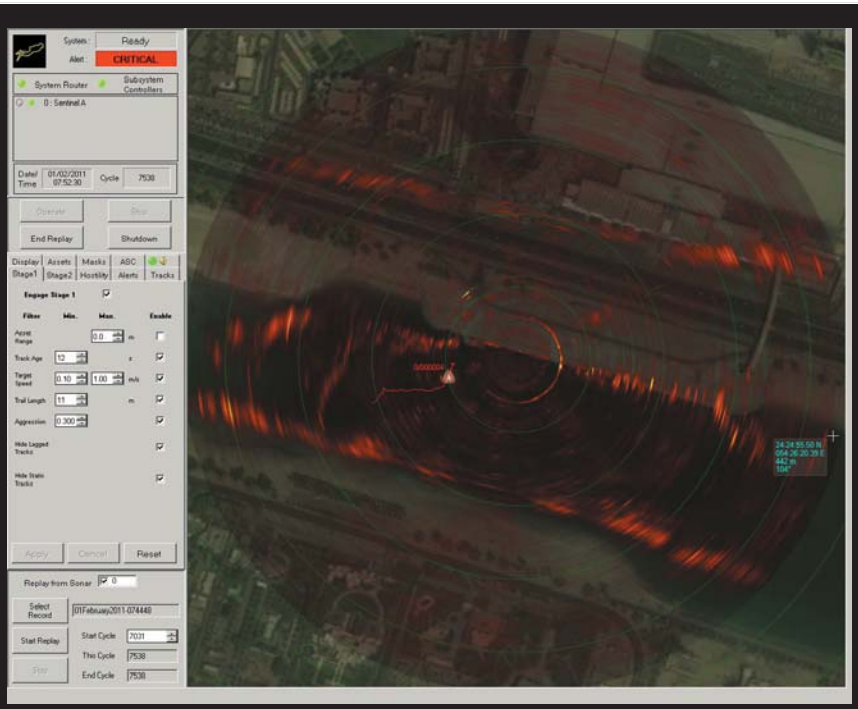
Prior to the tow, Compatt 6 transponders were installed at 850 metre intervals along the bundle and these formed the backbone of an 'acoustically hopped' communications

With the first tow now complete, Subsea 7 will deliver five more pipe bundles in the summer.

network passing data along the entire length of the bundle. A cabled data highway was provided as a backup to be used when acoustic conditions were poor.

The Compatts captured information from a variety of sensors including depth, carrier pipe pressure and towing wire angles, and relayed this data acoustically to a nearby vessel for continuous shape monitoring. Sonardyne Lodestar attitude and heading reference sensors were also connected into this network and used to monitor the shape and travel direction of the bundle at three critical locations.

This information provided the towmaster with vital data on the pipeline's status along its entire length. It was then possible to control the depth profile of the bundle so that it did not sag or snake excessively during the tow, thereby ensuring it was 'flying' at the required depth.



Despite the challenging environment, Sentinel tracked the divers as soon as they entered the water.

DEFENCE

Sentinel beats Navy divers during demonstrations

The effectiveness of Sonardyne's Sentinel diver detection sonar in protecting high value marine assets has been demonstrated at a major naval defence exhibition in Abu Dhabi. Twice a day, Royal Navy clearance divers from HMS *Pembroke* attempted to evade detection during a simulated underwater assault on the Sentinel-equipped ship as it lay alongside the show's quay.

On each occasion, Sentinel was able to detect the underwater threat as soon as the divers entered the water, raise a critical alarm and use its unique acoustic signature classification algorithm to identify the targets as 'closed circuit divers'. Sonardyne's Scylla underwater loudhailer would then automatically broadcast a message to the divers warning them that they had been detected and to surface immediately.

Away from the live action in the water, it was announced that Sonardyne had won a major contract for an integrated waterside security project in the UAE in partnership with FLIR Systems Inc., USA. This news attracted a large international audience consisting of visitors from the military, government, commerce and the media to Sonardyne's stand, keen to understand why Sentinel is now the world's best selling diver detection sonar.

Rob Balloch of Sonardyne said, "The Abu Dhabi event was a perfect opportunity for us to rapidly deploy a versatile, integrated and autonomous underwater security system. Our thanks go to the Captain and crew of HMS *Pembroke* for their co-operation in making the Sentinel demonstrations a complete success."

News Feature

Deepwater Horizon

At the height of response effort, 19 principal vessels, some up to 250 metres in length, were stationed within a radius of 500 metres of the spill site. Deployment of Sonardyne Wideband acoustic positioning and telemetry solutions proved invaluable.
All images: © BP p.l.c.

On April 20, 2010, the Deepwater Horizon rig was drilling an exploration well in the Macondo field when a blow-out caused a catastrophic explosion onboard. Eleven lives were lost and it was three months before the damaged well could finally be sealed off. For the first time, Baseline reports on the role Sonardyne's cutting-edge Wideband acoustic technology played in the unprecedented engineering challenge that took place 5,000 feet below the surface.

One year on...

News Feature

Deepwater Horizon

AWAY FROM THE constant scrutiny surrounding the direct effects of the oil spill, some of the most remarkable images recorded were of the huge fleet of vessels that were clustered around the site of the incident. Remotely Operated Vehicles (ROVs) working far below fed a constant stream of live video that provided the watching world with front-row access to the enormity of their task. For most people, however, these dramatic scenes failed to reveal the recent technical breakthroughs in subsea acoustics, without which would have made this scale of operation almost impossible to undertake.

Simultaneous Operations (SIMOPS)

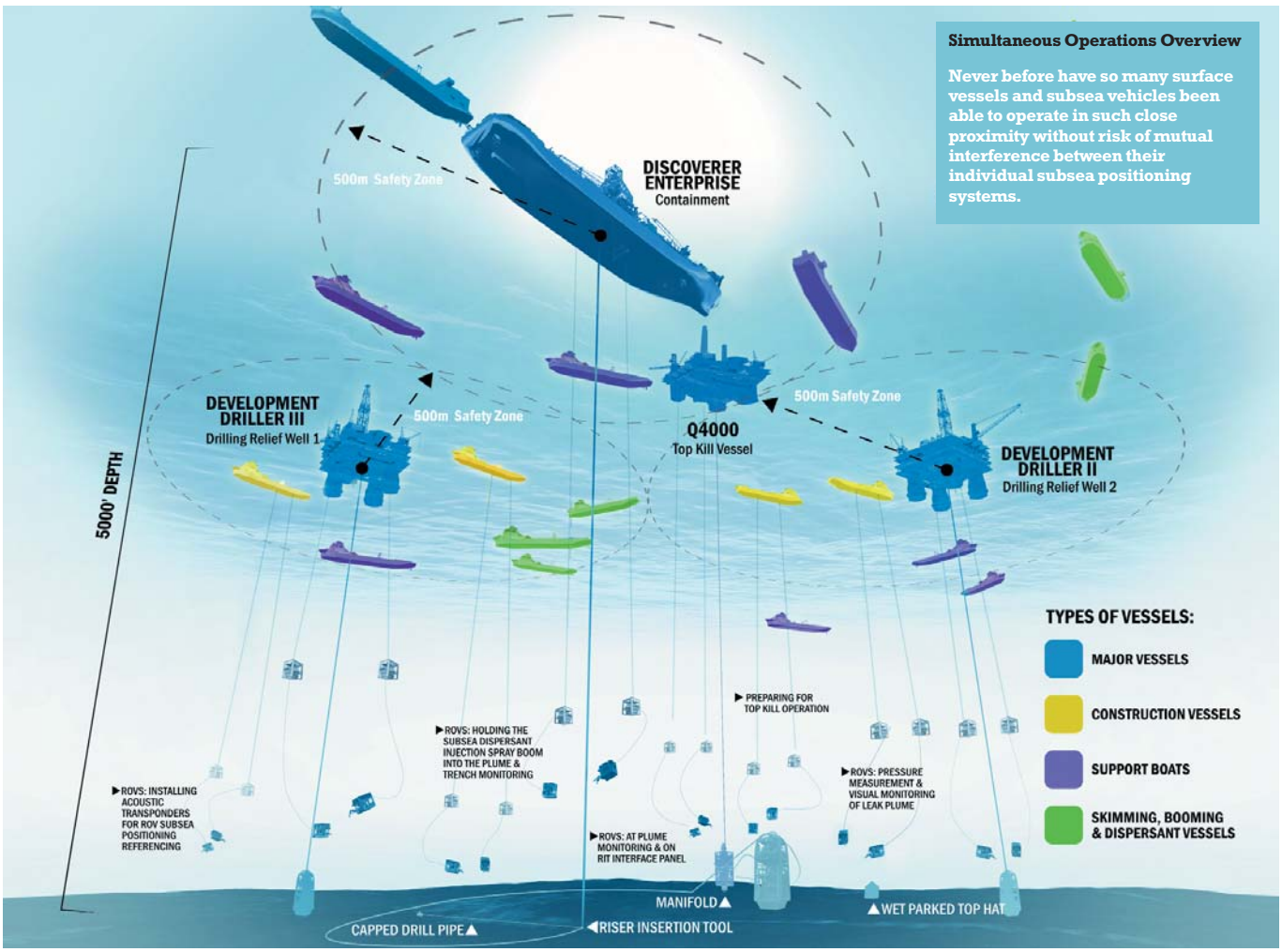
At the height of response effort, 19*principal vessels, some up to 250 metres in length, were stationed within a radius of 500 metres of the spill site. A mile down, the scene was just as crowded with 16* ROVs (27 at one point) collaborating side-by-side in almost zero visibility; some monitoring, some performing intervention procedures, some clearing debris. Never before have so many surface vessels and subsea vehicles been able to operate in such close proximity without risk of mutual interference between their individual subsea positioning systems. So how was it achieved?

Just a few years ago, the acoustic reference systems that enable a vessel to dynamically position itself or track an ROV whilst it goes about its work, were based entirely around analogue signal architectures.

These systems had a limited number of unique channels, or tones, on which to transmit and receive acoustic signals. In turn, this limited the number of vessels and subsea vehicles that could operate in the same area and at the same time leading to complex frequency management issues, poor vessel utilisation and operational delays. *(*Source: BP p.l.c.)*

Sonardyne Wideband

Taking inspiration from the technology revolution in mobile communications, Sonardyne invested heavily in the development of a proprietary Wideband (digital) signal capability that would lift the restrictions imposed when using analogue systems. In 2004, the first LBL acoustic positioning systems to utilise Sonardyne Wideband were introduced.



The new technology was designed for the real-time transfer of large quantities of relatively short data packets, commonly associated with subsea navigation. Compared to the older tone systems that offer a maximum of 14 discrete channels, Sonardyne Wideband systems offer hundreds of digital channels (over 800 with new Wideband 2) which could be operated alongside vessels still using tone.

Wideband became rapidly adopted throughout the offshore industry. It delivered the multi-user capability operators demanded, along with high precision measurements, robust data telemetry and faster, more efficient positioning operations.

At Macondo, deployment of Sonardyne Wideband acoustic positioning and telemetry solutions proved invaluable. With so many vessels in attendance at the scene, analogue frequencies were quickly allocated. Therefore the majority of the operations, including the containment vessel *Discoverer Enterprise*, the top kill vessel *Q4000*, the two Floating Production Storage and Offloading (FPSO) vessels *Helix Producer* and *Toisa Pisces*, as well as numerous support vessels, relied upon Sonardyne Wideband for the critical acoustic inputs into their dynamic and subsea positioning systems.

BOP monitoring

In addition to enabling the simultaneous positioning of so many vessels, Wideband transponders were deployed on the seabed to gather crucial environmental data from the damaged BOP stack and the surrounding area and send it up to the surface for analysis.

Sonardyne engineers supported Unified Area Command by modifying standard Compatt 5 transponders so that they could be connected to pressure sensors on the BOP stack, within just a few feet of the extremely noisy plume venting oil and gas into the Gulf. A total of 15 Compatt 5 transponders, recognisable by their distinctive yellow floatation collar, transmitted pressure data from critical points on and around the well at seven second cycles in Wideband telemetry mode to acoustic receivers fitted to ROVs operating from the *Enterprise*, *OI3* and *Q4000* vessels.

Despite the severe noise pollution from the ruptured wellhead (that can severely limit analogue acoustic performance), the Wideband transponders were able to reliably receive commands and transmit data to the surface via the ROVs. They are the first subsea acoustics to be proven in a blow-out scenario.

Sonardyne 6G

As a hurricane threatened to force the evacuation of the surface fleet, additional Sonardyne transponders were modified and deployed at the scene within 48 hours.

These were the latest Compatt 6 transponders and their task was to work alongside the installed Compatt 5 transponders and utilise their unique 'autonomous' operating mode (without surface control) to record the critical pressure data from the newly installed cap. Compatt 6 transponders have a built-in high resolution noise measurement capability which provides the option to monitor noise levels subsea without affecting other critical telemetry activities.

Measurements were taken at regular intervals, the data logged in the instruments and uploaded to the surface once the storm passed and the vessels had returned.

24-hour operational support

Throughout the incident response, Sonardyne engineers based at the company's headquarters in the UK and locally in Houston, provided 24-hour support and engineering assistance. This included ensuring the availability of a wide range of equipment, rapid mobilisation and installation of digital Wideband positioning systems on vessels heading to the scene, assistance with frequency planning to allow seamless operation of the vessel fleet and creating bespoke releases of firmware to enable seamless operation of different generations of transponder technologies.

Never to be repeated

On 19 September, the Macondo well was declared "effectively dead". In responding to, and successfully conquering the complex challenges of the Deepwater Horizon tragedy, major advances in capability across the industry have been developed. The use of new technologies that did not exist even a few years ago, made a significant contribution to the recovery effort and will continue to benefit future deepwater operations. Sonardyne Wideband acoustic technology has been proven for telemetry and multi-vessel positioning in the world's most extreme, and hopefully never to be repeated again, simultaneous operations environment. **BL**

Gulf monitoring system delivered in just six weeks

In the wake of Macondo, Government and Industry identified the need for an emergency containment system to be permanently on stand-by in the Gulf region to respond to any future incidents.

A consortium of major oil companies selected Trendsetter Engineering Inc., to design and build a subsea capping stack with the ability to shut-in oil flow or to flow the oil via flexible pipes and risers to surface vessels. As part of the containment solution, a Sonardyne data acquisition system was delivered in January 2011.

Mario Lugo, president of Trendsetter Engineering said, "The performance of Sonardyne's Wideband technology at Macondo was a key factor for its selection. The technology was shown to work reliably in areas of extreme subsea noise that previously could only be estimated. The functions of the new system are to monitor pressure and temperature sensors at different places on a 'high mass' containment system that would be placed over a damaged well to stop the flow. In the future, the Sonardyne system has the capability to control valve actuation."

Feature

Sonardyne's sixth generation technology platform

6G.

The new standard

In just twelve months since its market launch, Sonardyne's sixth generation (6G) technology platform has gained acceptance from its successful involvement on projects around the world. It has made an impact on diverse subsea operations from monitoring the containment cap on the Macondo blow-out in the Gulf of Mexico to a complete field development offshore Malaysia. Baseline examines how this enabling technology now provides robust performance, simple user operability, greater functionality, equipment flexibility and compatibility with aided inertial technologies. We talk to **Simon Partridge**, Engineering Director and **Richard Binks**, Offshore Business Development Director at Sonardyne.

Engineers preparing a Compatt 6 for deployment. The Wideband 2 technology inside it enables faster, more efficient solutions for applications such as spool piece metrology and subsea structure placement.

Feature

Sonardyne's sixth generation technology platform

"If we use the analogy of the Internet, where first we had dial-up connectivity, and then broadband and now super fast broadband," says Simon Partridge, "You can begin to understand what 6G is all about. Today we all expect to watch live TV on our computers, get instant access to online content and stream video seamlessly across multiple devices wherever we are. Likewise the subsea industry wants technologies and systems that deliver greater functionality, faster operations and, above all, reliable performance."

"We set the standard high with our digital Wideband 1 acoustic signal technology that moved the industry away from analogue tone systems five years ago," explains Richard Binks. "Wideband 1 improved ranging precision, provided more operating channels and changed the way many subsea projects were carried out. For example, shorter range, higher frequency equipment became redundant and multiple vessels could work in close proximity to each other without interference."

Wideband 1 delivered a reliable subsea equivalent of early internet broadband levels of performance; a sizeable achievement given the varied nature of the wireless subsea acoustic environment. However Sonardyne was driven by market demand for simpler systems that could deliver more. To meet these seemingly conflicting demands was the inspiration behind moving the technology on to Wideband 2. Achieving this would offer truly robust, digital-only, high bandwidth data communications infrastructure around which a new, more versatile family of integrated instruments and software could be created.

Sonardyne's vision for its sixth generation products would see users of different skill levels being able to mix and match acoustic techniques and offer optimised solutions for their applications.

Introducing 6G

For over three years, Sonardyne's development team worked behind the scenes on the prototype technology, assessing its capabilities both in the test tank and on a variety of challenging real world projects. "Performance gains soon began to appear," recalls Simon. "We discovered that we could test 6G in shallow and complex environments where expert users had previously been required to ensure robust operation. Offshore integration of new 6G USBL transceivers with our Lodestar ring laser AHRS system saw USBL accuracies close to what you might expect from LBL."

"When we set down the path towards 6G, we wanted to develop a family of products that would maximise operational efficiencies ...these goals have been realised"

6G Wideband 2 signals can carry much more data than Wideband 1, enabling integration and simplification of command and data gathering sequences. For LBL, this means faster baseline measurements; on one project a 67 percent time saving over the previous generation hardware was achieved.

In March 2010, Sonardyne was ready to go public; unveiling the new 6G equipment line-up to the offshore community gathered in London for the industry's premier trade show – Oceanology International. Sonardyne demonstrated 6G in Albert Dock by the Excel exhibition centre, a notoriously difficult place to demonstrate acoustics. Any industry cynics over 6G were soon silenced by the astonishingly successful results of both ranging and high speed telemetry. "We received our first purchase order for 6G on the opening morning of the show and within six weeks, a full field development off Malaysia was committed to using exclusive 6G equipment," points out Richard. "Even we were surprised that this level of acceptance happened so quickly. It can only serve as testimony to the exhaustive testing that had gone on prior to release and the fact that early 6G equipment was used to evaluate autonomous monitoring applications with an Oil Major over the previous few years." Active evaluation of 6G was carried out by contractors from early 2010, focusing in particular on how it could save vessel time. Although 6G was a completely new set of equipment it was already correctly perceived as low risk by contractors.

Easier, not harder

A key philosophy of 6G is that the new acoustic instruments can be operated more easily than ever before. Sonardyne's engineers have built the complexity into the hardware not the software which reduces the variables that a user has to configure. This lessens the need for highly experienced operators and in turn, reduces operational risk. All range observations can have a quality metric providing "much loved" quality control for critical operations in harsh environments.

Six of the best: Here is just a selection of Sonardyne's 6G comprehensive product range>>

Lodestar AHRS Subsea
High grade subsea aided INS with GPS, DVL, USBL, depth, SV and sparse LBL inputs. Li-ION battery and logging.

Compatt 6 Transponder
Long range, ultimate accuracy navigation transponder for LBL, USBL, data logging and high speed modem applications.

Lodestar Gyro Compatt 6
Compatt 6 and subsea Lodestar for wired or wireless aided INS metrology and structure positioning. Li-ION battery.

"Our customers are telling us that 6G 'just works,'" says Simon. "In a recent metrology project (page 24), surveyors onboard had time on their hands because they had budgeted several hours for a specific task, only for the 6G LBL hardware to get the job done in half the time it normally takes. Additionally there was no interference from the jacket despite the fact that two of the Compatt 6 transponders were in very close proximity to it." He adds, "If you multiply this time saving across a full metrology campaign you can start to see immense cost savings on vessel time."

Do more for longer, with less

Another cost efficiency from deploying 6G, is the fact that these intelligent modern instruments can be used for a variety of different applications and it's this versatility that reduces the cost of ownership.

"We encourage users to maximise the potential of the equipment," reveals Simon. "For example, with Compatt 6 you can utilise its precise LBL ranging ability one day, its high speed telemetry mode for recovering sensor data the following day, and as an autonomous tide gauge the next." Despite longer codes sending more energy into the water, power consumption, through intelligent power saving modes, has given longer battery life (up to six years of continuous operations) enabling 6G users to quite simply "do more for longer" which further reduces overall project costs.

One way Sonardyne is getting the message out about the capabilities of 6G is through its Survey Support Group (SSG). This team of experts have been on the road conducting technology workshops and providing high level advice and analysis for customers planning 6G deployments.

"Through case studies and simulation, the SSG demonstrates the way in which an oil company might approach the development of a field using 6G, highlighting the efficiency gains compared to how it would have been done just a few years ago," says Richard. "More robust signals mean more confidence in the direct ranges so fewer have to be taken. And because the instruments themselves are more capable, whereas as once you might have used four Compatts to measure a spool, the same can be achieved with one Compatt 6 and a GyroCompatt 6."

Backwards compatibility

Recognising the investment customers have in previous generation equipment, Sonardyne has ensured that there is compatibility between '5G' and 6G. New transceivers such as RovNav 6, Dunker 6 and HPT can be used to configure, calibrate and track Compatt 5 arrays and other fifth generation transponders," stresses Simon. "Currently over 90 percent of Compatt 5 configuration, calibration and tracking commands are supported with our '5G emulator' which works transparently within the 6G technology. 6G transceivers are also capable of working in LBL arrays mixed with Compatt 5s and Compatt 6s providing a gradual route and seamless transition onto the new platform." However, the full performance benefits of the new technology can only be gained with exclusively 6G operations.

Aided Inertial Navigation

The 6G story is not solely about better signal processing and more capable acoustic hardware. It encompasses integrated inertial navigation in the form of Sonardyne's proven Lodestar platform which has seen system capabilities enhanced in parallel with the development of Wideband 2.

Inertial navigation offers contrasting and complementary characteristics to acoustic positioning. Tightly integrating the two technologies into a single solution provides users with the best of both worlds; a continuous position output with no drift. "We can now offer acoustically aided INS tailored for DP reference (see page 04) or subsea vehicle tracking (see page 18). These systems deliver greater overall precision and accuracy than solely acoustics or inertial, very high update rates and more efficient operations," says Simon. "You can now push deeper with your USBL whilst maintaining precision with your aided INS. Sparse transponder arrays also now become a viable option."

6G operational worldwide

"When we set out down the path towards 6G, we wanted to develop a family of products that would maximise operational efficiencies and, at the same time, minimise vessel and project costs for our clients," reflects Richard. As readers will discover overleaf and throughout this issue of Baseline, these goals have been realised. 6G's capabilities, reliability and performance have brought tangible cost efficiencies and built expectation across the industry that a paradigm shift has happened. "Super fast 'subsea broadband' is here," he concludes. **BL**

This issue of Baseline is dedicated to Sonardyne 6G technology. Discover more about is benefits by reading these articles which showcase the new platform at work.

Autonomous Monitoring Transponder
Integrated sensors, data logger and high speed modem. Double battery pack provides six years of operation.

Lodestar Gyro USBL
Integrated USBL and Lodestar INS for rapid deployment on vessels. Ultimate accuracy and high speed telemetry.

RovNav 6
LBL transceiver, USBL responder and emergency transponder mode. Telemetry modem support. Li-ION battery for back deck testing.

6G® YEAR ONE

Gulf of Mexico

SIMOPS

At Macondo, deployment of 6G acoustic positioning solutions allowed surface vessels and subsea vehicles to operate in very close proximity.

Gulf of Mexico

Inertial DP reference

Sonardyne DP-INS installed as position reference resilient to acoustic disruptions and completely independent from GPS.

Gulf of Mexico

Remote well monitoring

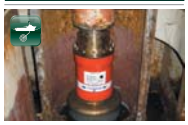
Compatts operating within feet of the Macondo well become the first subsea acoustics to be proven in a blow-out scenario.

North Sea

Pipeline bundle tow

Compatt 6s and Lodestars installed to monitor the position and status of pipeline bundles, relaying data acoustically to a nearby ROV support vessel.

Bay of Biscay



Long layback tracking

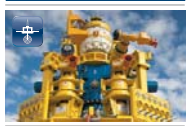
Deep water trials to demonstrate the extended operating range and positioning accuracy gains obtainable when using 6G USBL transceivers.

Gulf of Mexico

Riser monitoring

6G instruments monitor riser tower positions, depth, temperature, inclination and turret buoy position relative to the seabed.

Gulf of Mexico



BOP data acquisition

Trendsetter has selected a Wideband BOP data acquisition and telemetry solution for the Gulf's emergency well containment system.

Track Record

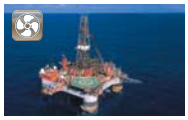
This global view demonstrates the positive impact Sonardyne's 6G acoustic and inertial technology has had in its first year of operational deployment. Results from the Gulf of Mexico, Brasil, South-East Asia and Europe echo a constant message; 6G has to be used, it has to be experienced to understand how good it is. Operations are faster and more efficient, equipment is simpler to use and you can do more with it. No matter how deep, how shallow or how complex the subsea environment, "6G just works."

South Atlantic

Current monitoring

Over the next two years, multiple Fetch instruments will be deployed across the Drake Passage to monitor changes in the Antarctic Circumpolar Current.

Brazil



Inertial DP reference

Extended trials confirm the reliability and precision of Sonardyne DP-INS as an independent reference in operating regions where GPS is unreliable.

Track Record

Where in the World is 6G?

Key to Industry Sectors

- Ocean Science
- Dynamic Positioning
- Drilling
- Construction Survey
- Pipeline
- Asset Management

Norway

Infrastructure surveys

AMT sensors deployed in deep water for six years. Data is logged autonomously and high speed telemetry allows near real-time data recovery.

Norway

Deep water construction

An optimised 6G USBL is capable of meeting many structure positioning requirements previously only achievable with LBL.

China

Civil engineering

Fusion 6G supplied for a shallow water project to precisely install subsea modules in a high multipath environment.

Ghana

Spool piece metrology

Fusion 6G delivered 67% time saving for baseline measurements during a metrology campaign. GyroCompatt was wet stored, saving further costs.

Angola

Spool piece metrology

Deep water (2,000m) metrology using a mixed array of Compatt 5s and Compatt 6s commanded by RovNav 6 transceivers.

Malaysia

USBL-aided subsea inertial navigation

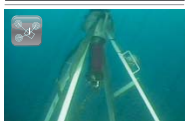
6G inertial technology enables USBL longer ranges to be achieved during a touchdown survey.

Malaysia

Field-wide positioning

Compatt 6s support the installation of all structures, flowlines and pipeline metrology with the highest accuracy independent of water depth.

Australia



Spool piece metrology

Despite difficult acoustic conditions, Fusion 6G collects and processes metrology data in less than 30 minutes, around half the time it normally takes.

Australia

As-left survey

AMTs configured as Compatt 6s to provide LBL positioning during multi-beam survey, locations of monuments and positioning for future trenching.

Pacific

Deep water tracking

The world's best known research submarine uses its multi-functional AvTrak instrument for deep water tracking and integrated modem functions.

Trials Report

Subsea INS

SPRINT: Subsea inertial navigation aids ROV positioning

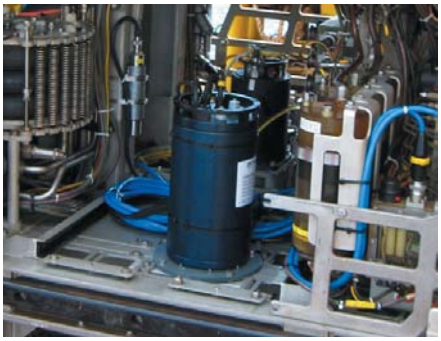
TOWARDS THE END of 2010, a Sonardyne SPRINT system (Subsea Precision Reference Inertial Navigation Technology) was mobilised onboard a pipelay vessel in South-East Asia. The trial was designed to evaluate the positioning performance attainable from SPRINT with the vessel's installed 'Brand-X' Ultra-Short BaseLine (USBL) system whilst tracking an ROV conducting touch-down monitoring operations. The vehicle would be working in less than 150 metres water depth and operating out to horizontal distances up to 1,000 metres.

This type of 'long layback' scenario can be problematic for USBL systems which are prone to increased positioning error or noise as the horizontal distance from the vessel increases. The precision and accuracy of the acoustics will generally be worse than positioning a target with the same slant range directly below the vessel. Sonardyne was therefore keen to show the improvements SPRINT, aided by acoustics, would bring to the subsea operations.

Lodestar INS

The core of SPRINT is Sonardyne's Lodestar platform introduced in 2007 as a premium quality Attitude Heading Reference System (AHRS). Using the same proven hardware platform, inertial navigation is now available for both surface vessel (see page 04) and subsea vehicle applications.

On its own, inertial navigation is



(Bottom left) The core of the system is the Lodestar platform. The unit is depth rated up to 5,000 metres and has an in-built battery backup that can maintain its inertial and AHRS algorithms for up to two hours if external power is lost. (Below) In this project, SPRINT enabled longer range touchdown monitoring.

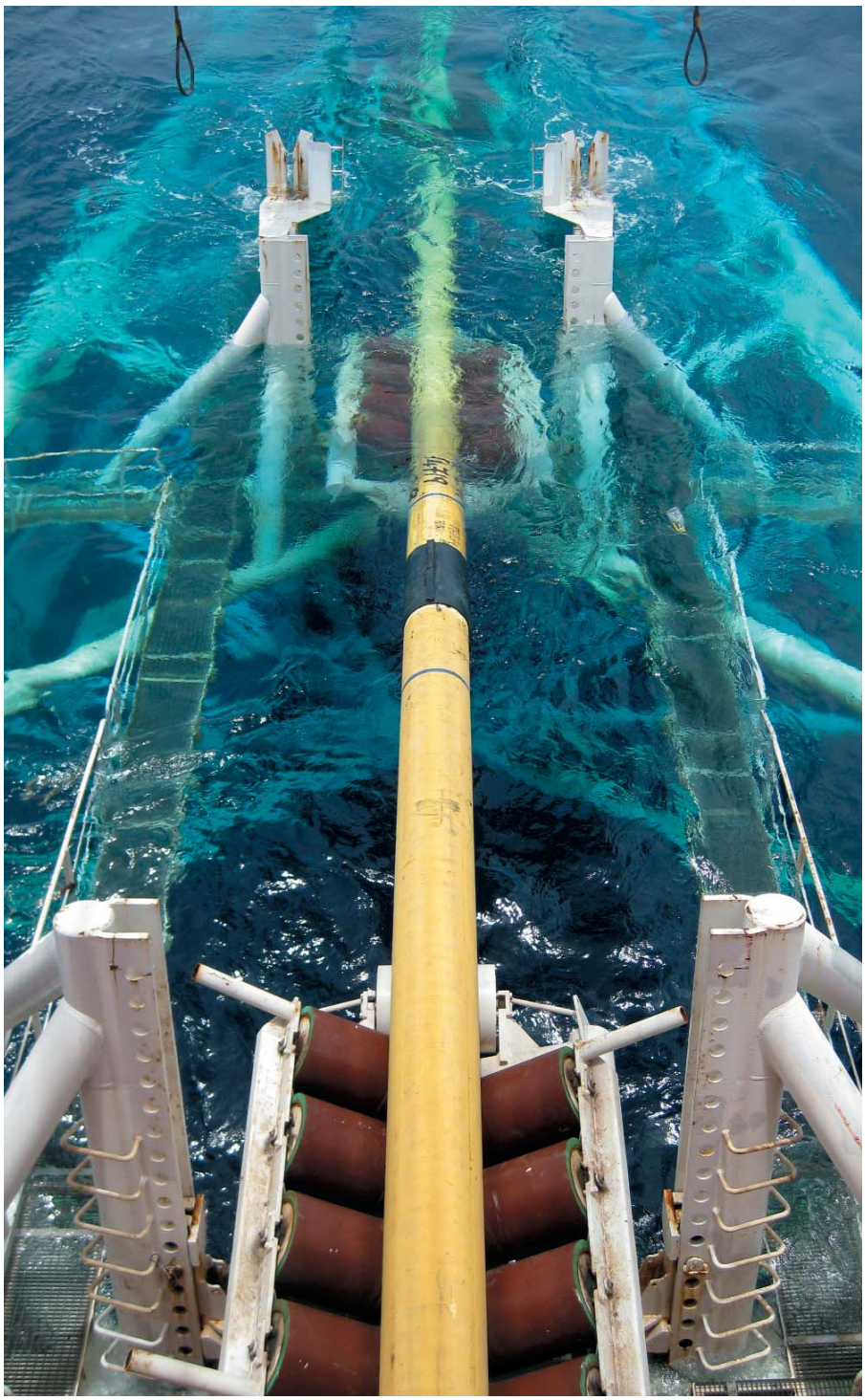


Figure 1: INS and USBL position fixes with ROV static

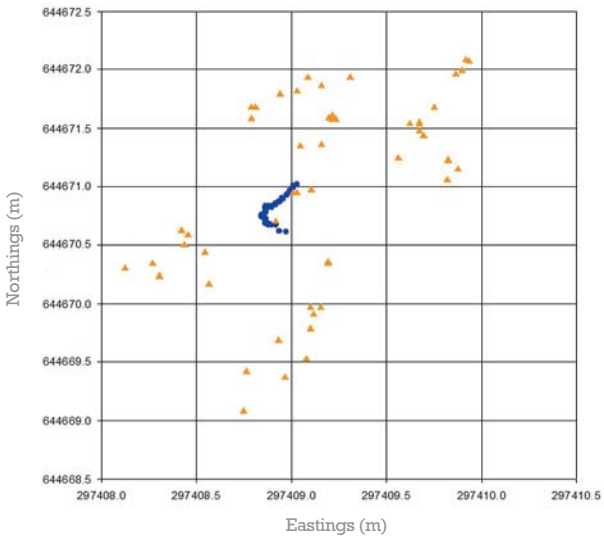
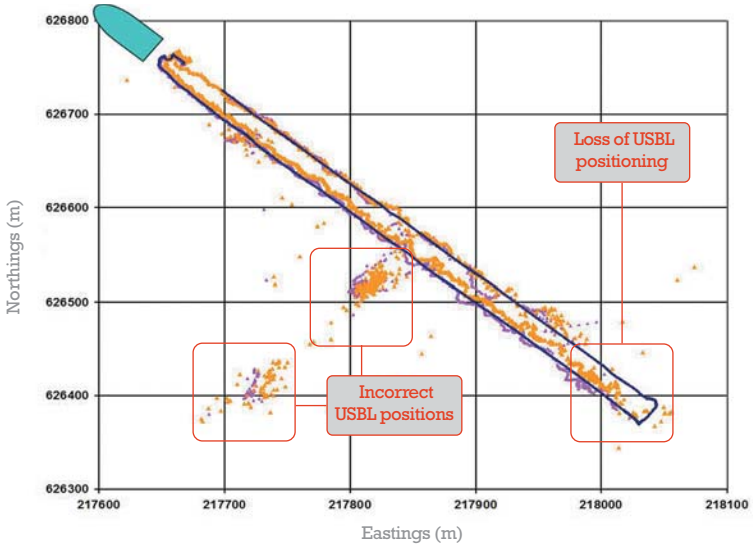


Figure 2: INS and USBL position fixes with ROV following pipeline



Key: ● **SONARDYNE SPRINT INS** ▲ **'BRAND-X' USBL**

completely self-contained and inherently robust. It provides continuous output with very good short-term accuracy but drift in the longer term. In contrast, acoustic positioning systems have higher position noise and a risk of potential drop-outs but provide excellent long-term stability. Blending these characteristics into a single, tightly integrated solution improves position accuracy, precision and integrity in any water depth while reducing operational time and vessel costs.

For ROV applications, SPRINT uses additional vehicle-mounted aiding sensors such as Doppler Velocity Log (DVL) and pressure/ depth sensors which help maintain a reliable navigation output even if acoustic aiding is interrupted. Similarly, the unit has an in-built battery backup that can sustain operations for up to two hours if external power is lost. This ensures that SPRINT can maintain its inertial and AHRS algorithms during intermittent power loss and will therefore require no re-initialisation or delay before navigation can resume when power is restored.

SPRINT does not need to be physically integrated with the DVL and this allows for more flexible mounting configurations. A user only needs to know any offsets or misalignments between the two instruments to the level they can reasonably measure once they have both been installed on the vehicle in an operating environment. If optimal DVL-aiding is required the 'fine' offsets and misalignments can be calculated in the field during a short calibration routine and Sonardyne's post-processing software.

To optimise performance, the vehicle-mounted sensors are plugged directly into the Lodestar unit minimising the effects of communications latency. Shared feeds from existing fit sensors are also supported.

Performance Analysis

With the Lodestar unit installed, the ROV was deployed and a number of static fixes were undertaken by both the USBL and INS while the vehicle was stationary on the seabed. Figure 1 shows the positions recorded over one minute while the horizontal distance between the ROV and the USBL transceiver was approximately 400 metres. A significant reduction in scatter is noticeable for the INS positions, shown in blue, compared with USBL in orange.

Other static fixes were recorded with the ROV at various distances from the vessel. Overall SPRINT provided seven times improvement in scatter/ precision over the raw USBL positioning and five times improvement in scatter/precision over the USBL positioning with survey software outlier rejection.

SPRINT's performance is further emphasised in Figure 2. Here, the ROV was running a generally straight south easterly track away from the vessel and in parallel with the pipeline in 130 metres water depth out to distance of up to 1,000 metres behind the vessel. In this case, the range was significantly greater than in typical operations and was actually beyond the range of the USBL system. At 1,000 metre layback, the ROV flew back over the top of the pipe and returned to the vessel.

The INS positions (blue) can be seen to follow the actual ROV dynamics much more closely than the USBL (orange) positions. The USBL positions also appear to become less precise as the ROV travelled further away from the vessel, with large position errors recorded. At maximum distance the Lodestar was no longer receiving or using USBL position updates but continuing to use only onboard sensors such as DVL and pressure/ depth sensors. The tightly coupled INS solution provided a fast (up to 100 times a second) continuous and precise output of the ROV position throughout its journey.

Conclusions

SPRINT provides significant advantages and cost savings for subsea vehicle positioning. Although the technology was specifically designed to optimise Sonardyne's acoustic positioning systems, field results have proven how effective it can be when interfaced with other subsea vehicle sensors. Its compatibility with other manufacturers' acoustic systems, makes it the most flexible option available today.

SPRINT's integrated solution offers considerable improvements to positioning reliability when compared with solely acoustic methods and in this particular project, enabled longer range touchdown monitoring. Extending the ROV (and vessel) operating window when pure USBL becomes marginal (i.e. if sea state, depth or range increases) is yet another advantage.

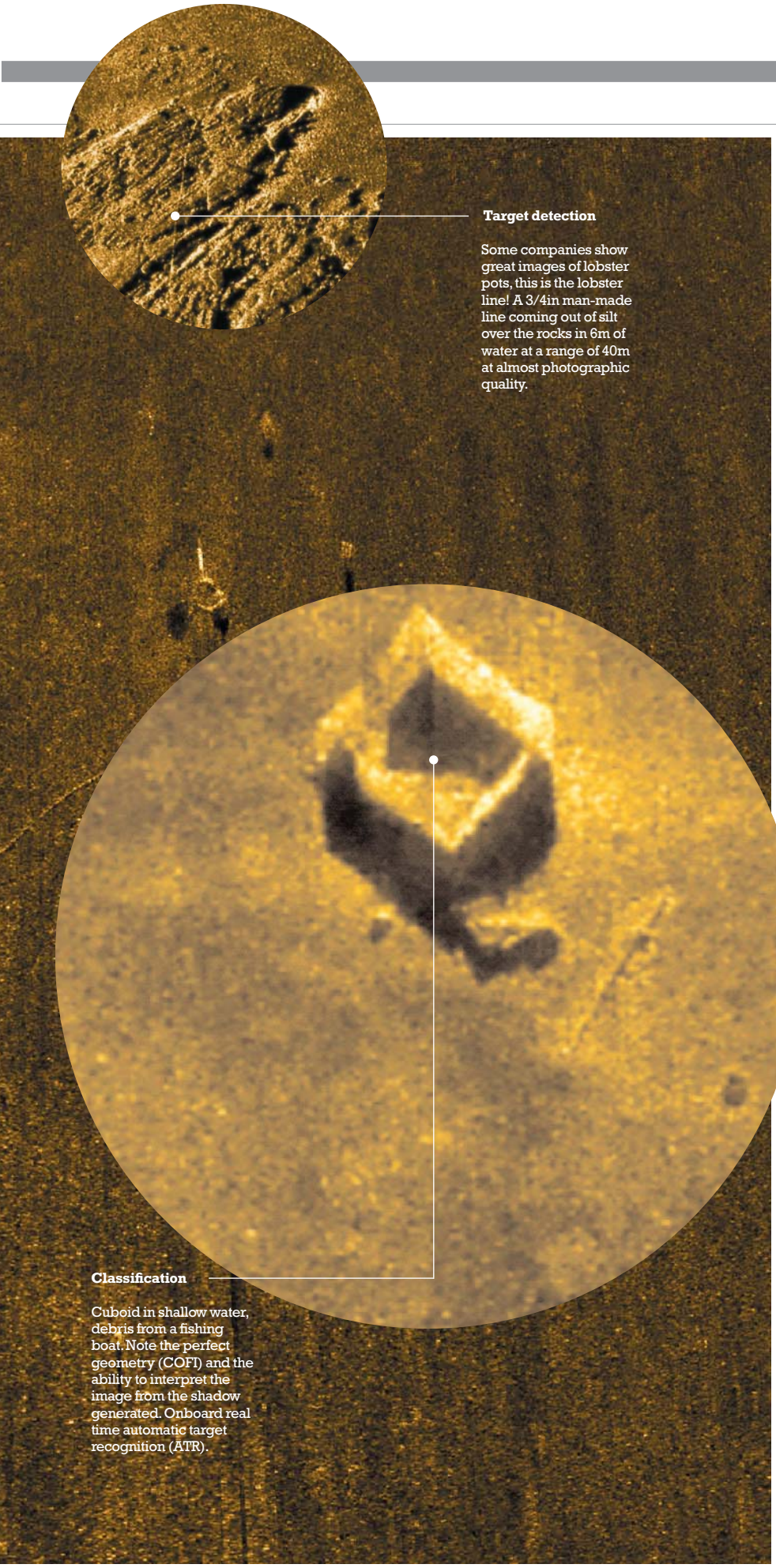
Technology

Solstice sidescan sonar

Fantastic shadow classification

This staggering image was obtained in a single pass with no third party processing (i.e. raw data in real time on the vehicle) in just 3-7m of water. The array was suspended 1m below the surface demonstrating the VSW capability with >10xWD and fantastic shadow classification.

Pixel perfect imaging



Target detection

Some companies show great images of lobster pots, this is the lobster line! A 3/4in man-made line coming out of silt over the rocks in 6m of water at a range of 40m at almost photographic quality.

Classification

Cuboid in shallow water, debris from a fishing boat. Note the perfect geometry (COFI) and the ability to interpret the image from the shadow generated. Onboard real time automatic target recognition (ATR).

As autonomous underwater vehicles (AUVs) are more routinely deployed for military, maritime security, oceanographic research, mapping, environmental monitoring and other underwater surveying applications, the sonar technologies that they are equipped with have yet to be fully optimised. Reporting for Baseline, **Rob Balloch** writes how Solstice, Sonardyne's new generation of search and classify sidescan sonar with integrated swath bathymetry, has been developed without compromise for AUV deployment.

CONSIDERABLE MARKET RESEARCH has revealed that users not only want a system that will match the resolution and performance of a Synthetic Aperture Sonar (SAS) system, but also has the operational benefits and costs associated with conventional sidescan. Additionally, it should be ultra-low power to increase the operational capability of the host platform and modular, enabling the system to be optimised for any platforms, large or small. Equally important is the ability of the system to be operable by a broad range of users, providing new capability for applications as diverse as habitat monitoring and bottom change detection in port security scenarios.

To understand Solstice you first have to put aside any preconceived ideas you ever had about sidescan. Sonardyne has created a seabed imaging tool that has transitioned some of the juicy bits from SAS technology such as auto-calibration and back-projection imaging into a new design that rivals the SAS system for reliable and robust imagery (it can

Technology

Solstice sidescan sonar

go round corners and provide shadow classification even in the very shallow water domain) but can be operated as simply and cost effectively as a conventional sidescan; we call this 'near-SAS'.

The key to an AUV's performance is power; a large proportion of the expensive AUV's currently operating use sidescans that cost less than $30,000 – why? – they operate at low power but with lower range and resolution than required. Any attempts at operations with higher technical specifications results in dramatically reduced operational capability as the power budget goes up.

That's why we describe Solstice as a 'game changer', not only does it provide class leading imagery over a wide swath with nothing short of incredible shadow resolution in shallow waters, it does so without the need for an expensive and restrictive INS (auto calibrating) and it produces images in real-time on the vehicle (automatic target recognition) with imagery that is perfect, free from distortion and data gaps – all this with a power budget of 10W, that's 10W for both arrays and the bathymetry operating simultaneously.

To put this into context, if you fitted Solstice to your vehicle, by doing nothing else to your AUV, you can increase its operational efficiency by 200-400 percent.

"If you fitted Solstice to your vehicle, by doing nothing else to your AUV, you can increase its operational efficiency by 200–400 percent."

Unique Features

Solstice has a number of unique capabilities. The dominant source of noise for all sidescan sonars operating in shallow waters is 'multi-path' reverberation. The nature of this noise means many acoustic pathways scattering from spatially unrelated regions of the underwater scene may nonetheless return to the sensor with identical flight-times leading to an inevitable loss of contrast. The ability to successfully classify an underwater target is a complicated function of resolution, signal-to-noise ratio and contrast.

The ability to infer shape from acoustic shadows cast by objects which are 'proud' of the seafloor is a particularly powerful classification tool. It follows that the degree to which you are able to correctly classify objects into threat/non-threat classes will largely be determined by the ability to deliver high levels of shadow contrast throughout the range scale.

Multipath Suppression Array Technology (MSAT) is a physical array-based technology that enables high shadow contrast to the maximum range of the sensor whilst maintaining high quality imagery at close quarters. Traditionally users would have had to choose between wide elevation beamwidths, allowing for broad coverage and the shadow contrast associated with very narrow beams. With MSAT, Solstice can provide object detection and classification at ranges greater than 10x water depth in the very shallow water domain.

All high frequency sidescan sonars attempt to image in their near field region. Another way of stating this is to say some degree of focusing is required to deliver the theoretically possible resolution. Solstice provides the ultimate in high fidelity dynamic focus by providing unique pixel based imaging on a 1in by 1in grid draped over the entire sea floor falling within the sensor field of view. The real-time onboard processor is capable of addressing 3.1Mpixels per second. This class-leading ability to fine-focus has two major impacts. Throughout the range swath, Solstice delivers diffraction limited resolution performance, i.e. the image will maintain the

highest resolution theoretically achievable at that position in space relative to the sensor. At short ranges the sonar is capable of providing resolution equivalent to that of a commercially available SAS system. At longer ranges where the spatial sampling rate significantly exceeds the resolution (the so-called 'super-Nyquist sampling' condition) the interpolated real-time imagery is significantly better than that of a conventional sidescan and dramatically aids human visual perception of the target geometry and hence aids classification.

Another first for a sidescan sonar system, conventional sensors use fixed processing schemes that compromise final imagery quality by ignoring content. Solstice uses a new proprietary approach that subtly varies the detail of the signal processing at every individual pixel in the image to optimise classification performance. Classification Optimised Focused Imaging (COFI) enables Solstice to calculate in real time all the pixels it needs to focus on to provide a complete frame, guaranteeing complete coverage of a scene.

Traditional systems are unable to guarantee 100 percent full bottom coverage due to their inability to compensate from intra-frame motion such as rolling, pitching and yawing motion of the AUV. Conventional images are also distorted by non-linear AUV trajectories, bias angles, bathymetry and sound speed changes especially at long ranges where these geometric distortions can render a target unrecognisable even with high resolution and contrast. Solstice's unique micro mosaicing algorithm stitches the 'tiles' together in such a way as to guarantee minimum

"Solstice can operate without the need for an expensive motion correction system, reducing power requirement, risk weight and cost."

distortion. What the end-user gets is imagery that is not distorted by platform motion and has high resolution, high contrast and minimum geometric distortion.

A single module Solstice array is only 670mm long but is made up of 32 individual elements, the relatively high operating frequency of 750khz means that the array is well over 300 wavelengths in extent. Therefore the array is acoustically 'long' and presents a challenge to ensuring mechanical linearity at the length scale of a fraction of a wavelength.

Solstice's next generation processing algorithms are designed to produce class leading imagery, for these to be efficient they depend on a high degree of acoustic linearity. In order to ensure such linearity from a purely mechanical design would render the array unattractively massive and impractical for the small vehicle market, real time auto-calibration (RTAC) is an onboard 'smart' that dynamically re-phases each individual hydrophone element seven times a second to compensate for any dynamical strains causing array non-linearity and provides better clarity. The practical advantage of this is that Solstice can operate without the need for an expensive motion correction system, reducing power requirement, risk, weight and cost.

Advanced imaging technology

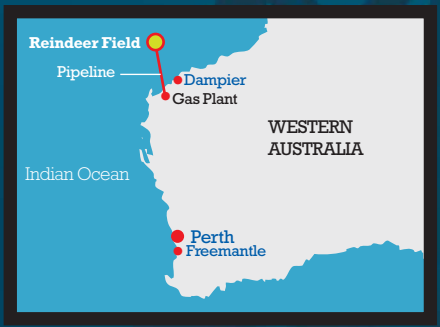
In Solstice, Sonardyne has produced a cost effective sensor that delivers class leading imagery across a vast range of AUV platforms and is suitable for a broad range of industries and applications. Its advanced imaging technology, extraordinarily low power consumption, simple mechanical integration and ability to overlay integrated bathymetry dramatically enhances the capabilities of small, medium and large AUVs. With its first customer deliverable this spring, the future of AUV sidescan is already here. **BL**

(Top) Solstice undergoing rail trials at Sonardyne's test facility in Plymouth, South-West UK.

Case Study

Devil Creek

The DCDP lies 40km south-west of Dampier. First gas from the field is scheduled for late 2011.



Fusion 6G exceeds metrolog

WORKING ON THE metrology phase of the Devil Creek Development Project and the associated Reindeer Gas Field off North-West Australia, survey teams from SapuraAcergy and TL Geohydrographics found to their pleasant surprise that they had time on their hands when they deployed a Sonardyne Fusion 6G positioning system.

The surveyors had budgeted for several hours' work in order to conduct spool piece metrology at a location where the 60 metre water depth and close proximity to existing subsea infrastructure was expected to contribute to a difficult acoustic environment.

Long BaseLine (LBL) observations were needed from Compatt 6 transponders that had been deployed around the site which would also allow for the collection of redundant measurements and would increase the ability to apply quality control checks and ultimately reduce the risk of the spool not fitting at all. Two of the transponders were close to the jacket, significantly increasing the chances of multipath acoustic interference during the data collection process. Therefore the teams had allowed themselves the time they thought they might need to overcome these potential difficulties.

Acoustic Metrology

Survey companies developed the techniques for conducting acoustic metrology in the 1980s as a cost-effective alternative to taut wire metrology; a technique at the time that utilised divers to take the measurements. The accuracies offered by the acoustic measurements met and often surpassed the ranging accuracies achievable by the taut wire observations and the deployment and recovery of equipment by ROV removed the requirement for divers. This meant that metrology could be completed from a vessel with a considerably lower day rate than a Dive Support Vessel.

In addition, the use of an acoustic metrology transponder array also allowed for collection of redundant measurements. This increased the ability to apply quality controls checks and ultimately reduced the risk of the spool or jumper not fitting at all.

Sonardyne Wideband and 6G

In recent years, survey companies worldwide have enjoyed the operational and economic benefits of Sonardyne's original Wideband signal technology when obtaining the measurements required in order to fabricate spools and jumpers.

The industry's hunger for yet more efficiency during these operations and the increasing trend for metrology campaigns in shallow water and inhospitable acoustic environments presented further technical challenges which have now been addressed

Subsea metrology illustration courtesy of : www.constructivemedia.com.au

In order to fabricate a connector to fit exactly between the hubs on the manifolds and pipeline ends, highly accurate measurements are required between the connecting hubs on the subsea structures. The method of collecting these measurements is called 'Metrology'.

y expectations at Devil Creek

with the introduction in 2010 of Sonardyne's Wideband 2 technology and associated 6G (Sixth Generation) hardware.

Wideband 2 products utilise ultra-wide bandwidth, digital-only acoustic signals that

> "Considering the difficult acoustic environment...6G was noticeably better than on past projects in similar conditions with previous generation hardware."

now make it possible to obtain significantly improved ranging and telemetry performance. As the SapuraAcergy and TL Geohydrographics surveyors would subsequently discover, this makes Sonardyne's LBL system faster and easier to set up and operate, and more robust, even in the most challenging subsea operating environments. These features all contribute to improving the efficiency of field development projects, reducing vessel time and generating cost savings for owners.

630 baselines in under an hour

At Devil Creek, the surveyors' experience of using Fusion 6G was so problem-free that they had finished collecting and processing the required data for the metrology calculations in less than 30 minutes, around half the time it normally takes. Finding themselves with time to spare, they completed another metrology session, again in just 30 minutes, as a confidence check and to provide themselves with some redundant data.

The baseline data was then processed together with the inclinometer and depth data, and the final metrology report was submitted in just six hours of the operation commencing. Remarking on the success of the campaign, senior project engineer for SapuraAcergy, Jeremy Cohen said, ''The performance of the 6G LBL equipment was excellent. A total of 630 baselines were observed and adjusted within the Compatt array in less than an hour.

''Considering the difficult acoustic environment due to other subsea operations nearby and transponders being attached just one metre from the jacket legs, it was very impressive. 6G was noticeably better than on past projects in similar conditions with previous generation hardware.''

Fusion 6G LBL offers metrology surveyors the following benefits:

- Simpler and more intuitive system operation
- Faster and more robust acoustic performance
- Greater precision
- Mitigates effects of multipath
- Greater immunity to noise
- Built-in range quality control metrics

Technology

Autonomous data acquisition

Wireless autonomy: Go

Shaun Dunn, Engineering Business Development Manager specialises in acoustic modem technology.

‘Fetch’ your subsea data

The world’s appetite for personal electronics and mobile devices has driven the development of ever smaller, lower power and higher speed digital signal processors (DSPs). Modern DSPs have been fully embraced by subsea instrumentation manufacturers due to their outstanding energy efficiency and have rapidly become a key enabling technology in the offshore energy and oceanographic sectors writes Shaun Dunn, Engineering Business Development Manager at Sonardyne.

Technology

Autonomous data acquisition

(Above) Fetch is packaged in a spherical pressure housing made from highly pressure tolerant and corrosion-proof glass. It has sufficient battery endurance for deployments of up to five years. (Below) Recent science cruises provided NOC scientists with their first opportunity to carry out tests on Fetch.

Until very recently, subsea sensor systems relied exclusively on marine cables to provide communications and power to each instrument. Despite the fact that subsea cables are notoriously expensive to install and highly vulnerable to damage, there was no viable wireless alternative that could be relied upon to deliver error-free data to the surface in a timely manner.

Today, the story is very different. Innovations such as Sonardyne's 6G technology (page 12) mean that wireless subsea instruments are rapidly becoming mainstream items due to their versatility and cost effectiveness for sensor data acquisition and long term monitoring roles. They offer high precision, accuracy and long term repeatability; important considerations as many physical phenomena in the subsea world are tiny in magnitude, slow to change and require a good deal of patience from those who require access to the data.

The fundamental component of these systems is the seabed deployed acoustic transponder. A unit such as Compatt 6 is a small, highly reliable and extremely low power instrument capable of precisely measuring ranges to neighbouring units, acquiring and logging a variety of sensor data and then transmitting it on command to the surface.

The DSP in each transponder is tightly coupled to all electronic sub-systems. It deals with every aspect of the instrument's operation from controlling efficient usage of battery power, interfacing with internal and external sensors and perhaps most importantly, supporting integrated wireless communications without requiring a separate external acoustic modem to provide this vital function

Versatile and cost effective

It is this tight integration between power management, sensors, acoustic systems and instrument mechanics that makes Sonardyne's latest 6G transponders extremely versatile, reliable and energy efficient.

From an acoustics perspective however, the subsea environment is fickle, with problems such as high levels of ambient noise, acoustic refraction due to non-constant sound velocities and hard surfaces causing acoustic reflections (multipath propagation). So our acoustic specialists have focused their attention towards determining the best signalling schemes, frequencies and transducer configurations to suit robust communications in a very wide variety of acoustic environments.

Sonardyne Wideband 2

Our latest generation of Wideband communications schemes support data rates as high as 10,000 bits per second for use when the environment is relatively benign, reducing in discrete intervals to 100 bits per second for the most complex of acoustic conditions. This flexibility ensures communication is achieved at the highest rate possible for any given environment whilst still maintaining error-free data transmission.

Autonomous Monitoring

We have developed our core transponder technology to provide a number of new wireless instruments that can function for many years without user intervention and are designed to meet our clients' specific subsea measurement needs.

The Autonomous Monitoring Transponder (AMT) operates as a network making hundreds

of thousands of measurements from a variety of sensors, it logs data securely and, on command, transmits it wirelessly to the surface error-free and in an energy efficient manner.

The AMT's unique autonomous operating mode enables it to 'wake up' at pre-programmed intervals and acoustically interrogate neighbouring AMTs and precisely measure the distances (ranges) to them. These ranges, along with precise pressure (depth), temperature, inclination and sound velocity are stored to the AMT's internal memory ready for acoustic extraction by a passing surface vessel. The resulting data can be used to detect any deformation of the seafloor or subsea structure with remarkable precision.

Fetch Your Data

To substantially reduce costs, by eliminating the need for ROVs and large deployment vessels, Sonardyne has now developed 'Fetch'; a lightweight autonomous sensor node whose primary role is to measure pressure at the seabed very accurately. This data can be used to monitor seabed deformation, determine mean sea levels and detect Tsunami waves.

Fetch is packaged in a spherical pressure housing made from highly pressure tolerant and corrosion-proof glass. It has sufficient battery endurance for deployments of up to five years depending on measurement type and frequency. Encased in a plastic hard hat it is connected to a small disposable tripod via a bespoke acoustic release mechanism.

Its glass sphere contains similar autonomous sensor measurement and wireless acoustic control systems as an AMT but at only 1.2 metres tall when deployed, it is not designed to support acoustic range measurement to neighbouring instruments. Instead, Fetch relies solely upon precise pressure measurement to monitor for changes to depth and is therefore an appropriate instrument for wider area coverage with reduced resolution compared to the AMT.

Fetch starts life negatively buoyant and is literally dropped off the back off the surface vessel by a small crane or davit. Careful control of its centres of gravity and buoyancy means that it freefalls gracefully to the seabed at around one metre per second and always lands feet first with its transducer pointing up.

The position of the instrument can be tracked acoustically from the surface during the descent to allow the effects of prevailing currents on final landing position to be compensated for. With practice, Fetch can be repeatedly deployed to significant depths within a 50 metre radius of a desired location.

When Fetch's mission is complete, an acoustic signal is transmitted to actuate the release mechanism which separates the housing from the tripod so it can float back to the surface for collection.

Data Harvesting

Acoustic to satellite communications 'gateways' can be fixed to a convenient surface platform or a permanently deployed buoy and mooring, and can be used to upload the data to the surface for onward transmission.

Often, however, instrument networks are spread out over considerable distances and the acoustic ranges involved are too great for reliable data transmission to a single surface gateway. Acoustic 'hopping' of data across a network provides a degree of improved range performance but at the cost of substantially increased system complexity. Therefore, moored gateways tend to be used only in conjunction with single or small numbers of closely packed seabed instruments.

Data harvesting in large area networks is currently undertaken using a surface vessel fitted with an acoustic transceiver which makes periodic visits to each instrument in turn. Upload costs can be substantial if the instrument network is large, a long way offshore, and the analysts require regular access to the most recent data.

It is clear that a method of harvesting data without requiring operator intervention has obvious merits, especially if such data simply arrives at analysts' computers with short latency and without them needing to leave the office.

Sonardyne is evaluating the use of mobile gateways that can be programmed to navigate endlessly around a network of subsea instruments, autonomously harvesting their data and forwarding it for analysis. These mobile gateways will be extremely cost effective compared to using surface vessels for data harvesting and we consider them a firm future component of wireless autonomy. **BL**

Fetch passes first NOC tests

NOC scientists were keen to get their hands on Fetch at its launch at Oceonology 2010

Recent science cruises on the Woods Hole vessel *Atlantis* and the NERC vessel *Discovery*, provided scientists from the National Oceanography Centre (NOC) in Liverpool with their first opportunity to carry out tests on their newly acquired Fetch instruments.

The tests were conducted to increase familiarity with the instrument and assess its potential for integration in NOC's Ocean Observatory science

> "Our next step is to do a short term full deployment of Fetch on one of our future cruises."

programs. Dr Stephen Mack from NOC reported, "Fetch was lowered to a depth of around 1,000 metres and a number of tests were carried out including status reports, data logging, ranging and data transfer using Fetch's high speed telemetry. Tests were also conducted on the release mechanism using a 'test disc' to simulate release at depth from the ballast weight."

He added, "These tests produced very good results and all operations were thoroughly examined. Our next step is to do a short term full deployment of Fetch on one of our future cruises."

International

News from around the World







SE Asia – Singapore
Nick Smedley
Senior Vice President

Sonardyne Asia has had a busy year. I have taken over general management leaving Bob Coutts to concentrate solely on sales. He is supported by Anthony Gleeson and Daniel Tan and we shall soon increase our sales team to support expanding market demand. James Hope, previously on secondment from the UK, has permanently joined us and is responsible for technical support and training.

6G Showcase
At the end of 2010, we showcased our 6G solutions at the region's major exhibition – OSEA. This was followed up with a well-attended series of customer workshops and seminars in Singapore, Malaysia and Australia. In 2011, interest in 6G equipment continues to build with 6G LBL, Ranger 2, Marksman and Lodestar all actively operating in the region.

Security
Growth in maritime security is strong with Sentinel IDS, a well proven surveillance tool throughout the region. With additional systems to be announced over the coming months, we are well positioned as a major player in this field. We look forward to an equally busy and exciting year to come.

USA – Houston
Simon Reeves
Senior Vice President

Now that the first drilling permits have been issued since Macondo, we expect to see activity in the region back on track in 2011. Sonardynes' Houston office provided support during the oil spill response and we have subsequently supplied an acoustic control system to Trendsetter for the emergency well containment system that will be on standby here in the Gulf.

The past year has also seen an increase in other areas of the business, including riser and pipeline monitoring and in IRM (Inspection, Repair and Maintenance). We have also increased our visibility into the oceanographic research organisations and expect some promising orders in the future.

Other growth
Richard Dentzman has just joined us as Sales Manager for Maritime Security USA. Significant growth in the area of port security is expected over the next few years.

Another important area of Sonardyne's business will be Life of Field development. We are working closely with the industry to communicate the technological advances we have made with 6G.

UK – Aberdeen
Barry Cairns
Regional Sales Manager

6G on tour
The team has been on the road in the last few months with 6G workshops being held in France, the Netherlands, Germany, Norway, Italy and the UK. By demonstrating the commercial benefits of the new platform, customers are realising that now is the time to switch to 6G. More workshops are planned for 2011; dates and topics will be announced on our website.

Rental sales
In January, GSE Rentals became the first rental company to invest in Ranger 2 whilst DPS have just purchased subsea Lodestars. The units will be deployed with Subsea 7 to provide attitude and heading reference data (sent via Compatt 6s) as pipeline bundles are towed out to North Sea fields.

Deployment of Sonardyne's solutions has expanded beyond oil and gas. DeBeers are now using AvTrak 6 instruments for AUV operations during diamond mining on the seabed.

Sales team
Simon Goldsworthy (based in Blackbushe) is now part of the European sales team working alongside myself and Alan McDonald here in Aberdeen. We look forward to a successful year.

Brazil – Macaé
Richard Binks
Offshore Business Director

The past year has been a period of change and rapid development in Brasil, both for Sonardyne and the offshore market. We have added four new people to our team of nine and are opening a new facility in Rio das Ostras (page 5).

Order highlights
Greatship vessels Rohini and Rashi have arrived in Brasil on contract for Fugro, with a Lodestar optimised Ranger 2 USBL system. A Marksman LUSBL system has been installed aboard the Aban Abraham drilling rig which also boasts a new modular acoustic BOP control system that is interfaced within a DTC subsea electronics module. New customer Georadar, is starting work with a new vessel running a Ranger 2 system and we have had astonishing results with our DP-INS product (page 04).

Training Manager Paul Smith has given extensive training on existing systems, and in September we ran workshops in Macaé and Rio on how 6G and inertial systems can save vessel time. With the expansion into our new Brasilian base, we shall develop more training courses and services including recalibration of instruments.

Help & Advice

Your questions answered

Ask Darren²

Darren Taylor and **Darren Murphy** are the front line of Sonardyne's customer support team. If you have a question, they have the answer.

Contact **support@sonardyne.com** with all your non-urgent technical questions for a fast response from the two Darrens. For emergency assistance offshore, please contact Sonardyne's 24hr helpline: **+44 (0)1252 877600**

Q Using Terminal, how do I configure my surface Lodestar AHRS to accept GPS and verify that it is being successfully decoded? With respect to the CRP of the vessel; our antenna is located as follows: forward -5.5m, starboard +2.35m, down -12.15m. Lodestar is located as follows: forward -17m, starboard, +0.5m, down -6.2m. I have allocated the RSXXX_2 port for GPS because RSXXX_1 is being used by Lodestar to output to other systems.

A There's a few steps involved. Start by connecting Port 2 on Lodestar to your GPS using the cable supplied (type 8084-050). It will need to be wired for RS485 – the manual details how to do this.

Next, input the Lodestar and GPS lever arm offsets by sending the following commands to Lodestar. LA 1 is reserved for Lodestar, LA 2 is for GPS.

SYS LA 1 -17.0 0.5 -6.2
SYS LA 2 -5.5 2.35 -12.15

After that, the following commands are required to configure Port 2 for serial protocol to RS485-9600-8-N-1:

OP 2 PROT 485F
OP 2 SER 9600 8 N 1

Configure Lodestar to accept GPS on RSXXX_2 using the following:

IN 2 MSG + GPS RP 2

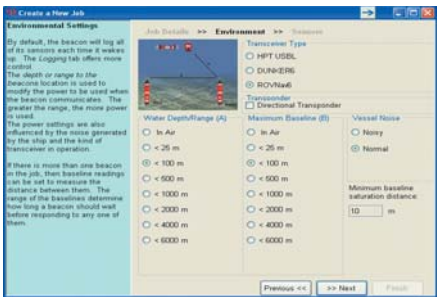
To verify that GPS is successfully being input and decoded by Lodestar, send the following command:

OP 0 MSG + SON1 1 RP 0

As a final check, the last character of the SON1 telegram should be 'A' and not 'U'.

Q How do I know my AMT data is logging correctly before I leave it for three months?

A We've just released a new piece of software for AMTs called Monitor that allows the transponder to be programmed, synchronised and functionally tested on deck and through the water. Once deployed, the AMTs can



be checked and baselines measured to confirm operation as expected. For peace of mind prior to leaving site, ensure one log period has elapsed and you've downloaded the first dataset for QC.

Q In our office we have an on-going debate about the best method for completing LBL box-ins. What is the Sonardyne stance on this?

A Wow, this is a big question with so many considerations and so little space in this column to do the question justice. It is probably best that we refer you to a recently published Sonardyne white paper on the subject. It defines the LBL box-in technique, why it is necessary, where it is necessary and most importantly highlights best practices. It is essential reading, so please go ahead and request a copy from the support section on our website.

Q Hi Darren² I was offshore recently and used Fusion LBL V1.11 for the first time. I came across a new feature called Script Tool. Can you explain what it is for and how to use it?

A The Scripting Tool has been developed to give users the ability to specify the particular type and quantity of measure-ments to be logged for a particular task using an LBL System.

The tool reads a script file that contains a number of user-defined commands that are carried out automatically with the results logged in a separate text log file. The credit for its development should really go to you, our clients who have requested this feature to make it easier when collecting measurements during acoustic metrology.

It is quite versatile and so could also be used for setting up a system to monitor structure settlement or any other sensor logging over a prolonged period of time. Try using it when you can, and let us know what you think of it.

Sonardyne
SOUND IN DEPTH

SOLSTICE

GAME CHANGER

Solstice redefines your expectations from a sidescan sonar. 32 channels deliver extreme multi-beam performance combined with integrated bathymetry in a compact, easy to install and low power imaging platform. A complete system consumes less than 10 watts, providing significant power budget savings for all classes of AUV. A fully focused back projection technique delivers pixel perfect imaging, auto calibration, multipath suppression and the ability to perform onboard auto target recognition. Solstice is a multifunctional tool delivering all the performance you need from an AUV based sonar in a single effective package, capable of coverage rates that are significantly greater than previous generation sidescans. Don't get left in the dark.

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