Sonardyne
SOUND IN DEPTH

SUBSEA TECHNOLOGY

Wide Area Hydrocarbon Leak Monitoring, Offshore Papua New Guinea

Stephen Auld, Global Business Manager
Sonardyne International Ltd.

Adapting to the Digital Future
1st November 2018
Aberdeen, UK

POSITIONING
NAVIGATION
COMMUNICATION
MONITORING
IMAGING

Agenda

- Very brief introduction to Sonardyne
- A look back at the history of Pasca-A offshore Papua New Guinea
- What the client needed to perform during a new drilling program
- What was delivered in terms of hardware and daily reporting
- What does it all mean for the digital future and for the subsea industry in 20 years?

Introduction to Sonardyne

Leading independent provider of underwater acoustic, inertial, optical and sonar technology

70+
The number of countries where we operate

250
Sonardyne employees worldwide

46
The age of our company

10,000
Transducers manufactured each year

10mm
Positioning accuracy of 6G acoustic technology

156,000
Total square footage of our facilities

Up to 500Mb/s
The speed we can transfer data subsea

12,000m
How deep our equipment can operate

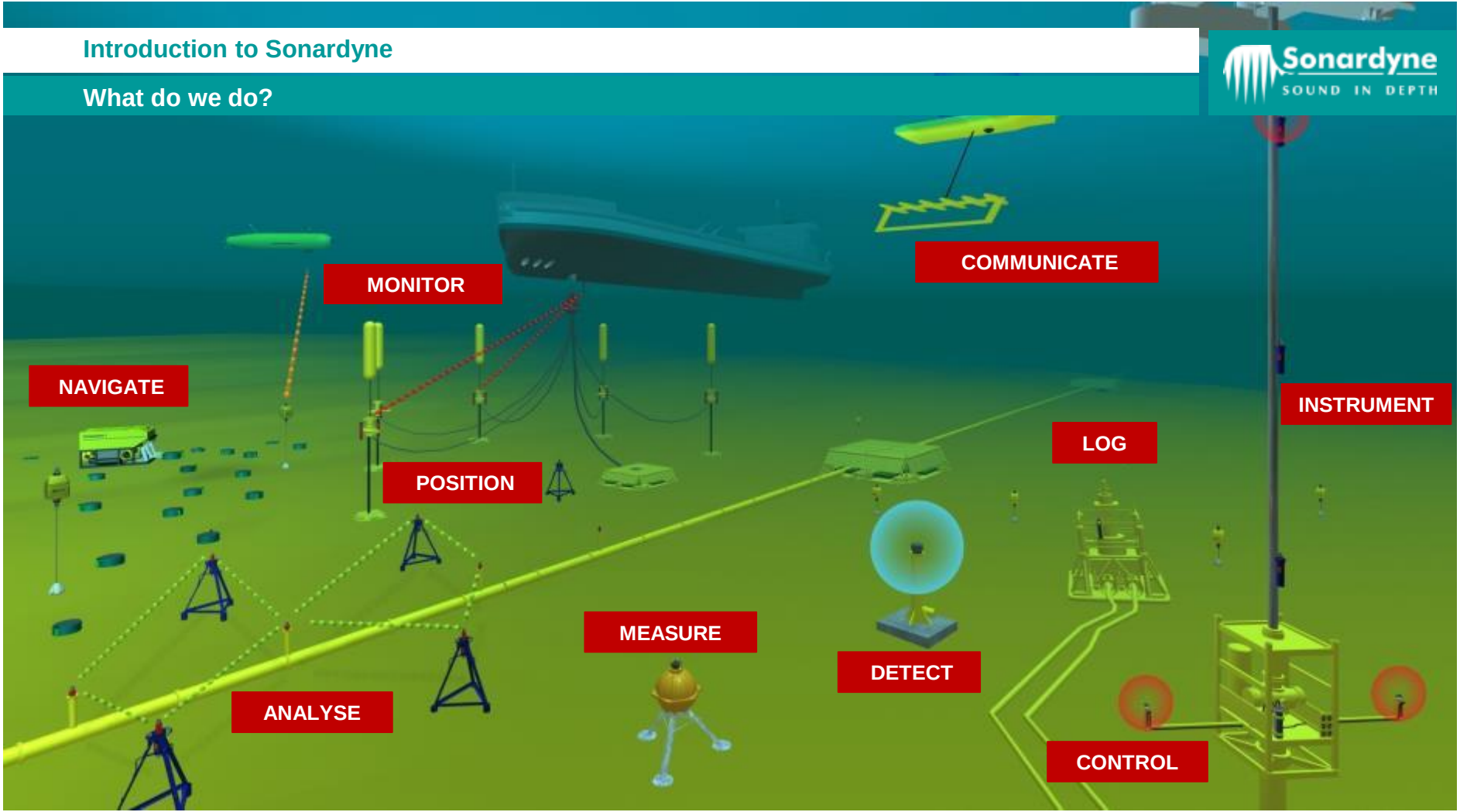
100%
Deep water fields where Sonardyne technology is used

80%
Percentage of products we export

24/7
Support any time you need it

Introduction to Sonardyne

What do we do?



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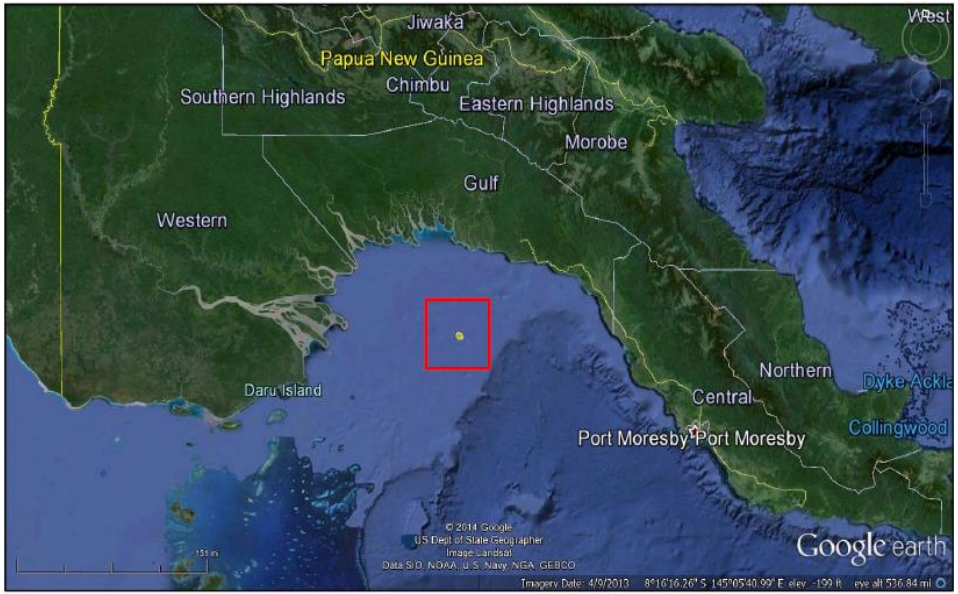
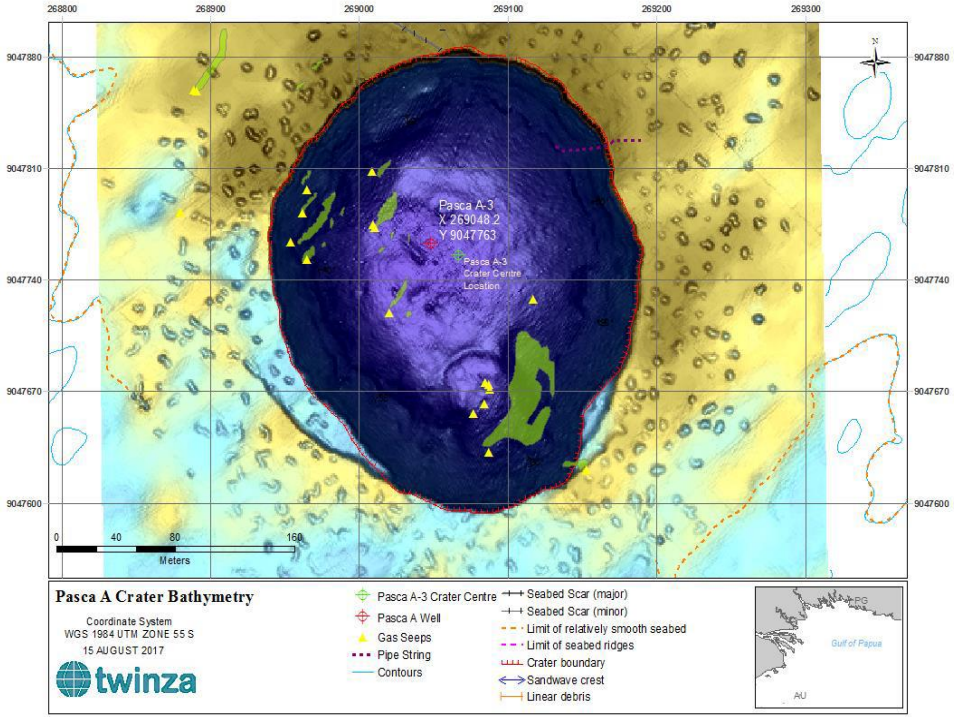
History of the Pasca-A Field Development



- Pasca-A is situated offshore PNG between Port Moresby and Daru in approximately 95m of water depth
- Site was a rich gas condensate discovery
- High flow capacity and liquids rich with >50% condensate and LPG's
- Originally the Pasca-1 discovery well was drilled by Philips in 1968
- Pasca-A2 appraisal well was drilled in 1969, experiencing high mud-losses in a high pressure reef with high flow capacity on test
- Superior Oil took over Pasca licence in 1979, drilling only 1 well in 1983 which experienced a loss of well control
- Licence for the block changed hands several times until Twinza Oil and partners were awarded the block in October 2011

Wide Area Hydrocarbon Leak Detection

History of the Pasca-A Field Development



- The blowout in the early ‘80’s was significant, leaving a crater roughly 250m in diameter by about 40m deep
- No real intervention tool place and the well was deemed to have sealed during the blowout
- Due to concerns relating to the new proposed drilling program by Twinza, a survey was conducted by Fugro to show base-map seepage
- The results of Fugro’s study indicated several bubble stream locations with roughly 9.8 bubbles per second, largest in the SE area of the crater
- As Twinza Oil’s new drilling program was taking place close to this crater the authorities wished continuous monitoring to ensure no increase of gas leakage occurred

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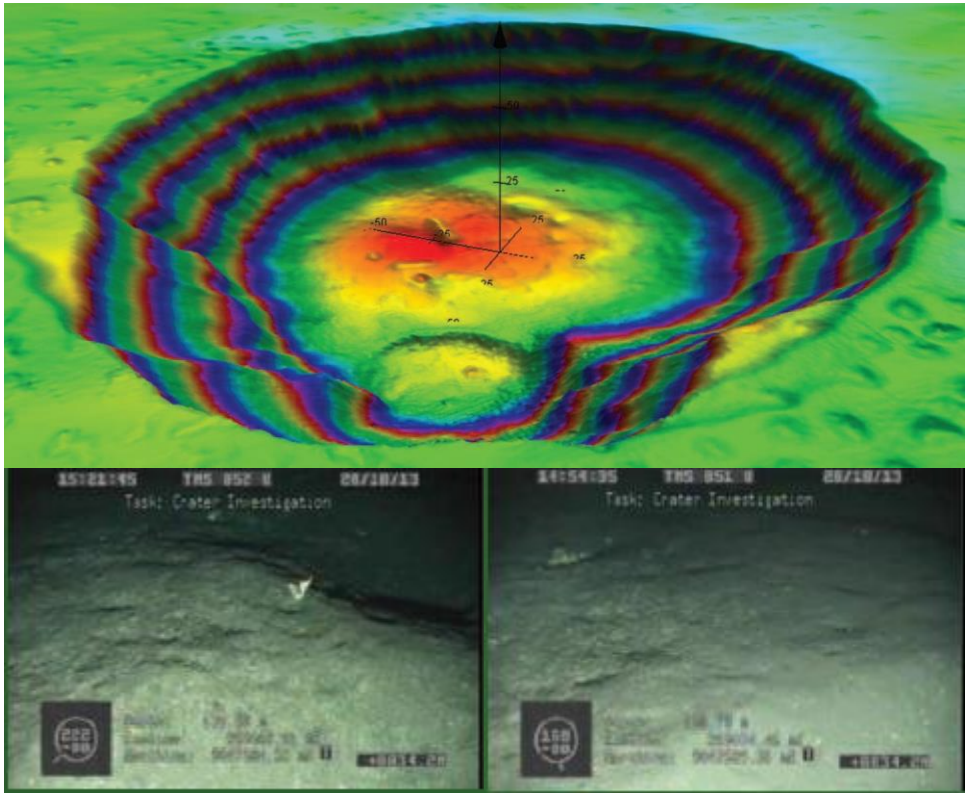
Pasca-A Field Monitoring Requirements



- Twinza Oil were confident that drilling could be done without disturbing the crater's residual seeps using new drilling techniques and blowout prevention
- Even so the PNG regulators insisted that continuous monitoring was to take place during operations
- Any increase in the rate of seepage from the crater would lead to a cessation of the drilling program, costing downtime and cost to the operator
- Twinza turned to Resolve Subsea to conduct a study of available technology including using cameras, methane sniffers, ROV monitoring, and unmanned surface vehicle monitoring amongst other techniques
- Finally, Resolve Subsea selected the Sonardyne Sentry wide area integrity monitoring sonar, but in doing so many challenges still had to be addressed

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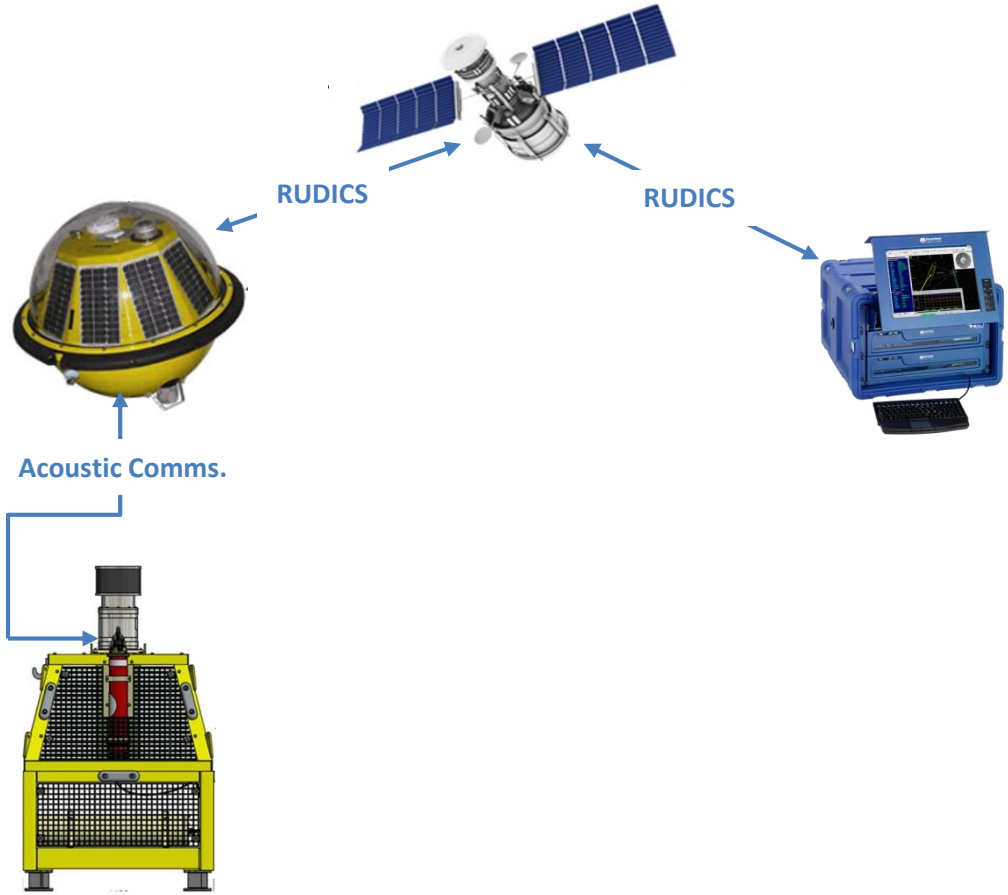
Wide Area Hydrocarbon Leak Detection

Sentry Integrity Monitoring Sonar (IMS)



- Little to no infrastructure meant power could only be supplied by batteries
- The Sentry-B (battery) system was designed to last for just over 6-months of continuous operation
- All automatic target detection computations had to be performed subsea using low-powered SMART technology
- Summary data could then be wirelessly transferred from the lander-based SMART to the surface buoy
- Data was then transferred to the shore (UK and Singapore facilities) via satellite
- Sentry was set for 3 minute ‘looks’ per hour with uploads every 6 hours to shore via surface buoy and satellite comms.

Wide Area Hydrocarbon Leak Detection

Sentry Integrity Monitoring Sonar (IMS)

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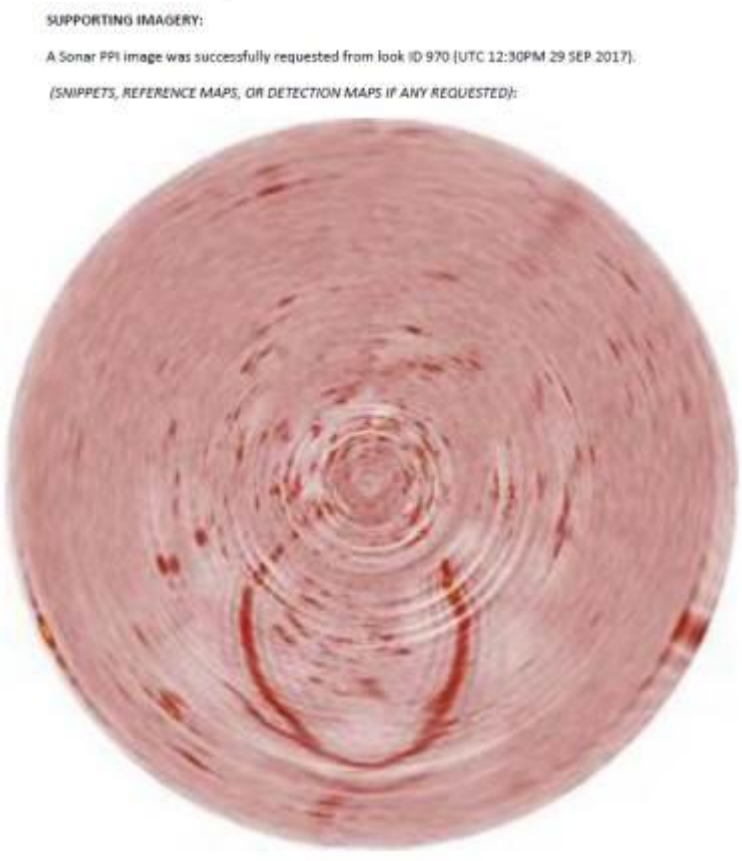
Pasca-A Field Monitoring Requirements



- Sentry-B (or the wired, Sentry-W) is capable of monitoring more than one billion cubic feet of seawater
- The sonar has 360° of coverage from a single ping with an operating frequency of 70 kHz and an 11° viewing angle
- Has the ability to automatically detect changes or alerts by comparing the operational scene to a base map
- During the Pasca-A deployment over 2,500 hourly looks were made across the crater
- Four (non-consecutive) automatic detections occurred around same location, post-mission this was probably moving fauna
- Based on mission reports no significant leaks were detected over and above the threshold levels of the existing and known seeps

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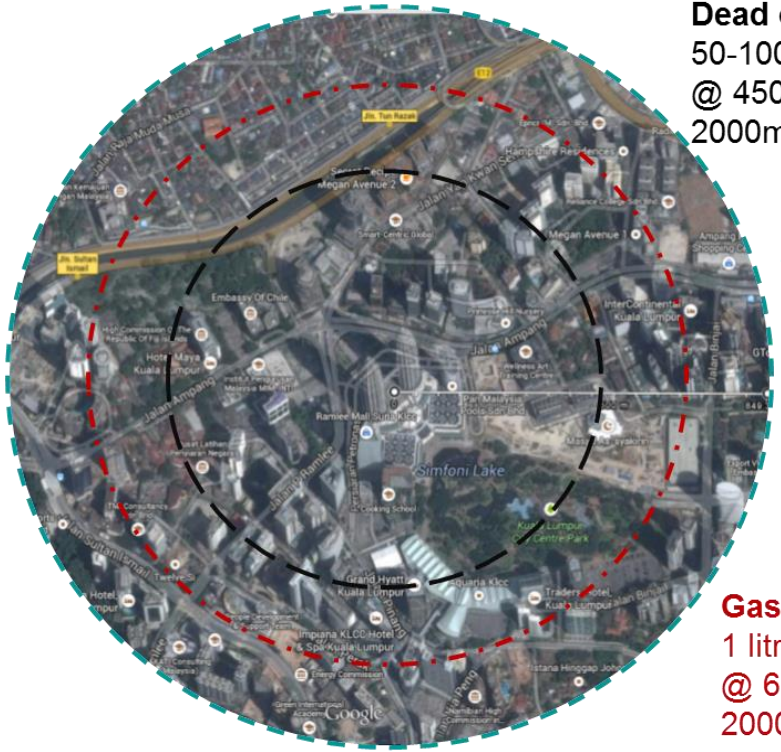
What Does it all Mean Digitally and for the Future?



Dead oil (2012)
50-100 bpd
@ 450 m range
2000m depth

CO_2 (2014)
2 litre/minute
@ 850 m range
10 m depth

'Live' oil (2013)
1.5 bpd
@ 670 m range
2000 m depth

Gas (2013)
1 litre/min at 1 bar DP
@ 670 m range
2000 m depth

- Automatic wide area, sonar-based, technology can detect and monitor subsea assets for the presence of oil and gas leaks
- This provides greater environmental comfort and early warnings of potential loss of integrity
- Low-powered electronics need to be used to prolong battery life for monitoring older, brownfield, sites (or those like Pasca-A)
- Data analysis needs to get smarter, with more data processing taking place subsea
- Robust, reliable and high bandwidth wireless acoustic and optical communications will play a part in securing cost-effective field developments

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Thank you.

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