



Pipeline Integrity Management: Leak Detection

OptaSense[®]
a QinetiQ company

OptaSense®

OptaSense® turns fibre optic cable into a highly sensitive listening device with thousands of virtual microphones along its length.

OptaSense® provides valuable, cost-effective, intelligence for pipeline integrity management, advanced leak detection, inline inspection gauge monitoring and third party interference protection.

The Earth's Nervous System®

As world leaders in Distributed Acoustic Sensing – OptaSense® provides round the clock monitoring and situation awareness systems for linear assets and critical sites such as pipelines, railways and nuclear power stations as well as additional services for oil field services, downhole solutions.

In use in over 40 countries, the OptaSense® system is field proven and now provides operational protection for nearly 10,000km of pipeline globally. These systems provide 24/7 monitoring of critical oil movement within host nations which delivers important GDP performance to governments.

In most circumstances the effective use of monitoring and incident response actions by clients has all but eradicated theft from pipelines being monitored by OptaSense®.

Not all pipeline incidents can be prevented by proactive monitoring. The OptaSense® Leak Detector Toolkit is designed for the detection of leaks in pipelines by a sensor fusion process combining the individual and unique benefits of pressure, temperature, strain and acoustic components of a rapidly developing leak.

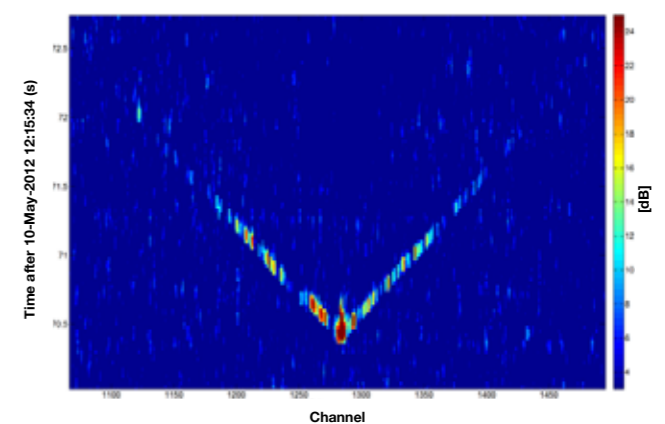
The system is live and requires no training, averaging or compositional modelling. The module will detect leaks very rapidly after initial occurrence (approximately 30 seconds) and can detect leaks with very low flow rates (minimum detection dependent upon products, structure and environment).

The OptaSense® Leak Detection module uses recognised leak detection methodologies of acoustic monitoring, negative pressure wave and temperature detection as well as new and innovative techniques such as turbulent flow and environmental strain. This ensures OptaSense® can quickly and accurately detect leaks in Gas, Liquid and Multiphase products

“OptaSense® detects leaks in Liquid, Gas and Multiphase products quickly, accurately and reliably”

Negative pressure pulse and noise from pipe rupture events

The most obvious signature of a pipeline leak can be the failure of the pipe itself. The rupture event and the subsequent rapid pressure drop inject vibrational energy into the pipe wall and fluid and cause propagating modes down the pipe.



OptaSense® waterfall signatures on oil pipe showing propagation distances of approximately 1 km (10m/channel) at 1 km/sec.

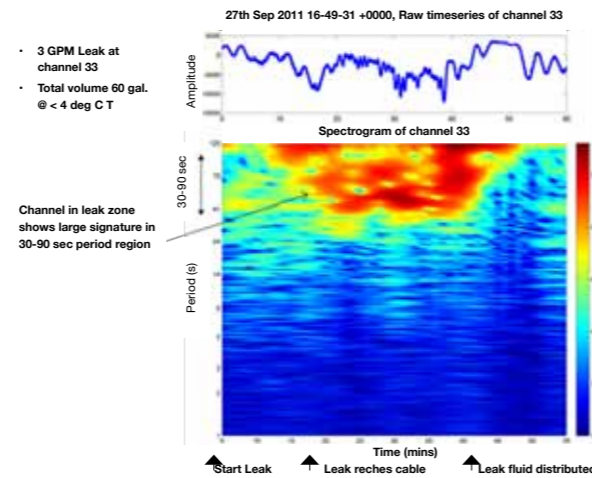
The pressure change at the leak location initiates a continuous random pressure wave inside the pipe that can propagate at relatively low-loss for long distances. For this leak detection mode, OptaSense® has an advantage over other acoustics-based products that use discrete acoustic pressure sensors because OptaSense® can detect the negative wave front along the entire route of the pipe.

Signals from small leaks will propagate 1-2km with adequate signal to noise ratio. Localization of these leaks will be very accurate—the origin of the propagating waves, as well as the highest sound level, will pinpoint the origin of the leak to within 5-10 meters, typically in less than 30 seconds.

The increased speed and accuracy of the OptaSense® system allows remedial action to be planned immediately, reducing product exposure and excavation costs.

Temperature change

OptaSense® DTGS (Distributed Temperature Gradient Sensing) can be used to measure temperature changes, and thus can also exploit this sensing modality. DTGS does not measure absolute temperature, but instead measures temperature temporal and spatial gradients with an extremely low noise floor using thermal strain and thermo-optic effects read out by the Rayleigh, rather than Raman scattering phenomenon. OptaSense® can detect changes of better than 0.01°C and can be reported at per second rate to this accuracy. Making OptaSense® DTGS more sensitive than traditional DTS technology by several orders of magnitude.



OptaSense® measurements of a small fluid leak using Distributed Temperature Gradient Sensing.

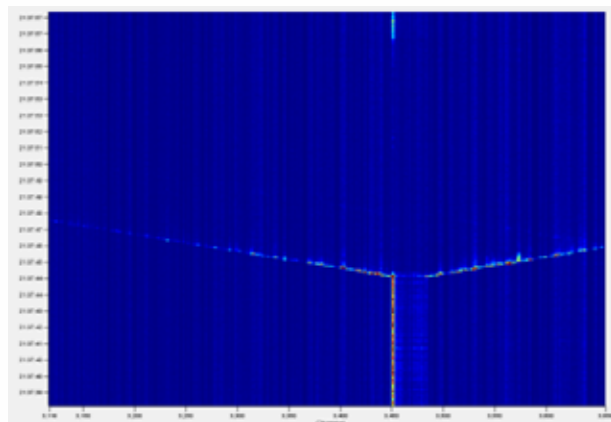
Environmental Strain

High pressure gas pipelines will not only see effects of temperature gradient change but will also experience a ground heave within the surrounding environment via Joules Thompson expansion.

Fluid lines may also experience wash out of surrounding soil caused by consistent flow and saturation thus changing the relationship between surround and sensing cable OptaSense® detects the low frequency changes caused by these short term strain effects.

If a small leak develops within a pressurised line, even if there is no major rupture event, the turbulent flow through the small orifice generates an acoustic signature that can be picked up by OptaSense®.

The signal radiates into the ground from the orifice directly, and also sets up a continuous random pressure wave inside the pipe that propagate at relatively low-loss for long distances.



OptaSense® monitoring turbulent flow and pressure pulse signature.

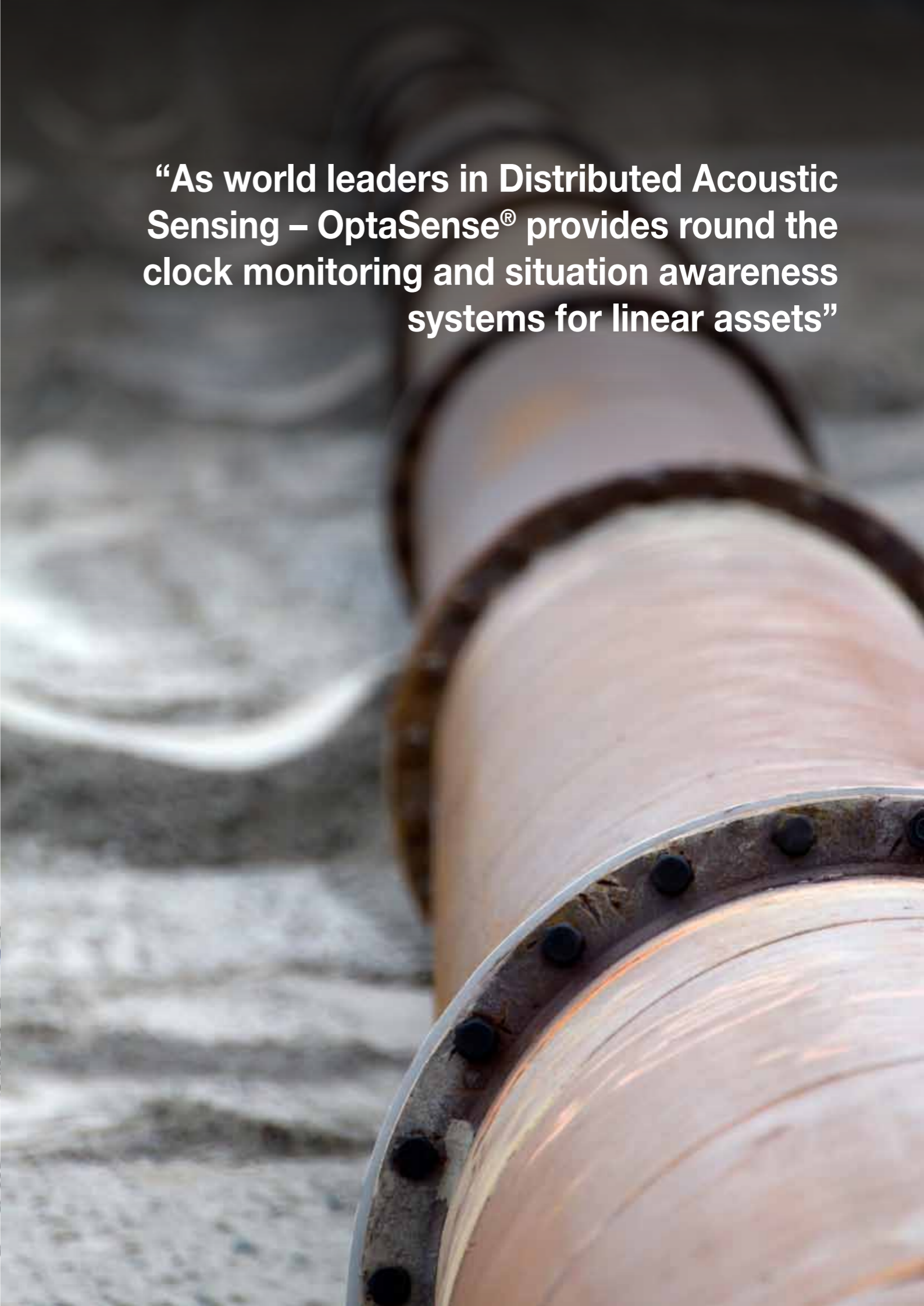
Multi Detector Methodology

The OptaSense® Leak Detector Toolkit will rarely rely on one of the above phenomena alone. All leaks or breaches affect multiple aspects depending upon the product and the conditions.

By fusing this information together OptaSense® is able to reliably detect and classify these events. By matching the leak location with the position of the maintenance team, response times, spill rates and excavation costs are reduced to an absolute minimum.

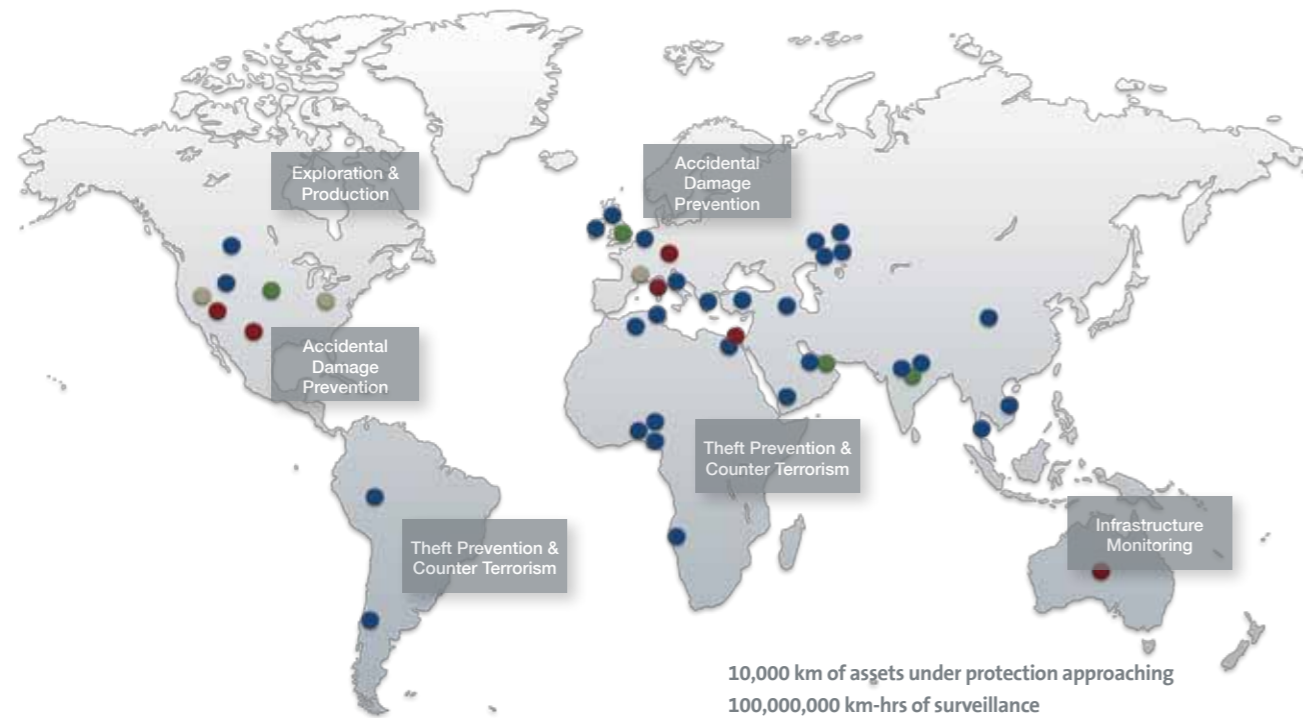
OptaSense® provides the tools for Prevention, Detection and Remediation.

“As world leaders in Distributed Acoustic Sensing – OptaSense® provides round the clock monitoring and situation awareness systems for linear assets”



A Global Business

OptaSense® is a world-beating British technology, built on decades of home-grown expertise at QinetiQ. Globally, combined with local delivery and service capability our solutions are protecting some of the world's most valuable assets,



Already OptaSense® has grown from just 3 people to over 140 employees in four years and OptaSense® with solutions being deployed in over 40 countries, working either directly or through knowledge transfer, to enable local partners to install, maintain and operate the OptaSense® systems locally.

With offices in the London, Dubai, Houston, Boston and Calgary we are addressing the needs of pipeline protection and management, oil field services, transport, borders and military and critical site security.

Our technology protects thousands of miles of pipeline worldwide as we continue to work with major Oil and Gas corporations internationally to improve yield and return on investment. Increasingly our technologies are being selected to protect borders, critical sites and assets whilst assisting in military operations.

While other companies also operate in the field of distributed acoustic sensing, OptaSense® has combined the technology of the "listening fibre" with the power of advanced acoustic algorithms to build The Earth's Nervous System®.

Safety is Paramount

Across OptaSense® globally, health and safety is of paramount importance. It underpins the way we operate in every location and is an intrinsic part of our company philosophy through to daily execution of all tasks. From a simple visit to site through to field deployment of our personnel and solutions, safety is first, last and always.

From personal training through to instituting full and regular audits, we work to and invariably exceed international standards for the care of individuals and the standard of operational work. Every year we invest in hundreds of man hours of training for management and staff alike and have built up an enviable track record of incident free activity. In 2012, OptaSense® achieved more than 77,000 injury free operational man-hours and held in excess of 314 safety meetings and travelled tens of thousands of kilometres without accident.

We continue to make health and Safety of the highest importance, holding or arranging regular team briefings, vigilance in all pertinent areas and full education and development of staff at all levels.



- Trained on the "Life Saving Rules"
- Part of the ISNetwork
- Hold a valid Certificate of Recognition (COR)
- Safety policies including Drug and Alcohol and Fit for Duty Policies
- All field employees have certifications on H2S Alive, Defensive Driving and First Aid
- All vehicles have IVMS (monitoring and driver coaching system)
- 2012 Statistics:
 - 77,385 man/hour 0 injuries
 - 166,321 km 0 accidents

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