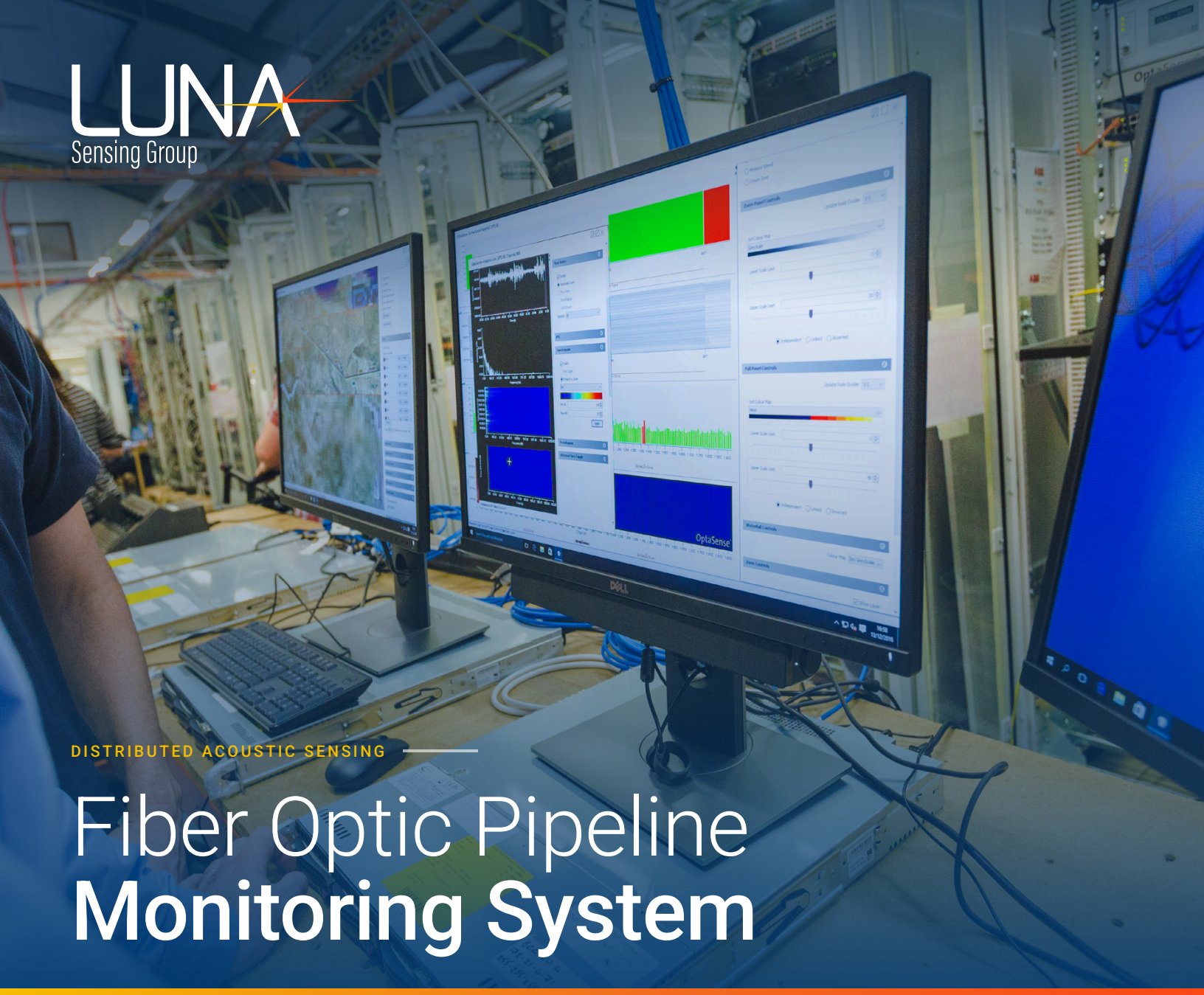
LUNA
Sensing Group



DISTRIBUTED ACOUSTIC SENSING

Fiber Optic Pipeline **Monitoring System**

Preventing and detecting leaks in real time

- Leak detection
- Third-party interference
- Theft prevention
- Ground movement
- Inline inspection tracking

One system. Multi-threat detection.

lunainc.com

01 THE CHALLENGE

Detecting pipeline leaks is a **high priority**

…but can be difficult to achieve without the right systems in place.

You go to great lengths to safely and reliably transport oil and gas to the market.

And, although there have been several developments in pipeline monitoring technology, many systems have limitations that leave pipelines vulnerable to leakage, damage and theft.

Overcoming these limitations often results in the installation of multiple, cost-prohibitive systems to effectively monitor various leak scenarios.

But it doesn't have to.

Luna raises the bar by delivering a single system that detects smaller leaks faster and more reliably, while simultaneously monitoring for third-party interference and other external pipeline threats in order to prevent leaks altogether.

Common system limitations

- ✕ Longer detection times for small leaks
- ✕ Limited leak localization ability
- ✕ Limited preventative monitoring
- ✕ Poor leak sensitivity and reliability
- ✕ Single-phase leak detection only
- ✕ Computational errors
- ✕ Numerous false alarms
- ✕ Requires dedicated pressure sensors and high sampling rates
- ✕ Higher maintenance and costs for additional sensors and infrastructure

One system that does the work of many

Detects smaller leaks
faster and more reliably

Monitors external threats
including third-party interference

Prevents leaks
altogether, by stopping threats early

Get **more** from a single system

Detect, locate and classify multiple threats in real time, along the full extent of your pipeline, with the Luna pipeline monitoring system from OptaSense.

Instead of relying on computational assumptions, this system uses **distributed acoustic sensing (DAS)** technology to transform a standard telecommunication fiber optic cable into a fully distributed sensor capable of detecting the physical characteristics of a leak, including changes in noise, temperature, pressure and ground strain—simultaneously and in real time. The integration of these four modes into a single leak detection system not only provides improved sensitivity, it delivers the reliability required to identify and validate leaks faster and with more confidence.

Once connected to Luna equipment (installed every 80km), this pipeline monitoring system monitors the entire pipeline and surrounding facilities, providing uninterrupted and secure data updates continuously, across each 10m of fiber. This means you can detect the presence and location of very small leaks in a matter of minutes, while protecting critical infrastructure from external threats that can lead to substantial damage and loss.

With the Luna pipeline monitoring system from OptaSense, you can rely on a single solution that fortifies your overall integrity management program by ensuring threats to your pipeline are predicted and averted.

01

One system, multi-threat detection

A variety of detector applications monitor leaks, right of way and third-party interference, geohazards, theft, critical infrastructure and inline pigging devices in real time, from a single operating system.

02

One system, lower installation costs

With a single operating system, you eliminate unnecessary spend on redundant hardware, so you can invest in what matters most—the real-time information required for optimal pipeline management.

03

One system, flexible design

Pipelines stretching long distances need a system that adapts to regional requirements and regulations. Customize a solution with detector applications that satisfy the demands of your pipeline environment.

Fiber optic system advantages

MULTI-THREAT DETECTION

- Leaks
- Third-party and right of way interference
- Ground movement
- Condition monitoring
- Inline inspection tool tracking

OPTIMAL PERFORMANCE

- Faster, more sensitive threat detection and classification
- Rapid, more accurate threat location
- Smarter, more reliable alarms
- Consistent, more robust system performance
- High-quality data and reliable communications

ADVANCED SENSING

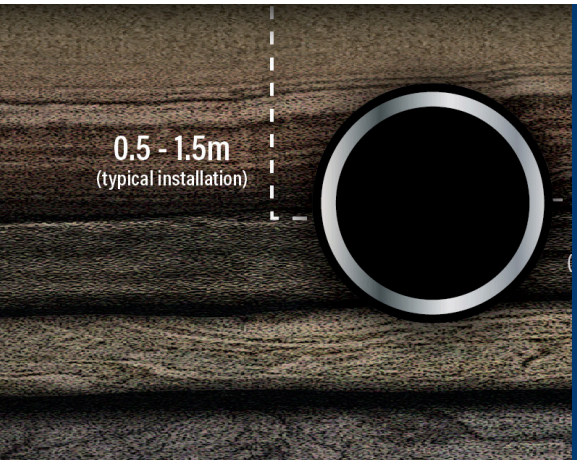
- Measures acoustics, temperature, pressure, strain and orifice noise
- Eliminates conversion and computational errors
- Performs in transient, slack-line and multi-phase flow
- Monitors longer distances using thousands of distributed sensors
- Provides localization accuracy of ±10m

FLEXIBILITY

- Customize a system for your specific pipeline environment

REDUCED INSTALLATION COSTS

- Eliminates the need for redundant systems and hardware



Benefit from a system that offers

- Real-time monitoring, greater reliability and improved operational safety
- Compatibility with standard telecommunication installation methods
- Reduced OPEX by minimizing annual data costs and maintenance fees
- A high data rate environment for pipeline automation and enterprise communications
- A private network that mitigates cyber security risks

Detect leaks faster and with **confidence**

Detecting a leak quickly and effectively can be limited by a system's level of sensitivity, accuracy, reliability and robustness.

10×	0.1%	±10m	4
faster small-leak detection than internal systems	leak size detected within a matter of minutes	leak location accuracy, in real time	detection modes: noise, temperature, pressure and ground strain

The Luna pipeline monitoring system eliminates the guesswork that compromises safe and reliable pipeline management by detecting and locating leaks accurately and in real time, regardless of fluctuating pipeline conditions and flow regimes.

1 Detect smaller leaks faster with superior sensitivity

Internal leak detection systems are one of the most commonly used methods to detect a leak. These systems use point sensors to track flow rates, as well as provide mathematical and statistical computations of pressure, temperature and product characteristics. Although useful, they take longer to detect leaks, and small leaks may go completely undetected.

Where point sensors lack in sensitivity, the Luna leak detection application identifies smaller leaks faster—allowing you to eradicate minor issues before they become major incidents. Our fiber-based system can detect small leaks 10 times faster than internal systems, detecting a 0.1% leak size within a matter of minutes.

2 Locate leaks with increased accuracy

Many internal systems determine leaks by analyzing discrepancies between predicted and measured values. Accurate computational modeling requires a large number of point sensors, so due to cost, sensors are only installed in increments along key areas of the pipeline—limiting coverage and reliability.

With DAS technology, the fiber cable acts as a physical sensor that offers thousands of detection points along the entire pipeline, capable of pinpointing the location of a leak within 10m, in real time.

3 Increase confidence in alarm reliability

Calibration errors and fluctuating pipeline conditions can impact a system's reliability—resulting in false alarms, missed leaks or an unnecessary shutdown. Many external fiber-based systems also produce nuisance alarms because they rely on a single detection method, such as temperature.

The Luna leak detection application validates leaks before sounding an alarm. Using a patented multimode leak detector, it confirms suspected leaks by measuring changes in noise, temperature, pressure and ground strain, simultaneously and in real time. Detector settings can be customized across every 10m section.

4 Rely on robust system performance

Today's complex pipeline networks require robust systems that perform under changing fluid compositions, temperatures and pressures, which for many internal systems often result in computational errors and false alarms.

The Luna pipeline monitoring solution performs under transient, slack-line and multi-phase flow conditions. Even when critical pipeline infrastructure goes offline, this fiber-based system ensures continuous and reliable real-time event detection, classification and location.

INLINE INSPECTION

Track inline inspection devices

Inline inspection tools monitor pipeline condition and remove accumulated debris, but they can get stuck in long pipelines, making them difficult and expensive to locate—not with the Luna inline inspection tool tracking application. By tracking the acoustic signature, it follows a device's progress through the pipeline network. As the tool passes each girth weld, the resulting pressure pulses propagate through the pipe and can be detected a considerable distance away, so operators can swiftly identify the location of a stalled device.

Mitigate the risk of **external pipeline threats**

Detecting leaks faster and reliably is a priority, but leaks only account for a portion of total risk.

Pipelines are susceptible to various external threats that can result in significant damage, or worse, a rupture. However, a majority of these incidents can be prevented. In addition to leaks, the Luna pipeline monitoring system detects the external events that lead to pipeline damage, so you can respond to threats before incidents occur.

Detect external interference

Offering third-party interference monitoring and right of way detection, our system alerts pipeline operators to potentially hazardous activity within the pipeline corridor—such as digging, vehicle movement and other large machinery—before contact with the pipe is made.

Utilizing the fiber optic network around remote facilities, the system can also detect threats and unwanted activity near above-ground infrastructure, such as block valves, refineries and pumping/compressor stations.

Protect pipeline infrastructure

Sabotage and theft can significantly impact pipeline integrity and an operator's bottom line. Protecting pipelines in high-risk areas typically requires separate leak detection and security monitoring programs, but the Luna pipeline monitoring solution can do both.

By integrating leak detection, security monitoring and theft prevention into a single system, it provides the sensitivity and reliability to detect and locate suspicious activity, such as illegal hot taps and vandalism, up to 100km from a single location. You improve incident reduction and increase the effectiveness of ground patrols and helicopter reconnaissance by focusing manual inspection on areas of real activity.

Monitor seismic disturbances

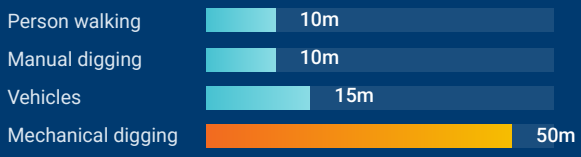
Sizeable ground shift and rock fall events can be detected with the ground movement monitoring application. By recording all activity near a pipeline before and after a large-scale disturbance, such as an earthquake, engineers can understand resulting damage and whether asset integrity has been compromised.

Why **DAS?**

Using fiber optic acoustic sensing technology, our system identifies the unique acoustic fingerprints of events that pose a threat to your pipeline, such as third-party interference, manual or mechanical digging and forces of nature.

Real-time detection

DAS converts a fiber optic cable into an array of virtual microphones capable of detecting, locating and classifying threats in real time.



Detection distance from buried fiber

Advanced processing and algorithms

Activities along a pipeline produce unique sounds and vibrations. Advanced processing removes background noise and converts them into a high-resolution visual; algorithms then create specific alarms for a given event or sequence of events—so you can monitor individual or interactive threats, where and how often they occur, whether they are time-dependent and their potential to become a major issue.

Reliable alarms

In many acoustic systems, background noise can trigger dozens of false alarms each hour. To minimize nuisance alarms, the Luna system observes activity over a short period to create an exact picture of the normal events in that area.

Smart zones

Customize alert settings for regional needs—terrain, roadways and rivers—at different times of day, so you can distinguish normal pedestrian and road traffic from an unexpected vehicle unloading several people.

One system, multiple applications

Our pipeline monitoring system provides real-time, actionable data that optimizes business decisions and costs by increasing operational efficiency, maximizing productivity and reducing risk.

INTERFACES

The right data, to the right people, in the right format

- CONTROL
- SCADA / DCS
- MOBILE
- CAMERA
- CLOUD
- REPORTS

DETECTOR APPS

Run individually or bundled as an integrated solution

LEAK DETECTION	RIGHT OF WAY MONITORING	THEFT PREVENTION	THEFT DETECTION	FACILITY SECURITY	GROUND MOVEMENT MONITORING	INLINE PIG TRACKING	CONDITION MONITORING
Negative pressure pulse	Mechanical digging	Mechanical digging	Negative pressure pulse (for existing hot taps)	Fence tampering	Seismic activity	Pig location	Tonal detector
Orifice noise	Manual digging	Manual digging		Manual digging	Strain change	Speed tracking	
Strain change	General activity	Personnel activity		Personnel activity			
Temperature change		General activity					
✓ SUBSEA	✓ SUBSEA	ONSHORE	ONSHORE	ONSHORE	ONSHORE	✓ SUBSEA	ONSHORE

All detectors available onshore Also available subsea

PLATFORM

Sensing, processing and networking hardware

- SENSING
- PROCESSING
- NETWORKING

Interfaces

Multifunctional interfaces deliver real-time operational data to the right people, in the right format: trending reports to operations management, security alarms to the security team via mobile devices, and leak detection alerts to main control via SCADA.

Detector apps

Detector applications are easily installed and interchangeable, and can be run as individual software programs or bundled together for an integrated solution.

Platform

Platform sensing, processing and networking hardware can be easily retrofitted for pipelines with existing fiber optic cables.

Ensure threats to your pipeline and critical infrastructure are predicted and averted with a solution that's proven to perform.

15,000+ km

of pipeline under contract

40+

countries protecting some of the world's most valuable assets

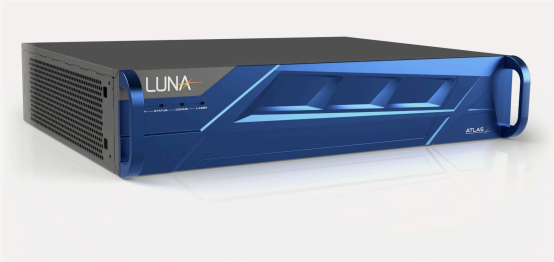
Pipeline expansion is accelerating around the world, as is the pressure to increase the safety and reliability of existing, aging infrastructure.

By combining leak detection and security monitoring into a single system, Luna helps you keep oil, gas and other products where they belong—in the pipe.

For a reliable and robust pipeline monitoring solution that **detects, classifies and locates** multiple threats in real time

Contact your local representative or visit us online to learn more.

lunainc.com



LUNA Sensing Group

Decision-ready data that increases operational efficiency, maximizes productivity and reduces risk.

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