



# WESTMINSTER

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## WG Acoustic Fibre Optic Pipeline Security System

Preventing or detecting leaks caused by corrosion, environmental or malicious damage is a major challenge to pipeline operators faced with ever tighter regulations worldwide.

Where pipelines run through sensitive areas or over long distances in remote, hostile territory, conventional monitoring and protection methods can be stretched beyond effective limits.



If a pipeline is damaged significant revenues will be lost, damage may also be caused to the local environment and the leakage could be a potential danger to the local population. More importantly a terrorist attack on an unprotected utility pipeline could have catastrophic consequences.



The WG Acoustic Fibre Optic Pipeline Security System (AFOPSS) is designed to protect gas, oil and other utility pipeline distribution networks and their remote facilities by providing an early warning of leaks, illegal taps, excavations and intruders which could pose a potential threat.

AFOPSS will monitor vibration and acoustics at every metre of a pipeline with a single standard communication optical fibre sensor linked to one or more interrogator units.

AFOPSS unique sensing solution will provide security and monitoring, detecting third party interference (TPI) tampering and illegal tapping attempts to within 1 metre along the pipeline.

AFOPSS unrivalled sensitivity means the sensor can detect analyse and locate leaks or potential threats instantly, regardless of distance.

AFOPSS will alert you with accurate (GPS / GIS) location and intelligent event analysis in time to mitigate the risk from leakage or threats such as digging, landslides, drilling, hot tapping or attempted sabotage.

The consequences of a pipeline failure mean that for a responsible business, integrity assurance and risk mitigation is mandatory.

AFOPSS enables pipeline operators to overcome many of the constraints of conventional systems, with AFOPSS you can:-

- One system can cover up to 40 km of pipeline
- Simultaneously monitor every metre of a pipeline of any length 24/7
- Immediately detect and locate leaks or threats to 1 metre accuracy
- Differentiate multiple events down to 2 metre resolution
- Track potential attackers in vehicles or on foot
- Identify real threats and avoid false alarms
- Detect and track direction and speed of vehicle movements or even footsteps
- Minimal false alarms due to event recognition
- Interface to GIS systems to rapidly show event location
- Report alarms to controls rooms, websites, text and PDA
- Remotely configure, manage and upgrade interrogator
- Low maintenance and resilient sensor
- It can utilise an existing fibre optic communications cable as the sensor, dramatically reducing the installation cost
- PIG's can be monitored in real time through a pipeline
- Detect leaks in real time
- Provide perimeter intrusion detection around pipeline facility buildings
- Provide plant monitoring facilities

### **Unrivalled Acoustic Surveillance for any Length of Pipeline in any Situation**

The AFOPSS unit analyses the back-scatter of pulsed laser light from a standard optical fibre cable (often already in place for SCADA or communications) to provide unrivalled monitoring sensitivity for up to 40 km of pipeline per unit.

By linking multiple units the system can monitor hundreds, even thousands of kilometres from a single location.

### **Pipeline Surveillance at the Speed of Light**

AFOPSS automated alarms can integrate with CCTV, security lighting and GIS systems and can provide the control room with pin-point audio-visual corroboration and location details of a suspect event.

### **Monitor, Identify and Alert; Minimise False Alarms**

The AFOPSS sensor typically detects personnel activity at 15 metres and vehicle movement at 40 metres either side of the sensor fibre.

The AFOPSS system recognises potentially critical events such as excavation, drilling or cutting near pipelines while ignoring background environmental noise thus minimising false alarms.

AFOPSS dynamically tracks vehicles or footsteps, and reports precise location, speed and direction of travel, enabling rapid engagement by security systems and personnel.

The graphical user interface for monitoring and alarming is simple, intuitive, showing each event on a map and giving data such as categorisation in visual formats.

AFOPSS integrates with PTZ CCTV, security lighting and GIS mapping systems, and will interface with security systems, IT networks, mobile communication and the Internet for remote monitoring and control.

*AFOPSS can simultaneously monitor multiple zones on pipelines of any length.*



### Simple and Rapid Installation

AFOPSS is simple to install and configure, if an existing redundant fibre in a SCADA cable is not available, then a new sensing cable can easily be attached to a pipeline or simply buried next to it regardless of ground conditions, using standard telecom methods.

### High Resilience, Intrinsically Safe and Low Maintenance

Resilient configurations can maintain full protection even if the fibre is cut, giving the precise location of the breach.

The sensor fibre requires no power or additional equipment along its length and is resistant to RF or any other EMI, it is also unaffected by lightning and does not corrode, so once deployed it is essentially maintenance free.

### AFOPSS Delivery

Westminster can provide full project planning, design, installation, integration and ongoing support worldwide.

The AFOPSS system can also be provided as part of a fully integrated pipeline integrity and security system.

**AFOPSS - Key Advantages:-**

- Simple installation
- 40 km range one unit, multiple units will cover any length
- Industry leading sensitivity
- Accurate location of events down to 1 metre
- Instantaneous detection of acoustic / vibration events
- Detection zones easily and remotely reconfigured
- Full integration with security management systems
- GPS integration with GIS mapping systems
- Intuitive graphical user interface
- Multi-platform integration to web, mobile, PC and smart-phones
- Intelligent characterisation of detected events
- Sensor is intrinsically safe in explosive environments
- Undetectable sensor with no EM footprint
- Immune to RF and all EMI
- Interrogator configurable via secure connection
- Low maintenance and extremely robust sensor

**Sensing System Technical Specifications**

- Maximum fibre length 40 km;
- Maximum spatial resolution @ 15 km 1 m
- Maximum spatial resolution @ 40 km  $\pm 5$  m
- Minimum separation for discrimination of unique events  $\pm 2$  m
- Maximum signal bandwidth 10 kHz

**Typical Threats****Excavation****Landslide / Earthquake****Digging****Hot Tapping**



**Typical Non-Threats**



**Animals**



**Transport & Farm Machinery**

**Operation**

The system has standard event recognition software, when commissioned the system will be set in a learning mode for period of time to experience all of the local environment conditions, those that are non-threats will then be assigned as non-alerts.

The system acts as a microphonic cable, sound can be ‘heard’ along the entire sensor fibre length.



The system sensor interrogator generates a special signal in the optical fibre cable, this signal is changed by sound or ground borne vibrations and the interrogator receives and interprets these vibrations as either a threat or non-threat.

Once programmed with the event recognition software, the interrogator can identify and locate the likely cause of the sound / vibrations and automatically send an alarm of a threat.

The alarm threat information is displayed on a user-friendly graphical interface; the system incorporates a “listen-in” mode to enable the user to actually hear what is going on at a particular location.

**Typical Detection Range**

<b>Events</b>	<b>Distance from Fibre</b>
Man Walking:	5 metres
Man Running:	10 metres
Car on smooth surface – 30 mph:	50 metres
Car on uneven surface – 30 mph:	50 metres
Excavation machinery	200 metres

## Graphical User Interface

The AFOPSS is supplied with a simple graphical user interface, providing:-

- Full integration with security management systems
- GPS integration with GIS mapping systems
- Intuitive graphical user interface
- Multi-platform integration to web, mobile, PC and smart-phones



## PIG Monitoring

Pipe Inspection Gauges (PIG) are used extensively in the pipeline industry to for cleaning, inspection and various maintenance operations on a pipeline. This is normally carried out without stopping the flow of the product in the pipeline.



The PIG can often become stuck in the pipeline during its operation, when this happens the actual location of the PIG in the pipeline is not known.

AFOPPS can provide real time monitoring of the PIG's travel / location along the pipeline.

## Leak Detection

Detecting leaks caused by defective pipes, illegal tapping, landslide, earthquakes or terrorist activity in surface, buried and underwater pipelines is often a major challenge

AFOPPS will constantly check the integrity of a pipeline preventing environmental damage as well as extending the life of the pipeline by ensuring that it is safe at higher pressures for longer.


A simple communication fibre mounted alongside a pipeline can detect in real time the early stages of a leak such as in-frequent bubbling or low volume leaks before anything more catastrophic damage can occur.

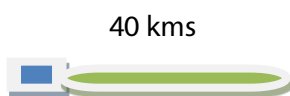
## Perimeter Intruder Detection

AFOPSS can be used to operate as a perimeter intrusion detection system around pipeline facility buildings i.e. pumping / valve locations using the same fibre sensing cable; this can be integrated with local CCTV systems to provide full security coverage of the local area.

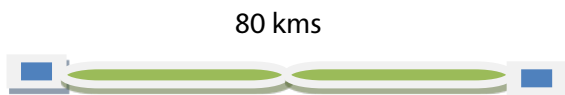
The AFOPSS can be utilised to provide remote condition monitoring of rotating machinery at in-line facilities i.e. pumping / valve locations using the same fibre sensing cable

## System Requirements Theory

 One AFOPSS interrogator will protect up to 40 kms of pipeline, power is only required at the interrogator position.



Two AFOPSS interrogators can cover up to 80 kms of pipeline.



By linking multiple AFOPSS interrogator units the system can monitor hundreds, even thousands of kilometres from a single location.



Electrical power is required at each AFOPSS interrogator position.

In reality electrical power is only available along a pipeline at pumping stations and sometimes at valve stations, therefore the actual positioning of the interrogators will be where there is electrical power available, typically on a crude oil pipeline this may be at 35 km spacing, therefore the maximum distance between interrogators would be 70 kms.

## Project Proposal

To facilitate Westminster to provide a project proposal we will require details of the pipeline:-

- Pipeline layout including distances between electrical sources (pumping stations);
- Type: Gas, Oil, Water etc;
- Location: Length Buried, Length Surface, Length Underwater;
- If Buried Soil type: Sand, Clay, Rock etc;
- Details of any road crossings, river crossings underwater, bridges etc.