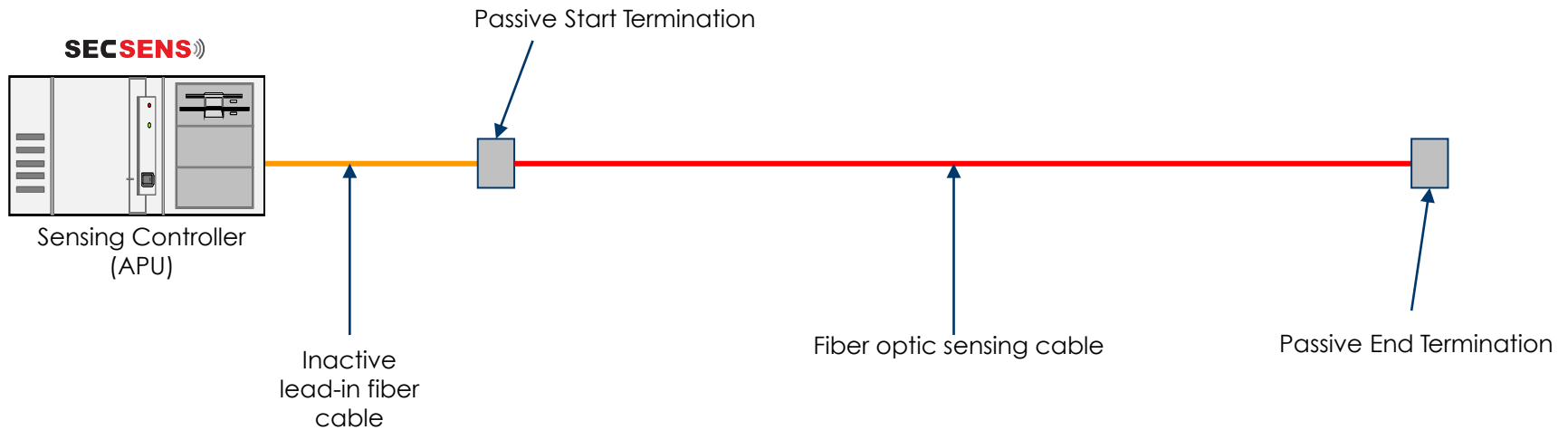

CANOVATE[®]

SECSSENS)))

**Fiber Optic Distributed Vibration
Sensing (DVS) for Security and
Safety Applications**



- Utilizes a fiber optic cable as the sensor.
- When any motion, sound or vibration acts on the fiber, or anything the fiber is attached to, the wave pattern of the laser light is changed and detected using proprietary and patented optical sensing technology.
- Time-of-flight information can be used to locate the disturbance.

Canovate Group has a unique Distributed Vibration Sensor (DVS) system that is practical and effective in the prevention of oil or gas spills due to its unique ability to detect, locate and classify vibrations caused by physical activity (such as third-party interference), while simultaneously monitoring for early-stage leaks, along the entire length of the pipeline, in real-time.

In comparison with other competing technologies, SECSENS is distinguished by the following main operational capabilities:

1. It operates over an extremely broad frequency range (3Hz to 500kHz) and is the world's first and only distributed ultrasonic detector. As a result, it can detect and locate early-stage leaks, directly and much earlier than other cable-based systems.
2. It is effective at discriminating different patterns of interferences and environmental/traffic noises from potentially dangerous operational events/threats. By reducing nuisance alarms, it alarms for events of true concern with an increased degree of confidence and thus allows for automatic response mechanisms with a practical degree of responsibility.
3. It offers completely uniform sensitivity and performance over the entire length of the optical fiber cable. Most other systems are non-uniform and their performance diminishes with distance.



- Up to 100km/62miles per processing resolution over the entire perimeter.
- Signature based detection indication.
- Can be used on the fence and underground with the same system.
- No electronics or power required in the field.



Chainmesh Fence Installation

The key advantages of the SECSSENS system are:

- Double sensitivity over all other currently available fiber optic transmissive interferometers.
- Extra sensitivity allows cable to be installed in conduit with minimal impact on performance.
- 500 kHz bandwidth, an unprecedented wide frequency bandwidth, which covers the low range associated with TPI events and the very high range (ultrasonics) associated with early leak detection (nearest competitor has 20kHz).
- Seven configurable (physical) levels of sensitivity at any point along the same cable in order to optimize its performance in different field conditions.
- Dedicated, integrated hardware using FPGA and DSP microprocessors (i.e., faster, more reliable, more robust, lower power consumption) - not based on commercial computers, no cooling required.
- Advanced processing software operates automatically for minimizing nuisance alarms.
- Ultra-high speed data acquisition and real-time automated processing simplifies operation, significantly reduces amount of data produced (KB/MB vs GB/TB) and enables more events to be simultaneously processed – reducing computing power and post-processing requirements.
- Extra fibers in the cable can be used for variety of extra singlemode fiber functions, such as telecommunications, SCADA, CCTC transmission, PIDS integration, etc.
- Significantly lower cost, aim to be at least 30% less than the nearest similar competitive product.

Technical Specifications

Alarm Processing Unit (APU)

- Dimensions: 5.25" x 16.5" x 22" Weight: 12kg
- Power requirements: 80-100 W
- Number of channels: 1
- Maximum monitoring range: 50 km with 11 db maximum optical loss
- Detection is realized within a very broad frequency bandwidth from quasi-DC to 500KHz including those of leaks and all possible TPI events
- Hardware platform: dedicated reprogrammable FPGA and DSP chips
- Programming input: firmware upgrading via TCP/IP
- Real-time self-calibration of optical system keeps system in optimum operating condition
- Operating temperature range of 0-50°C – no air-conditioned rack is required

Fiber-Optic Cable

- Type of sensor cable: single-mode, providing seven different levels of actual physical sensitivity of the cable in order to optimize system performance for different ground and environmental conditions
- More sensitive than traditional cable, permitting use of protective jackets and conduits without affecting required sensitivity
- Robust design includes protection against insects and rodents
- Sensing cable length per APU: MIN 500 m, MAX 50 km
- Maximum passive lead-in length per APU: unlimited to maximum range
- Maximum number of zones: unlimited, software adjustable
- Flexible unlimited zonal configuration, permitting flexibility in sensitivity for every zone
- Smaller diameter of cable and robust protective jackets permit additional installation flexibility and convenience

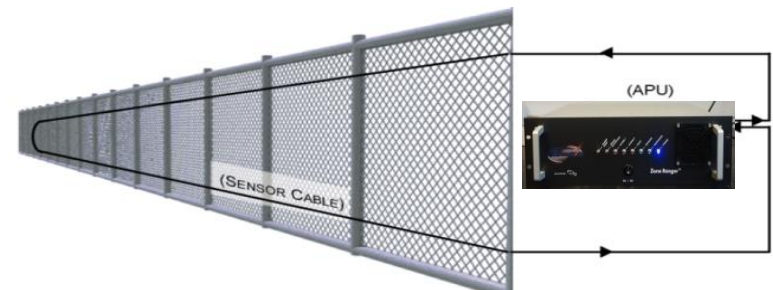
Perimeter Intrusion Detection Systems (PIDS)

- SECSSENS fiber optic PIDS offers proprietary and highly advanced security systems available for the detection of intrusion attempts
- Requires no power to the sensor in the field
- Very high rates of detection (typically >95%)
- Low false alarm rate (typically <3%)
- Can protect perimeters up to 50km in length with a single controller
- Locates an intrusion to within ± 10 meters

The sensor cable is deployed as an intrusion detection barrier along a site perimeter. The Alarm Processing Unit (APU) can be located many kilometers from the sensor cable, with a completely insensitive lead-in.

Common barriers Include:

- chain link and weld mesh fences, ornamental fences
- anti-climb fences, walls, rooftops, walls
- the sensor cable can also be buried covertly in approved media

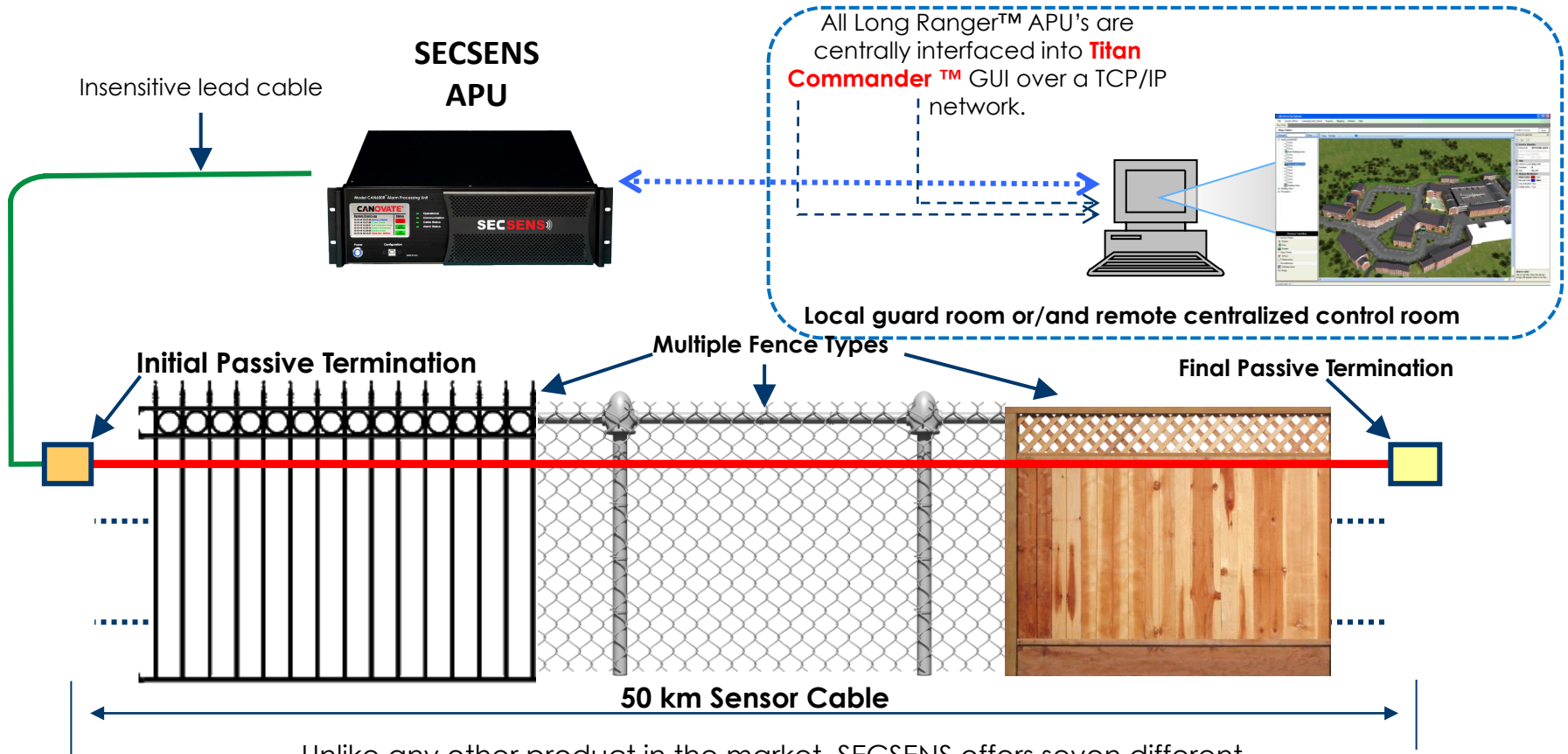




Wall Installation

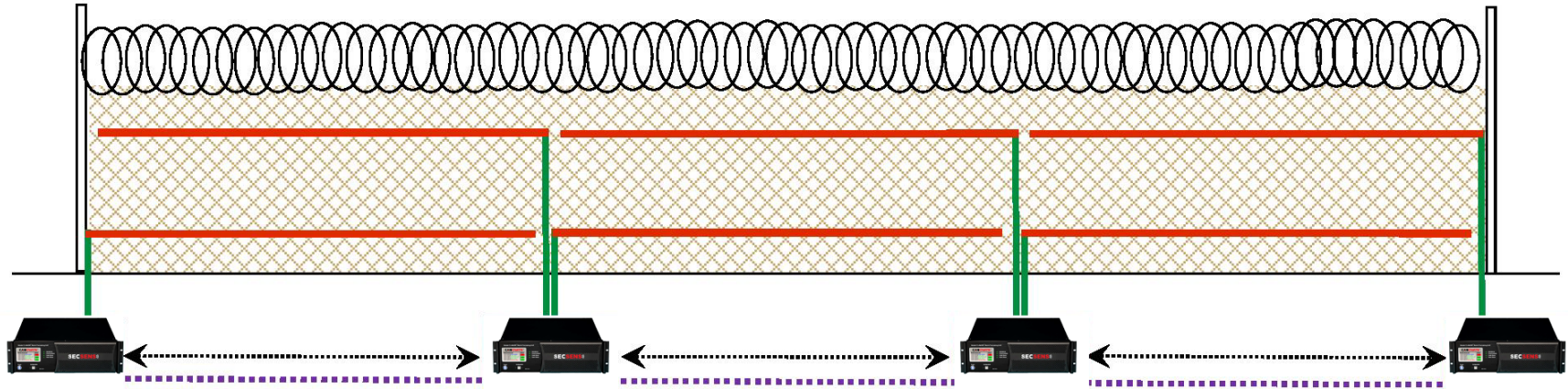


FLEXIBILITY FOR COVERING VARIOUS BARRIERS FROM ONE SYSTEM



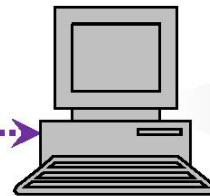
Unlike any other product in the market, SECSSENS offers seven different physical levels of sensitivity along the cable. This unique and patented ability is not performed by software.

Redundant Configuration



APU's (spaced 50 km apart)

APU's are centrally
interfaced into Titan Commander™
GUI over a TCP/IP network.



Titan Commander™
(PC on LAN)



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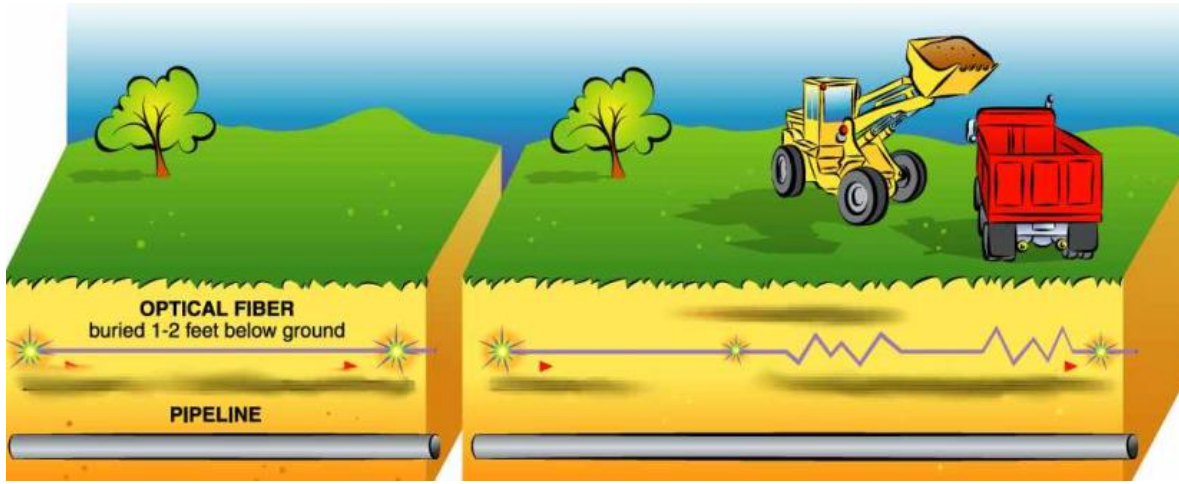
**Fiber Optic Pipeline
Monitoring and Security
Systems**

The oil & gas industry is currently facing a serious challenge in assuring spill and accident free operations of pipelines and associated infrastructure. To help meet the challenge of a zero incident target, the oil & gas industry must improve its technologies and ability to monitor their systems for safety in real time – permanently and distributed along the length of the pipeline network.

Fiber optic pipeline monitoring and security products are designed to provide an automated, real-time pipeline monitoring solution for prevention and corrective control of the most undesirable and dangerous events that can occur to pipelines, such as leaks and third party interference (TPI).

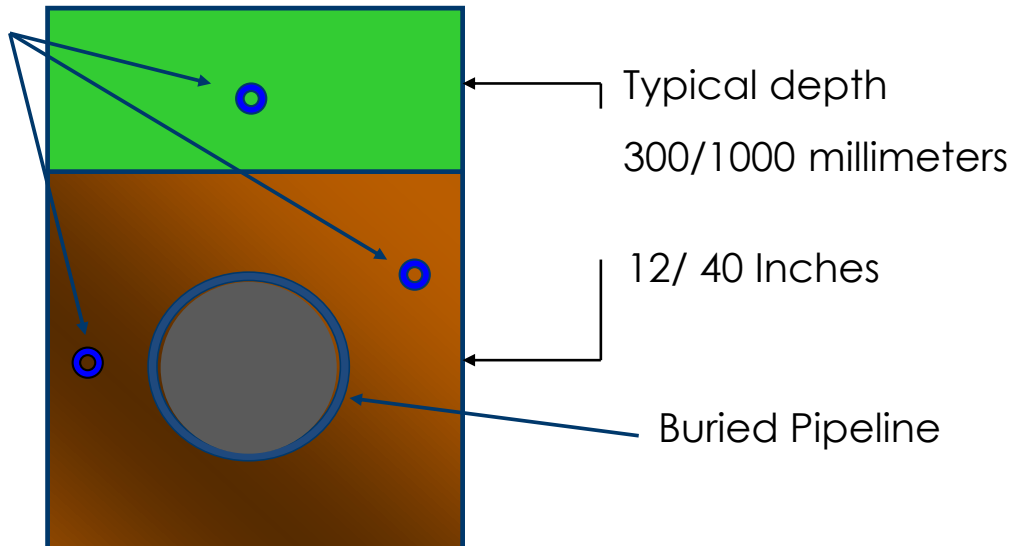
These systems are designed to protect oil/gas/liquid pipelines and utility right of way corridors against TPI, including illegal tapping and unauthorized excavation, by providing an early warning of these TPI activities – it is a preventative solution.

The ability to detect small leaks is a further advantage offered by fiber optics.



Surface activities are detected by the highly sensitive buried sensor cable.

Location of cable is variable.
Three optional locations shown. Only one cable is required.



SECSENS is a real-time, fully automated preventative monitoring solution for detection of third party interference (TPI), geo-hazard activity and leaks.

The ability to detect small leaks is a unique advantage offered by SECSENS.



**DVS ARE USED FOR EARLY DETECTION AND
LOCATION OF LEAKS, GEOHAZARDS OR TPI.**
APPLICATIONS INCLUDE:

- **Monitoring systems for Onshore pipelines**
- **Monitoring systems for Offshore pipelines**
- **Riser Integrity Monitoring solutions**
- **Downhole Wireline Monitoring solutions**

SECSENS

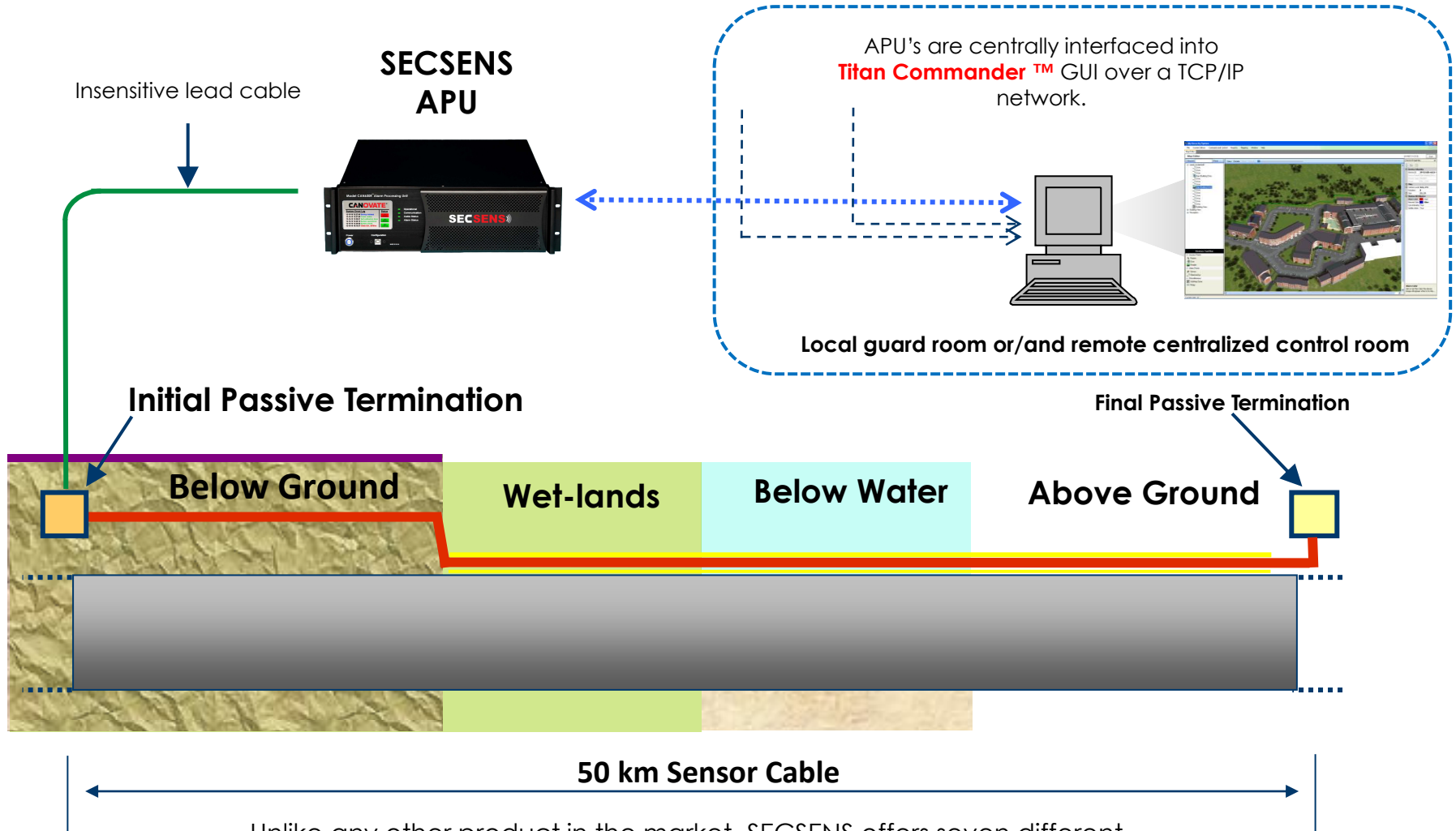
A New Generation Fiber-Optic
TPI and Leak Detection System
for Pipelines

Canovate Group has a unique Distributed Vibration Sensor (DVS) system that is effective in the prevention of oil or gas spills due to its unique ability to detect, locate and classify vibrations caused by physical activity (such as third party interference), while simultaneously monitoring for early-stage leaks, along the entire length of the pipeline in real time.

This unique technology acts as a continuous microphone, up to 50km in length, designed to “monitor” over an unprecedented quasi-DC to 500kHz bandwidth, to very distinctive frequencies generated by acoustic TPI and ultrasonic leak events, while discriminating between normal and ambient conditions.

This is by far the widest frequency bandwidth available for any distributed fiber optic sensing technology, and is the world's first distributed fiber optic ultrasonic sensor. Consequently, this technology is capable of monitoring far beyond the normal frequency bandwidth of conventional DAS systems, which are typically <2kHz for a 40km reach. Another significant differentiating advantage of this transmissive, hybrid interferometer technology is that its frequency response and location resolution/accuracy are not degraded with increasing distance, unlike conventional DAS systems.

The system has been undergoing independent field testing for the past 5 years on a number of operational pipelines, including a permanent installation in New Jersey, USA. The SECSSENS system has also undergone independent testing in a JIP leak detection program.



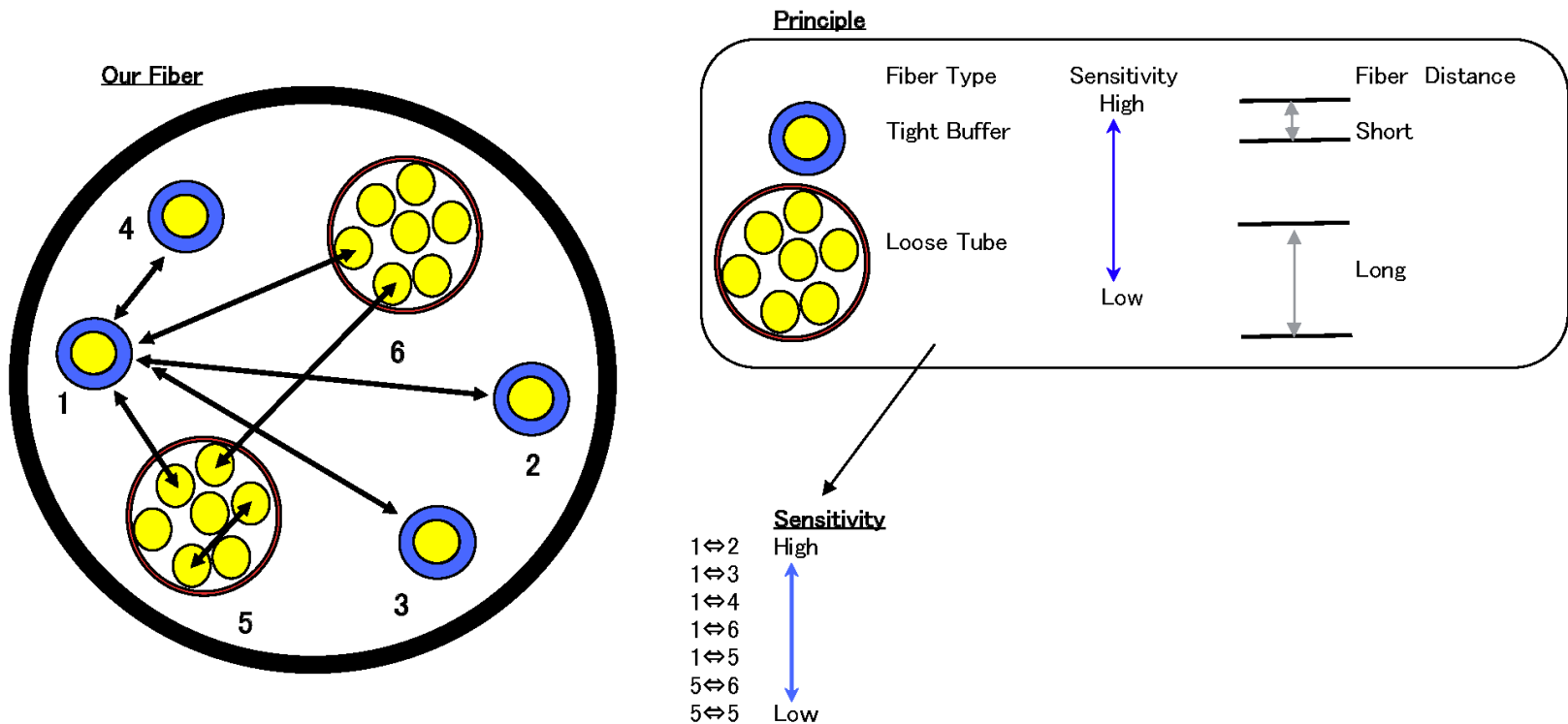
Unlike any other product in the market, SECSSENS offers seven different physical levels of sensitivity along the cable. This unique and patented ability is not performed by software.

The world's first locating, ultrasonic distributed vibration sensor (DVS) !

- **SECSSENS** has an unprecedented frequency sensitivity from quasi-DC to 500kHz throughout all distances up to 50km.
- It possesses a very significant capability by acting as a continuous microphone designed to “monitor” over a quasi-DC to 500kHz bandwidth, to very distinctive frequencies generated by TPI and leak events, while discriminating between normal and ambient conditions.
- TPI events occur in the low frequency range of quasi-DC to 5kHz.
- Leaks of interest occur around 80kHz for gas pipelines and around 40kHz for oil/water pipelines, when the leak is small (pin-hole leak). As the hole increases in size, the frequency lowers to a point where audible sound is made and physical vibrations can be felt.
- All currently available, competing fiber optic based technologies are limited to a 10-20kHz range, which makes it impossible to detect early, small leaks of pipelines.
- The **SECSSENS** technology, with its 500kHz bandwidth, is uniquely capable for early leak detection (prior to audible sounds and physical vibrations being generated).

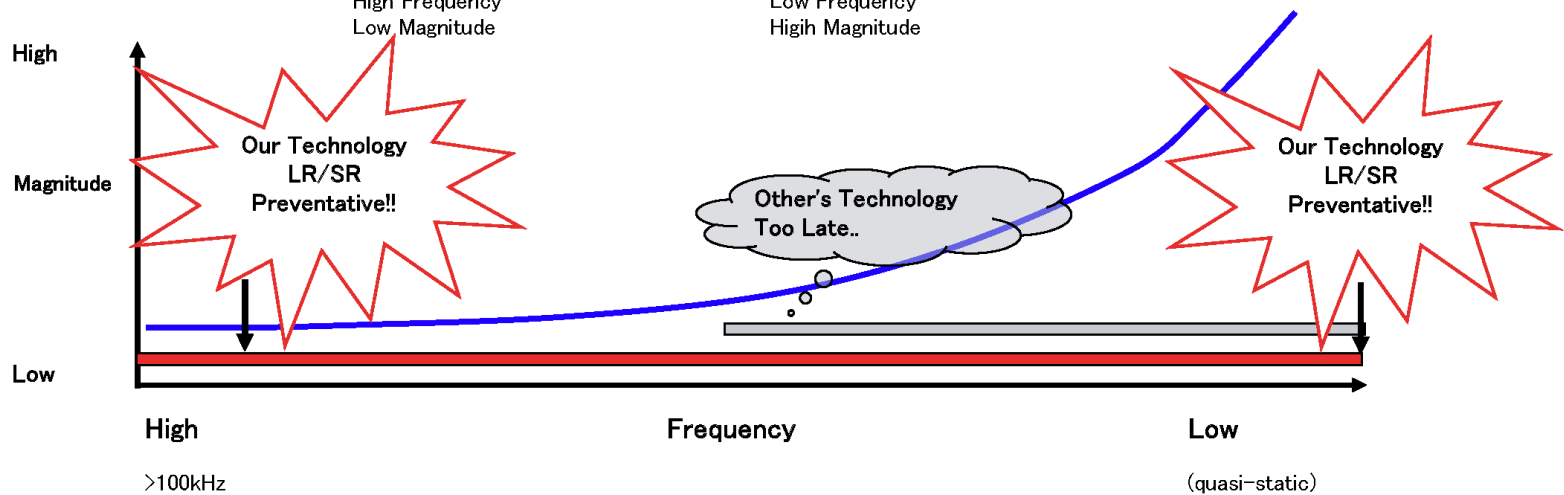
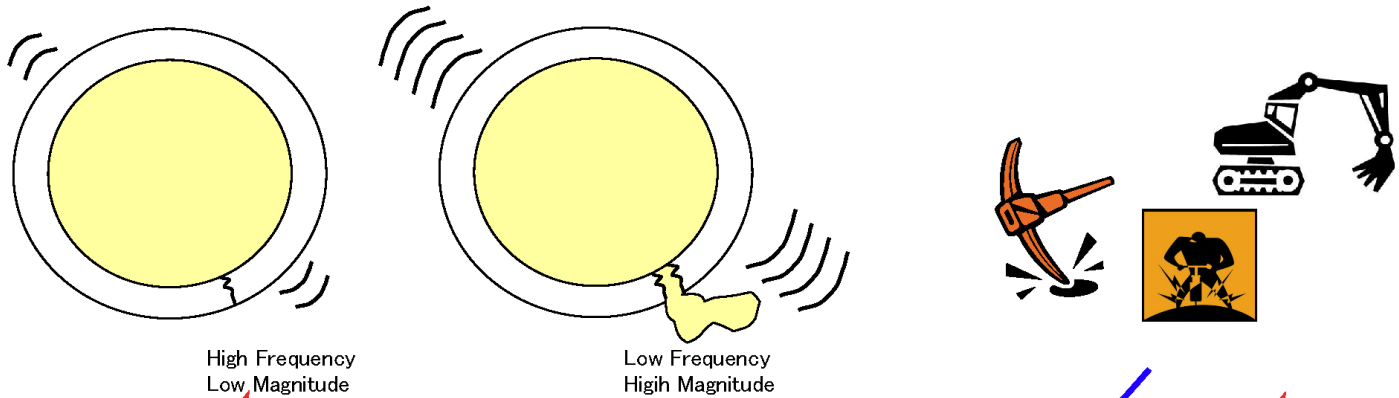
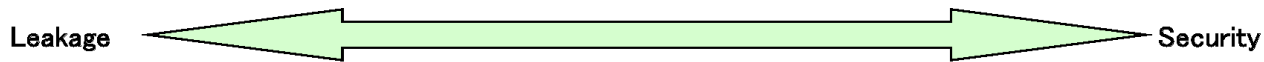
Unlike any other product in the market, SECSSENS offers seven different physical levels of sensitivity along the cable in order to optimize its performance in different conditions. This unique and patented ability is not performed by software.

Sensitivity adjustments are made by changing the combinations of fiber coatings, tubing and distance.



SECSSENS WIDE-BANDWIDTH CAPABILITY

- 1. Leaks can be detected from the high frequencies at the cracking stage.
- 2. Third Party Interference (TPI) detection is detected from the low frequency signals.



SECSSENS – at 50km – frequency bandwidth of 3Hz to 500kHz

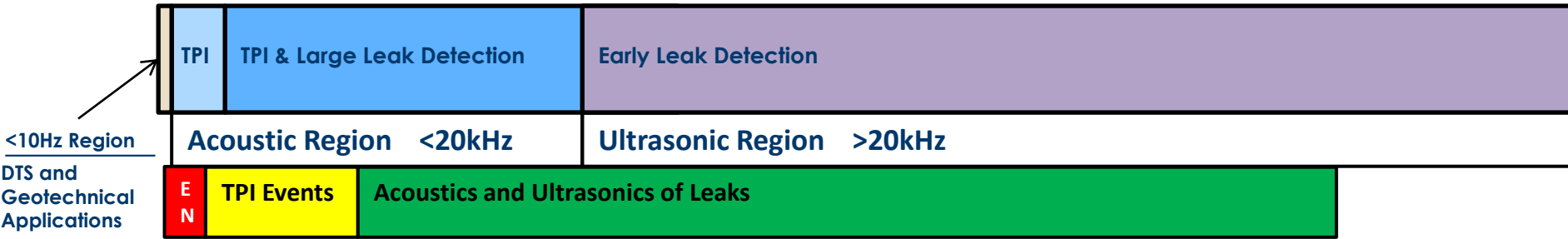


Other transmissive Technologies – at 40km – maximum frequency bandwidth of 20kHz

DAS Technologies – at 1km – typical maximum frequency bandwidth of 10kHz

DAS Technologies – at 40km – typical maximum frequency bandwidth of <2kHz

✗ DTS/DSS Technologies



<10Hz Region
DTS and Geotechnical Applications

Environmental Noise



- High **sensitivity** along the **whole cable**



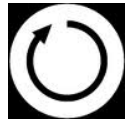
- Monitors **both** TPI **and** geo-hazard activity



- Detects **small leaks** with world's only **ultrasonic** capability



- Can operate in **different environmental conditions**



- Advanced processing software operates **automatically**



- System operates in **real-time**, no post-processing



- Significantly **reduced amount of data** (KB/MB vs GB/TB)



- Significantly **lower cost**

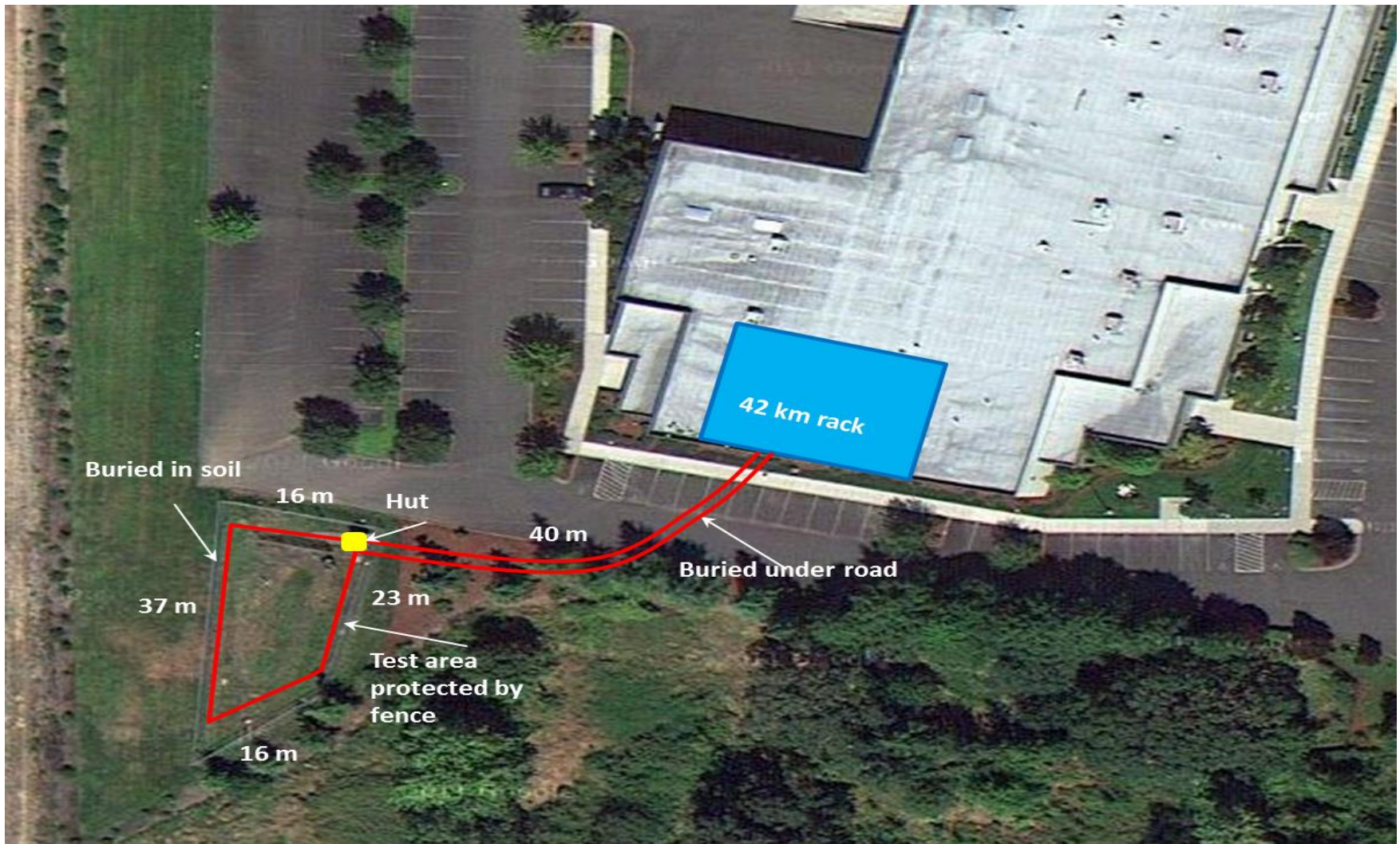
DVS and DTS technologies offer great synergy for pipeline monitoring when they are integrated into a single, complete solution:

- DTS and SECSSENS DVS technologies are complimentary, rather than competing.
- DTS technologies measure static or very low frequency changes in temperature.
- In the case of Brillouin-based, long distance sensing systems (Brillouin DTS/DSS), measurement of static or very low frequency changes in strain are also possible.
- DTS systems are particularly useful for detection of leaks by measurement of temperature differentials and geotechnical applications (ground movement/settling, soil stability/erosion, pipeline deformation, integrity monitoring, etc.).
- The SECSSENS DVS technology effectively detects vibrations associated with ROW third party intrusion and has the ability to detect ultrasonic signals such as the ones associated with most pipeline leakages.

DVS and DTS technologies offer great synergy for pipeline monitoring when they are integrated into a single, complete solution:

- The combination of DTS and DVS offers a system with a secondary and validating approach, as well as redundancy. This is important when a response to often remote areas is required.
- A DVS/DTS combination offers a comprehensive and cost-effective pipeline monitoring solution that provides efficient, real-time third party intrusion, leak detection and ground movement monitoring capabilities over long distances.
- In the case of pipeline leak detection, a combined DVS/DTS system could work to detect, verify and monitor a leak and its progression more effectively and reliably than a single technology solution.

42KM TEST SETUP IN OFFICE, OREGON



DISTRIBUTION PIPELINE GAS LEAK DETECTION INDEPENDENT STUDY 2016

APPLICATIONS

Gas pipelines to get fiber-optic monitors

11 Jan 2017

Southern California Gas to install technology on all new and replacement pipelines to detect leaks and damage.



Pipeline sensor

The **Southern California Gas Company (SoCalGas)**, part of the giant energy giant, is installing fiber-optic lines along all of its new and replacement gas pipelines, in order to help prevent pipeline damage and leaks.

Believed to be one of the first gas utilities in the US to use the photonics technology, that it will send early warning of pressure changes or vibrations that might indicate a leak.

[http://optics.org/news/8/1/18\[1/19/2017 3:54:22 PM\]](http://optics.org/news/8/1/18[1/19/2017 3:54:22 PM])

SoCalGas to Use Fiber Optic Technology to Monitor Pipelines in Real Time

One of the first natural gas companies in U.S. to deploy advanced early warning sensors



NEWS PROVIDED BY
Southern California Gas Company →
Jan 10, 2017, 18:03 ET

LOS ANGELES, Jan. 10, 2017 /PRNewswire/ -- Southern California Gas Company (SoCalGas) today announced the company will be one of the first natural gas utilities in the United States to incorporate innovative fiber optic cable technology to detect impacts and leaks along its transmission and high-pressure pipeline system.

The technology uses fiber optic strands to transmit data across long distances, and can send early warning of pressure changes or vibrations that could indicate a leak or an impact to the gas line. The technology quickly detects when abnormal stress, movement or temperature conditions are present. Continuous monitoring and measurement will help the company quickly identify threats to a pipeline from heavy equipment operation, unexpected earth

SoCalGas to Use Fiber Optic Technology Monitor Pipelines in Real Time

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SOURCE Southern California Gas Company

One of the first natural gas companies in U.S. to deploy advanced early

LOS ANGELES, Jan. 10, 2017 /PRNewswire/ -- [Southern California Gas Company](http://www.prnewswire.com/news-releases/socialgas-to-use-fiber-optic-technology-to-...) announced the company will be one of the first natural gas utilities in the United States to incorporate innovative fiber optic cable technology to detect impacts and leaks along its transmission and high-pressure pipeline system. <http://www.prnewswire.com/news-releases/socialgas-to-use-fiber-optic-technology-to-...> 1/20/2017

The technology uses fiber optic strands to transmit data across long distances, and can send early warning of pressure changes or vibrations that could indicate a leak or an impact to the gas line. The technology quickly detects when abnormal stress, movement or temperature conditions are present. Continuous monitoring and measurement will help the company quickly identify threats to a pipeline from heavy equipment operation, unexpected earth movement, or physical impact. When a threat is identified, information will be sent within seconds along the fiber cable to a remote monitoring station. The system can pinpoint where a potential problem may be developing within 20 feet.

The system can prevent pipeline damage from unauthorized construction work, geologic conditions or other physical changes like structural stress from broken water mains. It can also

