

Monitoring Borders with NITRO Fiber Sensing

The Problem

Border protection presents a unique set of challenges, particularly when it comes to monitoring vast and remote areas. Traditional surveillance systems such as CCTV cameras, motion detectors, and patrol units are often expensive, limited in coverage, and require significant infrastructure and maintenance. These systems struggle to provide continuous, real-time monitoring across long distances, especially in harsh environments or isolated regions.

CCTV systems, for example, require power sources, data transmission infrastructure, and regular maintenance. Their effectiveness is also limited by visibility conditions and camera placement, leaving blind spots that can be exploited. Additionally, deploying personnel to monitor these systems or patrol remote areas is both costly and logistically complex.

In regions where terrain is rugged or access is limited, the need for a scalable, cost-effective, and reliable monitoring solution becomes critical. Border agencies require technology that can detect and localize threats such as unauthorized crossings, tunneling, or vehicle movement without the prohibitive costs and limitations of traditional systems.

The Solution – VIAVI NITRO® Fiber Sensing

VIAVI NITRO Fiber Sensing technology offers a transformative solution to the challenges of border monitoring. This system leverages distributed acoustic sensing (DAS) to convert standard fiber optic cables into intelligent sensors capable of monitoring vast distances in real time.

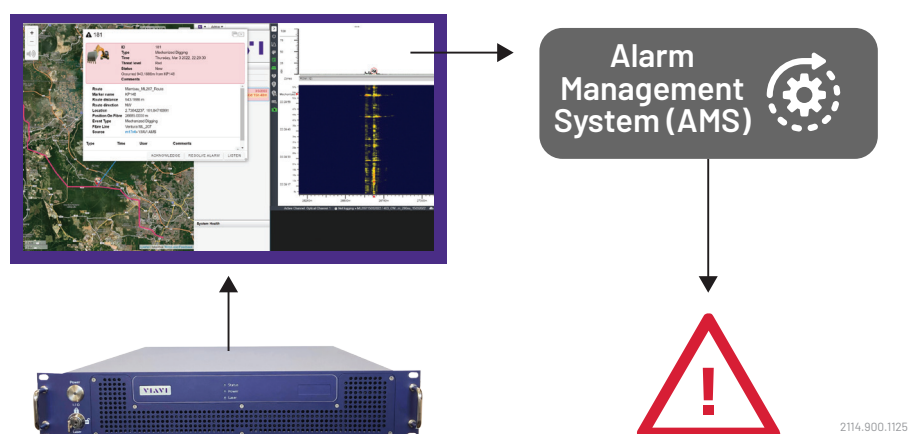


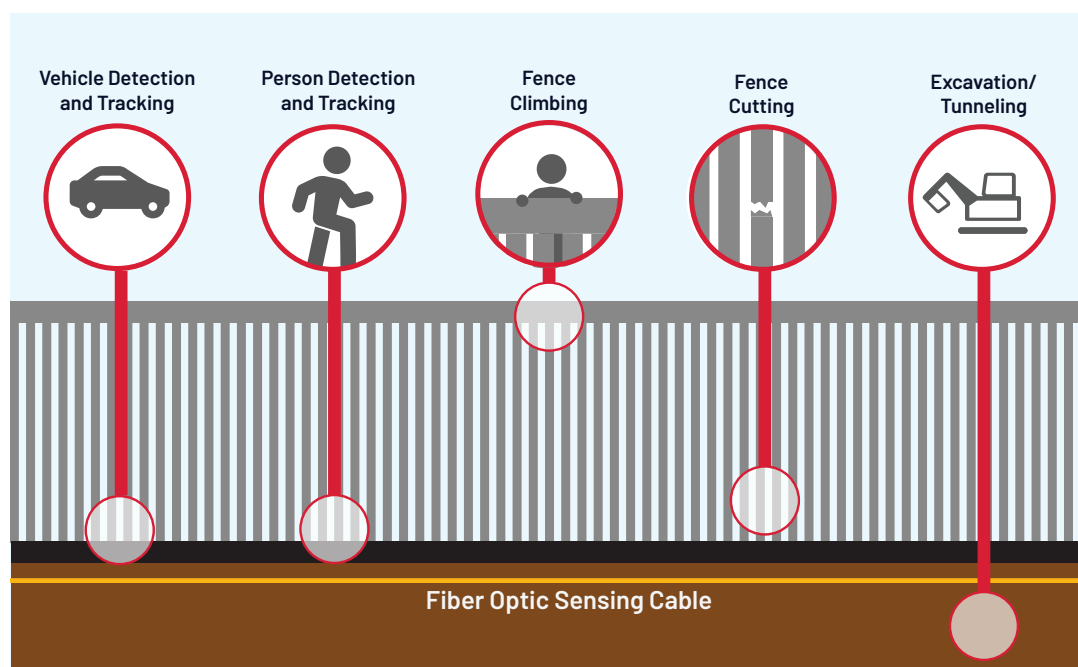
Figure 1. FTH-DAS test head connects to an existing fiber along the border. Real time sensing includes an alarm management system (AMS) that integrates to various security protocols.

By deploying fiber optic cables along border perimeters, NITRO Fiber Sensing enables continuous detection of acoustic vibrations generated by people walking or climbing fences, vehicles, and excavation and construction activity. These signals are recorded by remote fiber test heads (FTHs), which act as interrogators of the fiber. An alarm management system (AMS) takes care of analyzing data and providing precise location information, often within a couple of meters, of any detected activity.

Key capabilities include:

- Detection of people and vehicles
- Intrusion alerts for fence cutting, climbing, or tunneling
- Real-time monitoring of remote and inaccessible areas
- Integration into other systems including drones, CCTV, and other security notification systems
- Scalable deployment over hundreds of kilometers

Unlike traditional sensors, fiber optic sensing does not require power along the entire monitored length. The fiber itself acts as the sensor, dramatically reducing infrastructure and maintenance costs. The system is passive, immune to electromagnetic interference, and highly resilient to environmental conditions.



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Figure 2. Example of events detected by NITRO Fiber Sensing within border environments.

The Value

The adoption of VIAVI NITRO Fiber Sensing for border protection delivers significant value in terms of cost efficiency, coverage, and operational intelligence.

Lower Cost of Ownership

Traditional surveillance systems require extensive hardware, installation, and ongoing maintenance. In contrast, fiber sensing uses existing or newly laid fiber optic cables, minimizing the need for additional infrastructure. The centralized monitoring approach reduces labor costs and simplifies operations.

Comprehensive Coverage

Fiber sensing can monitor tens to hundreds of kilometers continuously, eliminating blind spots and providing uniform sensitivity across the entire length. This is especially valuable in remote or rugged terrain where deploying conventional sensors is impractical.

Real-Time Intelligence

Operators receive instant alerts with precise location data, enabling rapid response to threats. These in turn can be integrated to other systems within the control room. This proactive capability helps prevent unauthorized access, enhancing national security and reducing risk.

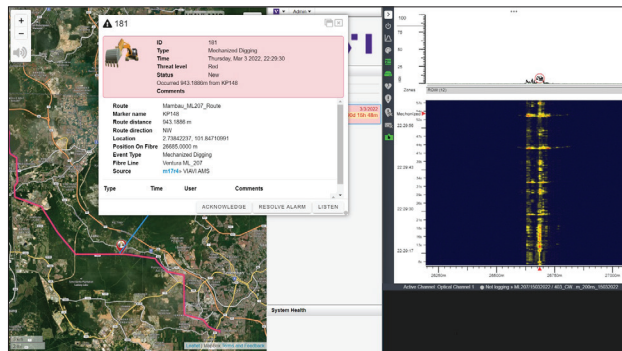


Figure 3. Events detected by the fiber generate alarms that are sent to control rooms where they are integrated with other surveillance technologies including drones, CCTV, etc.

NITRO Fiber Sensing supports compliance with critical infrastructure protection regulations and ensures robust monitoring even in adverse conditions. Its passive nature and high reliability make it ideal for long-term deployment.

VIAVI NITRO Fiber Sensing redefines border protection by offering a scalable, cost-effective, and intelligent solution. It replaces costly, maintenance-heavy systems with a resilient technology that delivers real-time insights across vast distances, empowering border agencies to protect national boundaries with unprecedented efficiency and precision.



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