

Distributed Acoustic Sensing (DAS) for Perimeter and Border Security

Protecting critical infrastructure, national borders, and high-security facilities requires continuous situational awareness across large and often remote areas. Traditional perimeter security technologies such as IR beams, microwave, radar, cameras, and point sensors can leave gaps in coverage, generate nuisance alarms, or require significant maintenance and infrastructure.



Distributed Acoustic Sensing (DAS) using optical fiber technology provides continuous, real-time intrusion detection and activity monitoring over long distances using fiber as a distributed sensor.

By detecting and classifying acoustic and vibration signatures along the full length of a protected boundary or corridor, DAS provides an intelligent and scalable solution for modern perimeter and border security.

Key Challenges

- Long boundaries requiring continuous coverage
- Remote or difficult terrain with limited infrastructure
- Unauthorised crossings or intrusion attempts
- Excavation or tunnelling activity
- High false alarm rates from conventional technologies
- Need for rapid detection, classification, and response
- Limited personnel available for continuous patrol and monitoring

DAS Technology Overview

Distributed Acoustic Sensing (DAS) transforms a standard telecoms optical fiber into a continuous distributed vibration and acoustic sensor.

A DAS control unit sends laser pulses through the fiber cable and analyses coherent backscatter (typically Rayleigh-based) to detect disturbances and events along the sensing cable.

Key Benefits

- Continuous monitoring up to hundreds of kilometres
- Real-time event detection and localisation
- Location accuracy to just a few metres or preset zone
- Passive sensing element with no requirements for power in the field
- Immune to electromagnetic interference
- Single fiber providing sensing over large areas

System Architecture

A typical DAS perimeter security system includes:

Fiber optic sensing
cable deployed
along fences,
buried corridors,
or protected
boundaries

Installation approaches:

- Fence-mounted sensing
- Buried cable detection
- Border corridor monitoring
- Perimeter and buffer zone protection

Event analytics platform for
detection, classification, and
alarm management

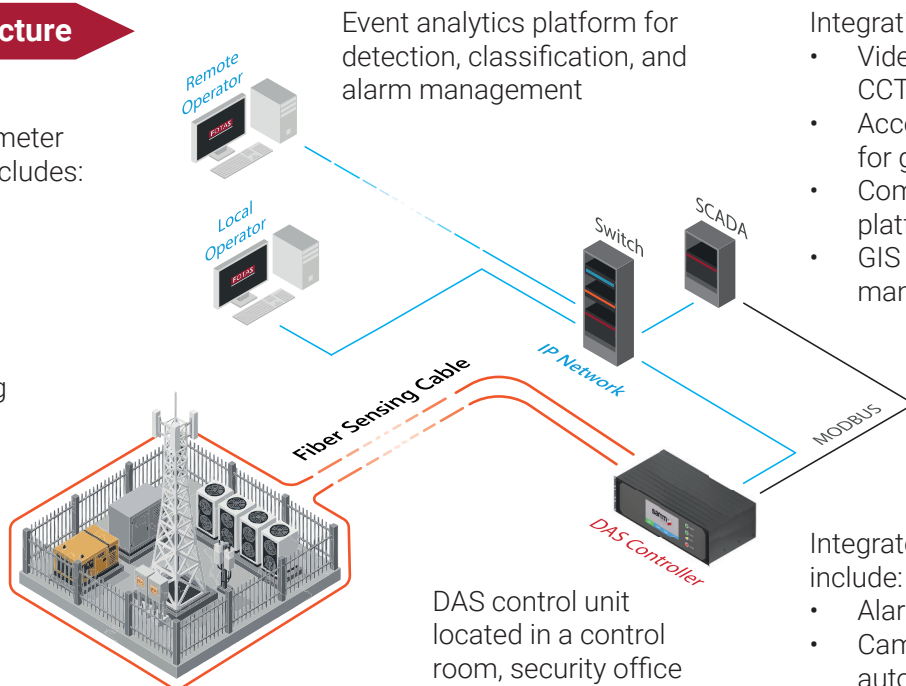
Integration interfaces

- Video surveillance and CCTV systems
- Access control systems for gates
- Command-and-control platforms
- GIS and security management software

DAS control unit
located in a control
room, security office
or field shelter

Integrated responses may include:

- Alarm generation
- Camera cueing and automated tracking
- Security or drone dispatch
- Threat escalation workflows
- Event visualisation and recording



Key Factors for Successful Deployment



Fiber Deployment Strategy

- Fence-mounted deployment for direct intrusion sensing
- Buried deployment for covert detection
- Corridor deployments for wide-area monitoring
- Hybrid approaches for layered protection



Cable Selection

- Mechanical durability
- Environmental suitability
- Sensitivity requirements
- Long-term deployment conditions



System Design

- Alarm zoning strategy
- Event classification tuning
- Redundant architectures for critical sites
- Integration with broader security concepts of operation

Key Applications

Critical Infrastructure Perimeter Security

- Data centres
- Utilities and substations
- Airports and seaports
- Oil and gas facilities
- Military and government installations
- Industrial plants and storage facilities
- Borders and boundaries

Detectable events may include:

- Fence climbing, cutting, lifting or tunnelling
- Approaching the perimeter
- Vehicle approach
- Tampering activity
- Ground disturbance near protected zones such as digging activities

Border Security Monitoring

Supports surveillance in areas where traditional technologies may be difficult to deploy. For national borders and remote security corridors, DAS can provide:

- Continuous intrusion detection over long distances
- Detection of foot traffic and vehicle movement
- Identification of crossing attempts
- Monitoring in difficult or remote terrain



Anti-Tunnelling and Underground Disturbance Detection

Particularly relevant for border protection and high-security installations. DAS can support detection of:

- Digging activity
- Tunnelling attempts
- Excavation near protected boundaries

Virtual Fence and Covert Detection Applications

Unlike visible security barriers, DAS can support covert buried detection zones where:

- Physical fencing is impractical or non-existent
- Hidden monitoring is preferred
- Existing fiber routes can support distributed sensing

Event Classification and Intelligent Detection

Advanced DAS analytics can distinguish between:

- Human activity
- Vehicle movement
- Digging and excavation
- Environmental noise (wind, rain, wildlife)
- Benign versus threat events

Key Benefits



Continuous monitoring over long distances with real-time detection and localisation



Scalable architecture for small sites to national borders



Reduced false alarms through event classification



Coverage in remote and difficult terrain



Low field infrastructure requirements



Integration with layered security systems



Higher operator confidence and swifter decision-making