

DISTRIBUTED ACOUSTIC SENSING (DAS) TECHNOLOGY EMPLOYED TO TACKLE OVERHEAD POWER LINE THEFT



The Scenario

Bandweaver's Distributed Acoustic Sensing (DAS) Horizon technology was used as an Overhead Distribution Line Theft and Tampering Prevention System for EDESUR at a substation in Santo Domingo in the Dominican Republic.

Tampering and the theft of materials on electrical distribution and transmission lines is a major problem for utilities worldwide in both urban and rural areas. Electricity theft and other non-technical losses now total over \$96 billion a year. This results in higher energy prices to customers, and often necessitates costly government subsidies.

Client Requirements

EDESUR was interested to investigate how fiber optic sensing could provide a cost-effective technology that can constantly monitor these assets and provide an instant alert if tampering or theft occurred along the route, immediately notifying security personnel exactly which pole (location) was involved. This would provide cost-savings in terms of lower theft losses, and reduced costs associated with outages and the associated manpower allocation.

The system was required to:

- Identify tampering and energy theft on overhead lighting and distribution poles that were connected via a fiber optic cable
- Detect each intrusion with precision (to the nearest pole)
- Demonstrate the system's cost effectiveness and instant alert notification

Monitored | Secured | Safe

What Did We Do?

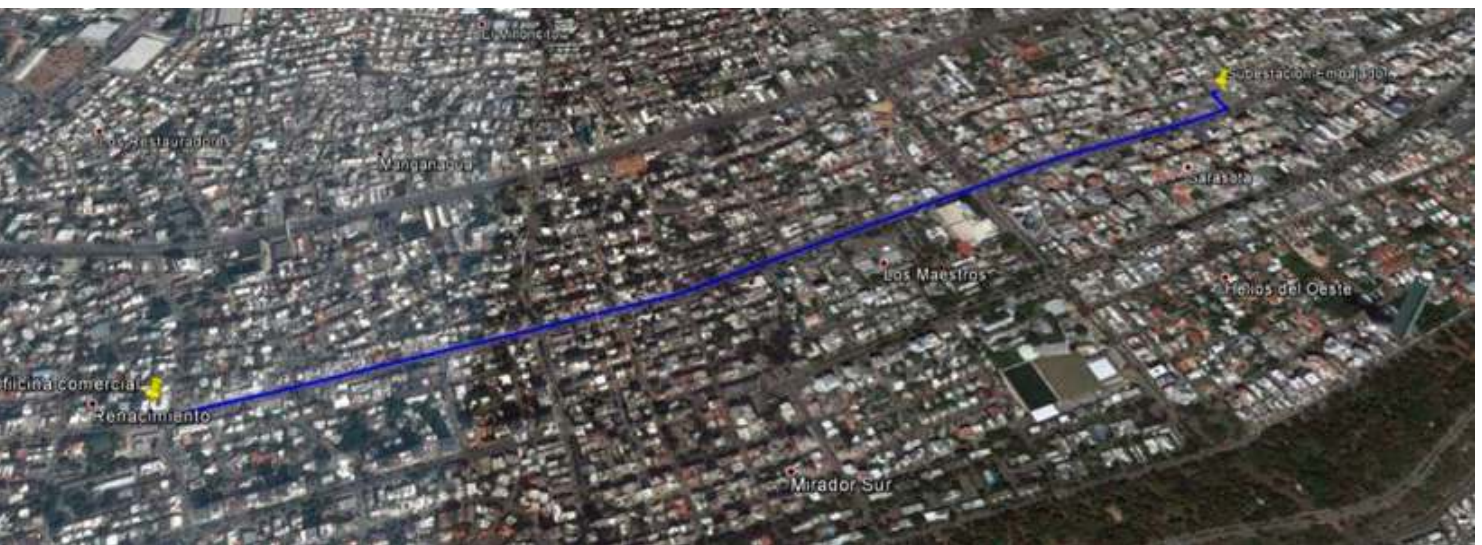
The proposed solution was the Bandweaver Horizon DAS system which utilizes a standard fiber optic cable connected to the poles being monitored.

Working with its local partner in the Dominican Republic, the SSS Group, Bandweaver used a Horizon Distributed Acoustic Sensor, which was connected to the EDESUR-supplied ADSS (All-Dielectric Self Supporting) fiber optic cable running from the substation onto the high street.

The Horizon DAS system is a compact, low-power, user-friendly device capable of monitoring fiber optic cables ranging up to 100km (50 km in each direction). It possesses inbuilt intelligent classification engines for accurate location of intrusion events with the capability of being tuned to minimize nuisance events and false alarms. It is the ideal

solution both as a Perimeter Intrusion Detection System (PIDS) and a Third-Party Interference (TPI) system and has been designed with safety in mind.

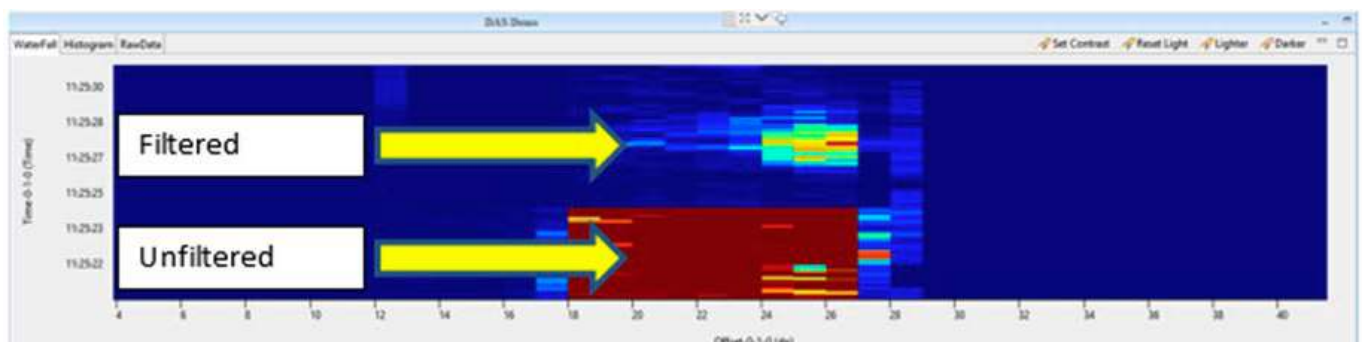
The demonstration site was located at the Embajador substation in the downtown area of Santo Domingo. EDESUR had already installed a short test section of the ADSS cable running out of the substation control room, through the adjacent grounds and onto the distribution poles that ran along Avenue Romulo Betancourt.



The Horizon unit was linked to the Comms rack in the substation and was monitored from within the control room.

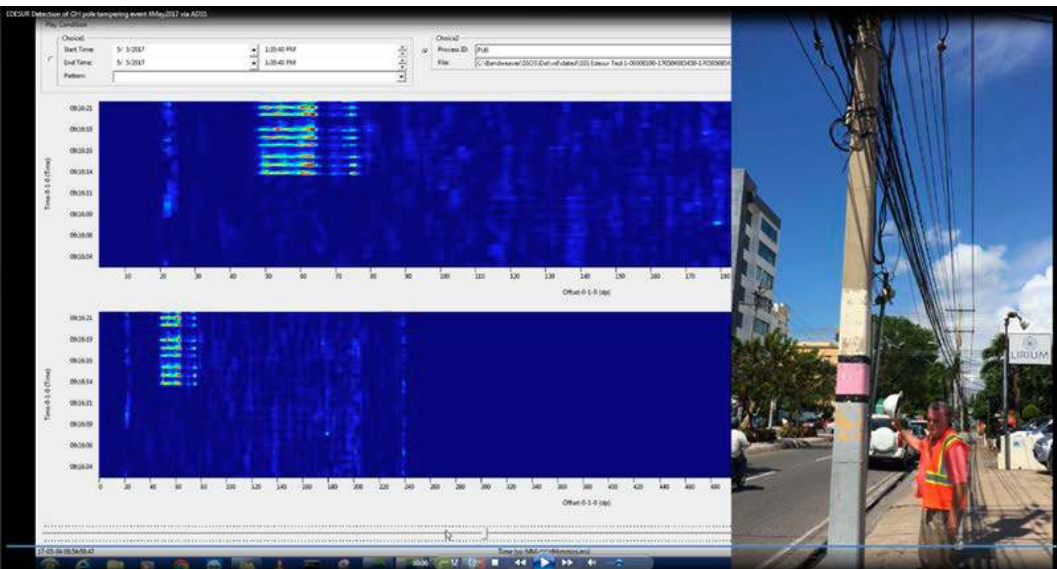
As there was a lot of traffic in the surrounding area, it was essential that the Horizon DAS system was able to filter out surrounding environmental noises to avoid unnecessary nuisance alarms.

The Horizon DAS was calibrated accordingly and it can be seen below how the data was filtered to block unwanted ambient noise but still allow underlying disturbances to the poles to be detected.



In order to qualify the system, EDESUR carried out a blind testing regime at random locations along the cable.

Each of the disturbances were seen and located by the Horizon DAS system.



Benefits to the Client

The Bandweaver DAS Technology Distributed Acoustic Sensing Systems demonstrated the following benefits in dealing with energy theft and tampering with overhead systems:

- Precision locating of disturbances and tampering along the route of the overhead poles. DAS Technology Distributed Acoustic Sensing Systems were able to detect intrusion and disruption of overhead power lines with complete precision in every instance.
- Can use existing fiber optic infrastructure (e.g. existing communications cable on the ADSS) – no additional investment in the external infrastructure.
- Provision of instant alerts to either the customer's existing SCADA or security systems for immediate action. Alerts can be broadcast to EDESUR personnel via email and SMS.
- Fiber optic is a passive, low maintenance solution which has no moving parts, does not rust or degrade and is immune to electromagnetic interference.

Overall, the Horizon DAS system provides a cost-effective solution to the problem of power theft and tampering with electricity lines. The entire route can be monitored for threats 24/7. Corrective action can be immediately taken by dispatching security to the exact location of a threat before any significant damage is done. There are applications available in both overhead and buried transmission and distribution systems as well as substation perimeter protection.



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