

Ensuring Successful and Uninterrupted Operations

Baku-Tbilisi-Ceyhan (BTC) Pipeline

The BTC pipeline, owned by The Baku-Tbilisi-Ceyhan Pipeline Company, is one of the longest crude oil pipelines in the world.

The pipeline covers a wide range of terrain, from the central Turkish highlands reaching elevations of 2,650m to the highly arable and populated Ceyhan/Seyhan valley.

The Turkish section of the BTC export system includes four pumping stations, two pigging stations, 52 block valve sites and the Ceyhan marine export terminal.

At a throughput of 1 Million barrels per day, ensuring successful and uninterrupted operations is of key strategic importance.

Securing the BTC with fiber optics

The OptaSense Fiber Optic Pipeline Monitoring solution was selected to monitor 1,770 km of the BTC pipeline on the Turkey section. The fiber optic system includes security monitoring to prevent incidents of theft or accidental damages. Security capabilities include include third-party intrusion and right-of-way monitoring.

Detecting a range of events

Shortly after the system was installed, the OptaSense pipeline monitoring system detected the approach of a vehicle, footsteps and periods of manual digging near the pipeline. The system raised an alarm, alerting operators to initiate and mobilize appropriate response mechanisms to the exact location of the incident. A significant impact to the environment and business operations were prevented.

Other successful episodes of damage prevention and operational efficiency includes:

- Hot tap attempt detected
- Telecommunication pylons construction detected on the right of way (ROW)
- Water irrigation canal construction detected on the ROW
- Successful pigging tracking for operational purposes

The system continues to demonstrate its performance in detecting and classifying events ranging from third party intrusion, agricultural and construction activities near or within the right of way corridor and seismic activity, as well as slack line and inline inspection tool tracking.



Background

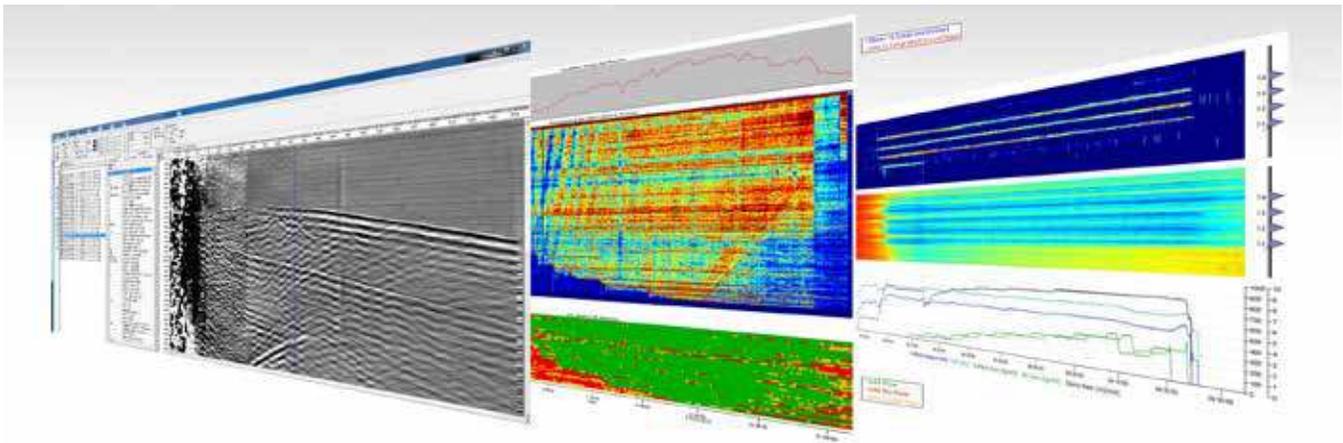
- BTC pipeline
- 1,770km of pipeline

Solution

- OptaSense Fiber Optic Pipeline Monitoring
 - Security Monitoring
 - Third-Party Intrusion
 - Right-of-Way
 - Theft Prevention
 - Slack Line and Inline Inspection Tool Tracking

Value Delivered

- OptaSense Fiber Optic Pipeline Monitoring has prevented incidents of theft and accidental damages
- Provided a single pipeline monitoring solutions that delivers
 - Security monitoring
 - Lower installation costs
 - Real-time, 24/7 peace of mind and security



Multiple measurements

The ODH-4 is a four laser interrogator. With four unique wavelengths, the ODH-4 not only provides superior imaging, it provides operators the opportunity to take full advantage of available DAS data by recording multiple measurements, such as fracture profiling and production flow monitoring, at the same time.

System performance

The ODH-4 provides robust system performance, including a variety of data outputs, enduring high-pressure, high-temperature conditions, and continuous performance monitoring.

- **Broad frequency range:** With a higher broadband frequency, the ODH-4 processing unit provides finer imaging at a sample rate of 200 kHz.
- **Robust operating range:** The ODH-4 is capable of enduring environmental conditions reaching 20,000psi and 300° C. OptaSense technology is robust, with more than 400 interrogator units operating in-field over the last 10 years at a nominal failure rate.
- **Real-time phase and amplitude coherent data:** The ODH-4 delivers DAS measurements with quantitative phase and amplitude output. Data can also be output in HDF5, SEG Y or SEG D formats.
- **Optimal recording:** The interrogator enables recording at every location along a single-mode or multimode optical fiber, including passive recording. For optimal measurements, the ODH-4 offers a system interface that leverages GPS to assign a spatial coordinate from surface to depth—ensuring microsecond accuracy across each segment of fiber.
- **Installation:** The unit fits a standard 19 inch rack mounting. It can be easily integrated with external devices, such as Distributed Temperature Sensing (DTS) and other downhole gauges, while providing a common time stamp and single display view.
- **Continuous performance monitoring:** The ODH-4 provides preventative features and alerts for critical events, including power failure, stop recording, fiber break and exceeded temperatures.

Real-time visualization and control

What sets our DAS technology apart is our understanding of the importance of operator control. In addition to acquiring DAS, OptaSense provides operators the ability to visualize and interpret their data, in real time.

The OptaSense DxS software suite provides an in depth analysis of acquired DAS data by applying processing algorithms, integrating large sets of distributed data, filtering critical data and enabling advanced workflows.

The software suite allows users to easily integrate large distributed data sets into workflows, including 3D depth, time and measurement data, while managing quality control, analysis and interpretation.

The DxS software is designed to handle industry standard distributed data sets, including:

- DAS
- DTS
- Time and depth live access server (LAS)
- Comma-separated values (CSV) data

So you can focus more on results, the suite down-samples larger data sets from terabytes to megabytes by allowing users to generate and extract filtered waterfall information. This software puts quality control in the hand of the operators, including verifying depth calibration, visualizing and qualifying generated results, and re-working data sets.

The software will also allow reprocessing and handling of large data sets by running proprietary algorithms and producing key metrics in industry standard data formats.