Case Study

SENSORNET COMBINED FIBRE OPTIC DTS & DAS PIPELINE MONITORING SYSTEM FOR DUQM REFINERY & PETROCHEMICAL PLANT
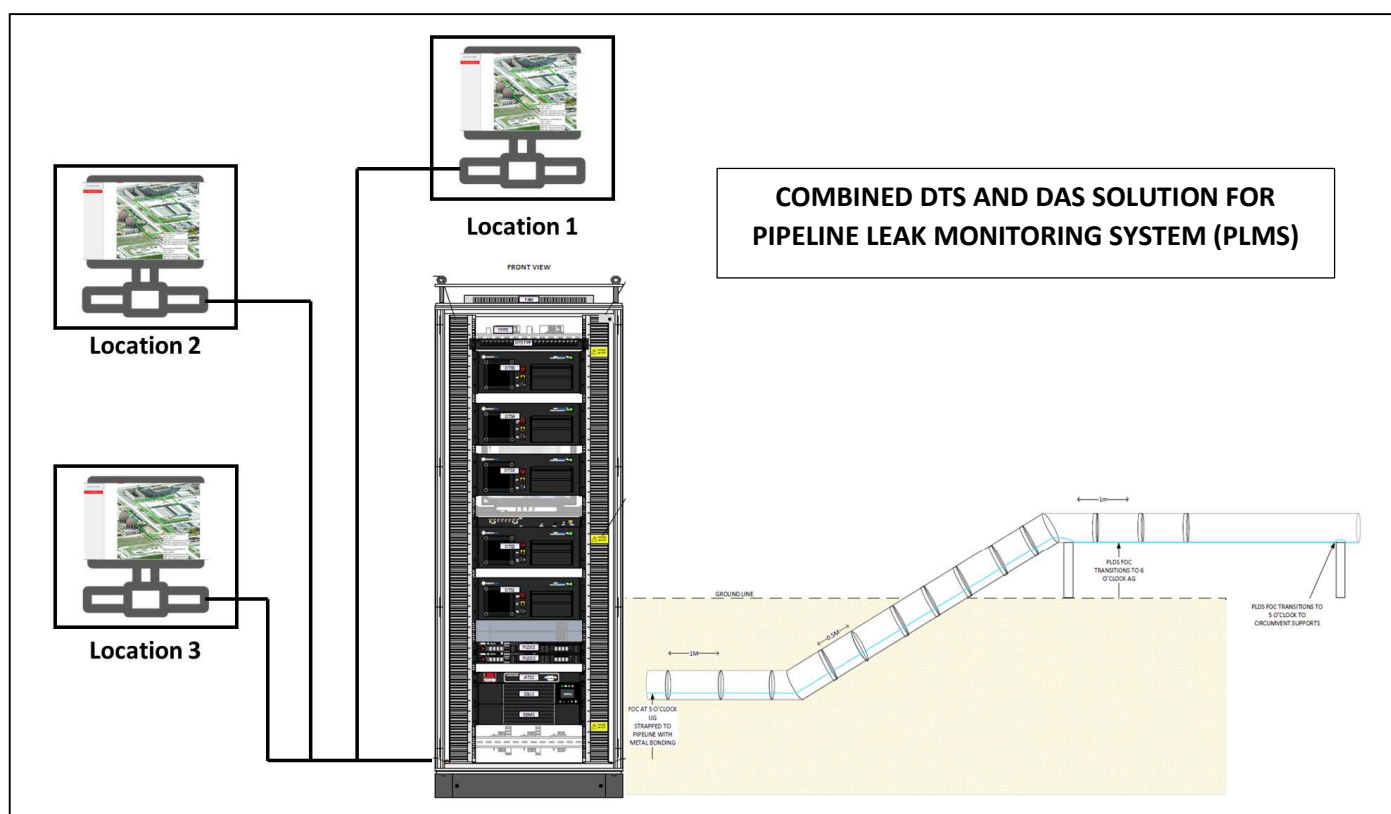

Fig1: Installation schematic

OVERVIEW

Duqm Refinery and Petrochemical Industries Company L.L.C is a Joint Venture (JV) between OQ and Kuwait Petroleum International (KPI) in Oman. Once completed, the refinery will have the capacity to process around 230,000 barrels of crude oil per day, producing diesel, jet fuel, naphtha and LPG as its primary products.

Petrofac and Samsung Engineering joint venture was awarded the contract by Duqm Refinery to complete EPC Package 2 and they issued Sensornet with a contract to manufacture and deliver the Pipeline Monitoring System (PLMS)

THE PURPOSE

The purpose of this project was to establish the design requirements and standards of the leak detection technology for deploying a multi-purpose detection system, utilising single-mode fibre optic cabling along 5 pipelines.

CLIENT'S REQUIREMENTS

The PLDS system was required to detect leaks along and fibre optic cable breakages along each pipeline with an accuracy of +/- 2m. Additionally, the PLDS was required to track scrapers and PIGS when in use, as well as detect the operation of shut-down valves along the pipes. A graphical presentation software with GIS features was also required to manage and process the data and, other than presenting a live graphical interface of the pipelines on 3 workstations in different locations, it should also handle the alarm setting and connectivity to the SCADA system using ModBus and OPC protocols, allowing 3 different layers of operators to graphically monitor the pipelines and take action when necessary.
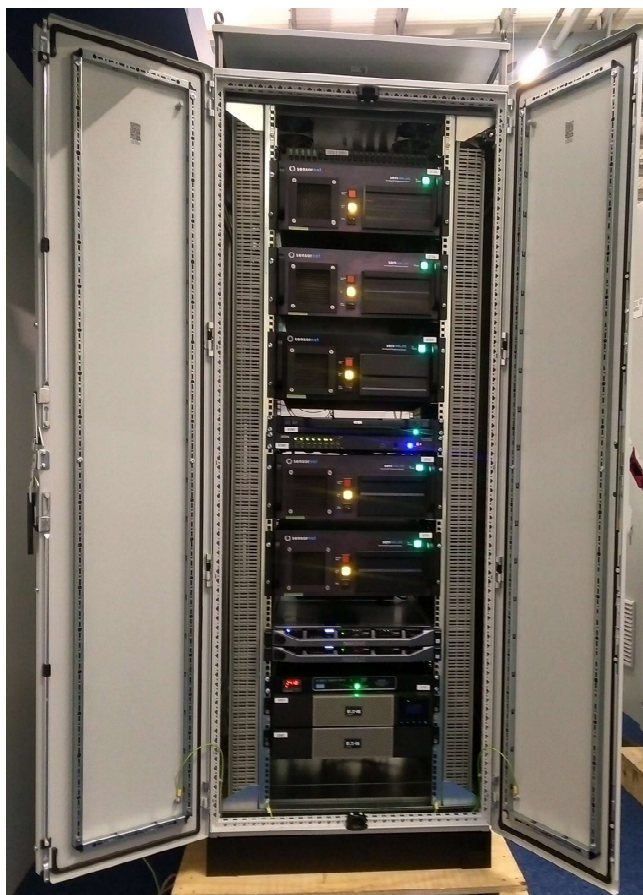

Fig2: Instrument rack cabinet at Sensornet factory

THE PROPOSAL

After carefully analysing the requirement, a decision was made to use Sensornet's Sentinel DTS alongside the FOTECH Helios® DAS System. The DTS would measure the temperature distribution along the pipeline and provide information on the leak and fibre break status/breakage while FOTECH Helios® DAS tracks the scraper movement and detect the valves' operation using acoustic sensing technology.

Five pipelines, each transporting differing payloads, were equipped with multi-core, single-mode fibre cables. The configuration was designed to be single-ended and the other end of the fibre cores were to be terminated inside a termination box.

The alarms for each pipeline are defined in various categories with certain thresholds and criteria. In case of an alarm, an alarm indication would appear in the main screen showing the alarm type, location and the LAT-LONG information of the fault. The same alarm is also shown in the workstations and the SCADA system.

CHALLENGES AND SOLUTION

- As all monitoring units consumed heavy power with high heat dissipation, the required airflow had to be carefully calculated in each cabinet to avoid overheating. Using Rittal's heat loss diagram, the required airflow obtained for each cabinet by calculating the total heat loss. The results of the analysis indicated that the equipment should be accommodated in 3 x 42U Rittal cabinets.
- The second challenge to overcome was to eliminate the non-PLDS point of failures and this required all network connectivities to be made redundant. Our engineers designed a redundant network system for all ethernet switches, servers, and media converters.
- Smartec DiView™ GIS presentation software was modified to capture information from both DTS and DAS and display the results on the same screen and, depending on the type of the alarms, to use OPC or ModBus to communicate with the client's alarm management system.