PIPELINE

Case Study



# Subsea integrity monitoring in hostile environments

## ALASKA

**> Leak > Soil Stability > Seabed Migration**

### The challenge

Situated off the north slope of Alaska, this oilfield site is partially sheltered from the more severe sea ice and wave conditions of the Arctic Ocean by its shallow water depths and a series of barrier islands offshore. Oil wells have been drilled from an artificial gravel island and two buried subsea pipelines extend to shore and the onshore tie-in pad.

Approximately 10 km of buried subsea flow lines transport the produced fluids from an offshore gravel island drill site to an onshore above-ground pipeline which meets an established pipeline run by another operator.

The maximum water depth along the flowline is only 7 metres and the pipelines are buried in a trench to protect them from ice gouge, but the shallow water holds its own challenges. The pipelines are vulnerable to migrating seabed features such as strudel scour and river channelling, which can leave them exposed or subject to upheaval buckling, resulting in significant stress loads.

Given these unpredictable conditions, monitoring the integrity of the flowline bundle was vital to minimise impact on the fragile Arctic environment as well as risks associated with leakages and flow down-time. Cost efficiency and schedule matching with the developer were also important considerations.

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### The solution

Real-time monitoring of potential flowline spanning and operating temperature conditions was desired to mitigate the risk of potentially excessive stresses caused by strudel scours, seabed migration and permafrost thaw settlements.

Omnisens installed its **distributed fiber-optic temperature sensing cable DITEST-LTM** along a 14km pipeline bundle before flowline start-up in 2007 and has continued to monitor it ever since. A robust submarine fiber-optic cable was integrated in the bundled 16" pipe-in-pipe production flowline, 8" water insulated injection flowline, 6" gas flowline and 2" diesel fuel flowline. A second fiber-optic cable is bundled to the power cables buried parallel to the flowline, just a few metres apart, to monitor the cable condition. The fiber-optic cables are used for temperature sensing purposes as well as for data communication between the island and the onshore station.

The application of this fiber-optic-based technology has demonstrated its ability to monitor the pipeline operational conditions, achieving efficient flow assurance. As visual inspection is impossible in these conditions, real-time temperature monitoring via optical fibers can provide an early warning of any incidents that may threaten integrity – such as erosion, insulation damage, seabed soil modifications and even small leaks.

The DITEST-LTM system uses fiber-optic Brillouin-based sensing technology, a technique enabling a distributed measurement of temperature and strain over long distance. This was selected for its high monitoring performance combined with its ability to detect temperature events within one metre of where they occur.

This system takes advantage of the temperature difference between the cold arctic waters and warmer pipeline operating temperatures. For example, a new strudel scour would be detected instantly as the relatively warm soil surrounding the flowline bundle will be eroded by the colder overflood water, long before the ice clears enough to mobilise a geophysical survey boat. Other visual monitoring methods such as helicopter viewing are also easily disrupted by weather conditions. Should a leak occur, Omnisens' system would sense a rise in water temperature at the critical point. Fiber-optic monitoring allows the quickest response time, significantly minimising financial and environmental consequences.

### The results

Omnisens' DITEST-LTM monitoring system was successfully used at this oilfield to monitor 13.5km pipeline and power cable bundles prior to start-up in late 2007 and has continued to be used during operation since then.

The system has been able to map seabed temperature profiles along the pipeline route and accurately track temperature deviations as they occur, using field-verified data before and during pipeline start up and operation.

**“ No other monitoring system could deliver this precision over an inaccessible buried subsea pipeline. ”**

No other monitoring system could deliver this precision over an inaccessible buried subsea pipeline. Only this unique application of the most advanced Brillouin optical fiber technology maintains system performance over longer distances without loss of accuracy.

The solution discussed in this case study is not limited to any length of pipeline. By combining multiple interrogators and remote modules pipeline routes of 1000s of km can be monitored with the Omnisens DITEST-LTM.

### About Omnisens

Omnisens is the leader in long-range continuous monitoring for industries including subsea, pipeline, civil engineering and power. We are delivering state-of-the-art solutions across five continents, working with teams of specialist providers and resellers in the Far East, Europe, Latin America, Russia and North America.

**We provide our customers with the best, most precise technology on the market. We use pioneering fiber-optic Brillouin-based sensing to deliver pinpoint-accurate monitoring to help protect the structural and operational integrity of critical resources 24/7, 365 days a year.**