

A Novel Liquid and Gas Pipeline Leak Detection System

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Environmental Problem

Methane is one of the most serious greenhouse gases contributing to irreversible climate change. The contribution of methane emissions from leaking pipelines and the expected increased throughput through the pipelines prompted the natural gas industry to set a goal of reducing emissions by 50% by 2010. The integrity of the pipelines is critical to the safety of the gas transportation infrastructure. The U.S. natural gas pipeline industry spends approximately \$50 million annually to comply with the U.S. Department of Transportation's increasingly stringent inspection regulations. Current legislation requires that more than 300,000 miles of transmission pipeline be inspected at least once a year. The reduction of detrimental greenhouse gas emissions and the compliance with pipeline integrity management regulations may be attained by using a device to detect liquid and gas pipeline leaks.

SBIR Technology Solution

With support from EPA's SBIR Program, Ophir Corporation has developed and demonstrated an optical remote sensing product, duoThane®, for

detecting and potentially reducing the emission of methane from fossil fuel sources such as natural gas and oil processing as well as from production and transmission operations. duoThane® independently and simultaneously detects methane and ethane, the primary constituents of natural gas.

Ethane emissions provide an excellent means of detecting and locating leaks in crude oil pipelines. The system has sufficient speed and sensitivity to enable cost-effective stationary surveys over gas and liquid pipelines. At a fenceline monitoring distance of 600 m, the duoThane® detection sensitivity is 50 ppb for methane and 33 ppb for ethane.

The duoThane® sensor employs the optical technique of active gas correlation radiometry, which uses an active infrared source and an optical, spectral correlation detection method. The duoThane® system can be employed in a stationary scenario directly over the transmission pipeline or downwind of the pipeline. The system also can be used to detect leaks from pipelines constructed under waterways. Currently, there is no efficient method for monitoring liquid pipeline leaks that emanate from pipes under waterways such as streams and rivers.

The duoThane® system also has been demonstrated for liquid pipeline application through an oil-on-water test on natural oil seeps in the Santa Barbara Channel off the coast of California. The ship-mounted duoThane® system successfully detected both methane and ethane in this demonstration.

duoThane® significantly reduces the costs associated with natural gas pipeline inspections, provides superior leak detection, and results in fewer false alarms than achievable with the current industry-standard inspection methods. The benefits of this remote sensing system are threefold: (1) methane emission reduction, (2) improved pipeline safety, and (3) reduced gas and liquid industry pipeline operating costs.

Commercialization Information

There is both national and international interest in the ground-based duoThane® system, as well as in an airborne natural gas leak detection device developed through U.S. Department of Energy (DOE) funding. duoThane® has been successfully demonstrated on operational natural gas transmission



duoThane® transmitter and receiver mounted on an oil spill clean-up vessel demonstrating the effectiveness of detection of leaks from pipelines that run under waterways.

pipelines with El Paso Pipeline Group and Williston Basin Interstate Pipeline Co., Inc. The sensor successfully detected the presence of methane and ethane in the case of a compromised pipeline and in calibrated leak scenarios.

Alyeska Pipeline Services Company, a large oil pipeline services company, co-funded a demonstration of Ophir's technology with the EPA. Alyeska continues to show interest in this system for the detection of leaks from pipelines under waterways. In addition, Ophir presented this duoThane® system for the liquid pipeline leak detection application at the Alaska Department of Environment and Conservation Best Available Technologies Conference in May 2004. Ophir is targeting this market by instrumenting aircraft with duoThane® to enable leak detection measurements for the lines that currently are inspected visually.

Company History

Ophir Corporation, based in Littleton, Colorado, and founded in 1980, focuses on research, development, and production of optical remote-sensing instrumentation for the atmospheric sciences. Ophir has been very successful in commercializing sensor technologies through the SBIR Program, and the company has commercialized optical, remote-sensing technologies with gross revenue from commercial sales exceeding \$45 million. Ophir's primary products are the Pilot Alert System (a laser-based radar system currently flown on the B-2

Stealth Bomber) and duoThane®. Ophir has been recognized for outstanding performance by the U.S. Small Business Administration, the Small Business

High Technology Institute, and the Northrop Grumman Corporation.

SBIR Impact

- Methane is one of the most serious greenhouse gases contributing to irreversible climate change.
- Ophir Corporation developed and demonstrated duoThane® for detecting methane emissions from leaking pipelines.
- duoThane® has the potential to reduce methane emissions, improve pipeline safety, and reduce gas and liquid industry pipeline operating costs.
- The system also can be used to detect leaks from pipelines constructed under waterways.