CleanAir

CASE STUDY

Remote Sensing of Stack Emissions Using a UAV

Background

A client approached CleanAir with a sampling challenge. They had an enclosed flare stack 80 feet tall and 30 feet in diameter with no sampling ports or access. They were required to measure emissions from that stack. One option was to erect a massive scaffolding structure and install ports to accommodate the test. They estimated this effort would cost up to one million dollars and pose numerous safety issues. CleanAir proposed a remote sampling solution using an unmanned aerial vehicle (UAV) for a fraction of the cost.

CleanAir's Approach

To meet this challenge, CleanAir used an open-path Active FTIR (AFTIR) system. This is not the Passive FTIR system employed in many of the recent flare tests. The AFTIR analyzer utilized an optical telescope to transmit an infrared (IR) beam through the measurement region. The IR beam was reflected back to the analyzer by a suspended retroreflector array. The analyzer measured the absorption of the IR radiation to determine the composition of the gas in the measurement region. The retroreflector array was suspended from a UAV hovering behind the emission plume relative to the AFTIR about 100 feet in the air. This is the first time (we believe) that anyone has used a UAV-suspended mirror array as one end of an open path monitoring system.

Results

The data from the test are being used by the client to establish operating parameters for the flare that meet US EPA requirements. The application of this technique is not limited to flares and could be combined with remote flow measurement techniques to determine mass emission rates on sources that are difficult to access.

Summary

CleanAir used AFTIR and UAV technology to remotely measure the composition of a flare plume. The application of this technique is not limited to flares and could be combined with remote flow measurement techniques to determine mass emission rates on sources that are difficult to access.