

NASA Glenn Technology Fact Sheet

Method and System for Fiber Optic Determination of Gas Concentrations in Liquid Receptacles

Researchers at NASA's Glenn Research Center have patented a fiber-optic sensor system that remotely measures the concentration of molecular oxygen, nitrogen, hydrocarbon vapor, and other gases in a liquid fuel tank. In the area of aircraft safety, there is a need to eliminate the explosion hazard posed by the mixture of fuel vapors and oxygen contained in the space above a fuel tank. Prior techniques for gas measurement pose a potential hazard in that an electrically powered sensor connected by wires may provide a source of sparks or electrostatic ignition. Based on an optical sensor element and remotely located Raman spectrograph, Glenn's innovation safely provides accurate and fast quantitative identification of gases. It provides measurements of the compositions of gaseous materials in liquid receptacles needed to determine the appropriate level of inerting required for safety. The system provides these data with accuracy better than 1 percent (by volume) over approximately 1 minute. This is a critically enabling sensor technology for the feedback control of on-board inert gas generation systems that are used in inert aircraft fuel tanks for the prevention of fuel tank explosion and fire. The result is a system with no potential safety hazards that reliably performs over wide temperature and pressure ranges.

Benefits

- **Cost effective:** Uses readily available small-scale optical and spectroscopic components that allow for reasonable production cost
- **Safe:** Does not present an intrinsic fire or explosion safety hazard compared to electrically based sensors that require wiring
- **Simple:** Is compact, lightweight, and can be made robust and reliable for aircraft use

Applications

- Commercial aircraft fuel tank monitoring
- Petrochemical industry with similar inerting and monitoring requirements for processing, storage, and transportation vessels of hydrocarbon materials

Patent

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