

Credits: NASA

## Sensors

# Photo-Acoustic Sub Part-Per-Billion Chemical Sensing

Photo-acoustic sensing based laser vibrometer for the measurement of ambient chemical species

NASA Langley Research Center has developed a photo-acoustics sensing based laser vibrometer for the measurement of ambient chemical species. The technology allows for detection of sub part-per-billion (ppb) levels of ambient trace gases and chemical species, with an order of magnitude more sensitivity than similar technologies. Among other applications, the technology could be used for the detection of explosives and hazardous or toxic chemicals.

## BENEFITS

- ➔ Allows for measurement of sub-ppb level concentrations of chemical species over wide temperature ranges and high altitudes
- ➔ Provides an order of magnitude more sensitivity than similar technologies
- ➔ Will be a compact/hand-held device

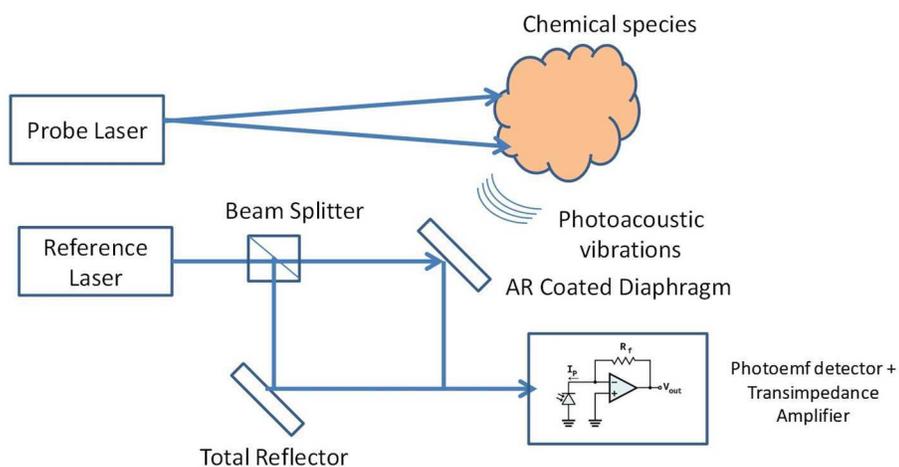
## APPLICATIONS

- ➔ Airborne and space based chemical detection
- ➔ Hand-held chemical detection

technology solution

### THE TECHNOLOGY

The technology is a sensor for remotely detecting sub part-per-billion (ppb) levels of ambient trace gases and chemical species. The system includes a high-repetition-rate, pulsed laser module that is spectrally tuned to a desired chemical species. The photons from the laser are absorbed by the target chemical, creating an acoustic vibration that impacts a diaphragm (which acts like a speaker). A highly sensitive, photo-emf detector is then used to measure the magnitude of the vibration, which corresponds to the concentration of the target chemical. The technology is being developed for NASA's trace-gas measurement needs for validation and ground truth studies to support airborne and space-based LIDAR operations. The technology has application as a chemical sniffer to detect hazardous or toxic chemical species in the vicinity of IEDs, explosives, or other chemical agents. In such an application the sensor could detect chemical species hidden inside closed containers, bags, or car trunks.



Schematic of technology.

### PUBLICATIONS

Patent Pending



National Aeronautics and Space Administration

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