Standoff Detection: Detection of Surface Contamination

Infrared Spectroscopy for Standoff & Point Detection of Chemical Threats Utilizing Quantum Cascade Lasers

Erik R. Deutsch, Ninghui Zhu, John F. Heanue, Adam Erlich, Petros A. Kotidis

erik.deutsch@blockeng.com 508.251.3100 Block MEMS, 377 Simarano Drive, Marlborough MA 01752

Impact to Mission / Warfighter

A single handheld version of this device will allow soldiers in the field to rapidly identify various chemical threats in both standoff and point detection modes. Furthermore, the use of infrared spectroscopy will allow a single device to detect gases, liquids, and solids.

Comparison to other Handheld Techniques

The Tunable Laser

LaserScan™ is a widely tunable Quantum Cascade Laser (QCL) absorption spectrometer. The system can tune across a 600 cm⁻¹ portion of the 1667-833 cm⁻¹ (6-12 μm) mid-IR spectral range. The output beam is Class-1 (eye-safe), but has sufficient power (~10mW) to analyze samples 6 inches to 2 ft away.

Experimental Results

Explosives such as TNT, RDX, TATP, Ammonium Nitrate, and Urea Nitrate have been successfully measured in both trace and bulk amounts at a 1 m standoff. Tests have been conducted at Edgewood Chemical and Biological Center (ECBC) where simulants, CWAs, and Emerging Threats were successfully detected. The system, used in combination with a gas cell, has measured gases such as cyclohexanone at low concentrations.

Pre-Dispersive Spectroscopy

Light from the QCL reflects from a surface or transmits through a sample, is absorbed at particular wavelengths, and is collected by a detector. The detector signal as a function of wavelength (grating angle) generates the spectrum. Advantages include the high brightness, the ability to collimate the output beam, and the insensitivity to stray light due to high speed pulsing of the laser which all enable sensitive standoff measurements.