



Core  
Laboratory  
Capabilities

**Electromagnetic Studies  
of Explosives Laboratory**

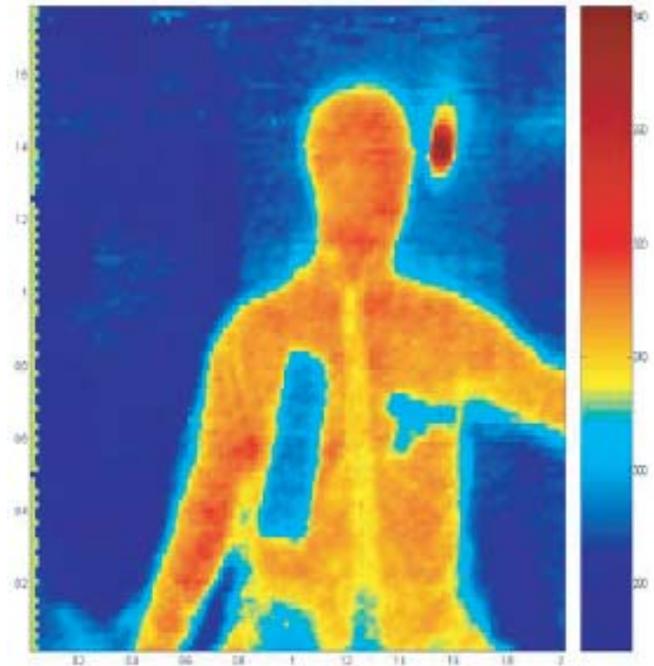
**Mission:** The Electromagnetic Studies of Explosives Laboratory (EMXLAB) provides research capability for examining the interaction between electromagnetic energy and explosives, metals, and other materials. Data and results from this laboratory support the development of state-of-the-art explosive and weapon detection devices.

**Overview**

The EMXLAB provides the capability to examine the interaction of materials with electro-magnetic radiation. Measurement of the response of explosive material and weapons to various types of electromagnetic radiation (gigahertz and terahertz radiation, infrared and ultraviolet radiation, and microwaves) supports the development of new threat detection technology. Several systems under development have already benefited from the EMXLAB results: bottle-screening devices for liquid explosives, an active gigahertz (GHz) system for detection of Improvised Explosive Devices (IEDs) concealed beneath clothing, a terahertz (THz) portal proof of concept, a passive THz camera, and a standoff detection system for vehicle borne IEDs. The understanding of the interaction of electromagnetic energy with explosives provided by the EMXLAB is critically important to the success of these and other emerging technologies. The EMXLAB is equipped with an array of systems that provide a broad coverage of the electromagnetic frequency range, and is staffed with Ph.D. physicists and chemists for analysis and modeling.

**Facilities:**

- Terahertz (THz) transmitter and receiver for spectra and imaging from 0.1-2.5 THz
- Research grade Raman spectroscopy system
- Full suite of equipment for dielectric measurements from DC to 110 GHz
- Transceiver heads for radar measurements from 50-110 GHz,
- Nd:YAG pumped Dye Laser with Spectrometer for laser spectroscopy from UV – NIR
- Supersonic molecular beam capability for single molecule spectroscopy (under development)



Passive THz camera reveals threats beneath clothing

**Expertise:**

- Spectral response of military, commercial, and homemade explosives to electromagnetic radiation from the ultraviolet to near-infrared range and the THz regime.
- Raman spectroscopy
- Dielectric measurements and modeling
- Radar measurements for model systems
- Modeling of interaction of electromagnetic radiation with various materials.
- Design of test apparatus for new systems and materials.



Apparatus for dielectric measurements in free air

## Transportation Security Laboratory



### Recent Activities

- **Terahertz Spectroscopy:**
  - Obtaining spectra and imaging of materials in the 0.1-2.5 THz range.
  - Providing objective evaluations to THz technology developers.
  - Collaborating with THz scientists in government and academia
- **Dielectric Measurements:**
  - Optimizing array of in-house dielectric fixtures.
  - Collaboration with Naval Surface Weapons Center at Indian Head in measurement of various explosives.
  - Dielectric signatures of homemade explosives.
- **Raman Spectra:**
  - Validation of samples used in vehicle borne IEDS study
- **Modeling and Analysis:**
  - Evaluation of imaging technology limits and performance characteristics with objective evaluations to technology developers.

The mission of the Transportation Security Laboratory (TSL) is to enhance homeland security by developing and validating solutions to detect and mitigate the threat of improvised explosive devices. Established in 1992 at the William J. Hughes Technical Center, Atlantic City International Airport, the TSL's 12 acre secure campus includes specialized explosive storage and handling areas and a multi-laboratory infrastructure designed for research, development, and test and evaluation of technology for explosives and weapon detection and blast mitigation. TSL's team of physicists, chemists, engineers, research psychologists and mathematicians is internationally recognized for its unique ability to advance technology from conception to deployment through applied research, development, prototyping, test and evaluation, assessment, certification, and system qualification. Research areas at the TSL include

- Vehicle and Infrastructure Vulnerability Assessment,
- Automatic Explosive Detection in Checked Bag
- Containerized, Bulk, Palletized and Parcel Cargo Screening,
- Fast Noninvasive Screening of Passengers, and
- Blast Mitigation Technologies and Strategies.

With award-winning R&D and ISO 9001 Certified Independent Test and Evaluation TSL proudly contributes to America's Domestic Security.



Setup for THz transmission and reflection



**Homeland  
Security**

Science and Technology

*From Science and Technology . . . Security and Trust*

For more information regarding the Electromagnetic Studies of Explosives Laboratory and other capabilities and activities of the Transportation Security Laboratory, send e-mail to [TSLinfo@dhs.gov](mailto:TSLinfo@dhs.gov)