Homeland Security
Science and Technology

Transportation Security Laboratory

Core Laboratory Capabilities

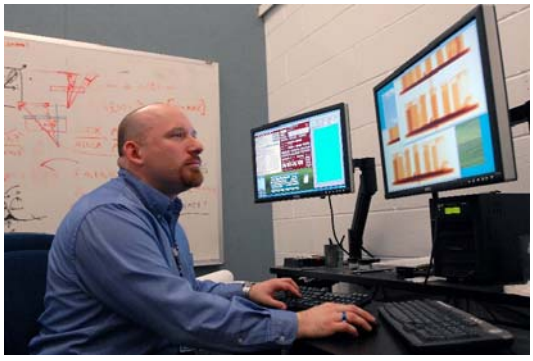
Bulk Detection Laboratory

Mission: The Bulk Detection Lab is committed to improving the detection of concentrated masses of energetic materials while simultaneously decreasing false alarms. The Bulk Detection Lab's activities range from materials characterization to the development and testing of detection technology.

Overview

As explosive detection requirements become more stringent, false alarms tend to increase. The Bulk Detection Laboratory attempts to offset this increase in false alarms through improved understanding of the interaction of energetic materials with incident radiation (i.e. explosive signatures). Bulk Lab work includes populating a database of CT-based, micro-tomographic and elemental analysis signatures of numerous explosives including commercial, military, and homemade explosives as well as false alarm materials.

The Bulk Lab supports other areas of research, including development of next generation system requirements and – with its capacity to analyze imaging data acquired from commercial explosives – development of advanced image processing and reconstruction methods. Much of the signature data measured by the Bulk Lab are used to support the development and validation of inert simulant explosive materials developed and synthesized at the TSL. The Bulk Lab also supports Certification and Qualification Readiness Testing (CRT and QRT) for bulk explosive detection baggage screening equipment. The CRT/QRT process is a thorough investigation into the vulnerabilities and detection capability of the system.



Focus Areas:

- **X-ray attenuation and High-Resolution CT measurements**
  - Microtomography (down to 10 micron)
  - Systems up to 320 keV in X-ray energy
  - Dual energy CT for mass density and effective atomic number measurement
- **X-Ray Diffraction analysis**
  - High-precision angular dispersive analysis
  - Energy-dispersive analysis analogous to explosives detection methods
- **Combustion elemental analysis**
  - For analysis of the Carbon, Hydrogen, Nitrogen, Oxygen and Sulfur content of explosives and false alarm materials
- **Advanced CT concepts development**
  - Correction of CT data
  - Improvement of image quality

Facilities:

- Phoenix X-ray V|TOME| XS CT System
- Custom-Built High Resolution 320 keV X-ray CT system
- Skyscan 1072 X-ray Microtomograph
- Philips X'Pert Pro X-ray Diffractometer
- Rigaku Miniflex X-ray Diffractometer
- Custom-Built Energy-Dispersive X-ray Diffractometer
- PerkinElmer 2400 Series II CHNO/S Analyzer

Using an X-ray diffraction system for characterization

Recent Activities

- Characterization of homemade explosives
- False alarm materials characterization
- Microtomography and high-resolution imaging
- Image quality studies including measuring the impact of image artifacts on CT data and the development of novel image processing tools.
- Texture analysis with high-resolution CT imaging (down to 66 microns)
- Characterization of the TSL explosives inventory using Dual-Energy CT and X-ray Diffraction
- Simulant explosives development support

Transportation Security Laboratory

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.

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For more information regarding the Bulk Detection Laboratory and other capabilities and activities of the Transportation Security Laboratory, send e-mail to TSLinfo@dhs.gov