



# ALERT: Awareness and Localization of Explosives Related Threats

## Overview and Focus on Transition

Presented by  
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**ALERT Co-Director**

**ADSA 06 Workshop**  
**November 8, 2011**



**A Department of Homeland Security  
Center of Excellence**



**Northeastern**

THE  
**UNIVERSITY**  
OF RHODE ISLAND



# The ALERT Mission: Help DHS Protect the Nation from Explosives Related Threats

Detection



Mitigation



Education & Outreach



Response





# Research Defined by DHS Priorities

✓ **Ultra-Reliable Screening**

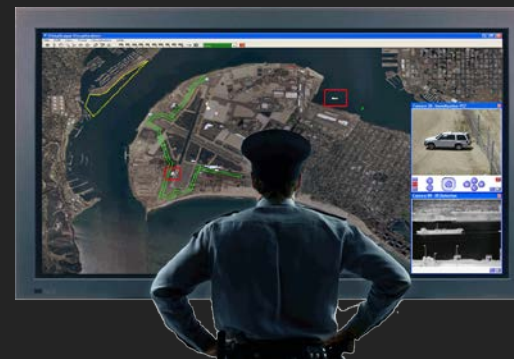


✓ **> 50 meter Stand-Off Detection**



✓ **Unequivocal Pre and Post Blast Mitigation**

✓ **Rapid and Thorough Preparedness and Response**







# ALERT Research Addresses Standoff and Portal Systems

## Standoff systems



## Portal systems





# The ALERT Fundamental Science Program: Encompasses Multidisciplinary CIED Elements

**Chemical & Physical  
Characterization  
Of Explosives  
(F1)**

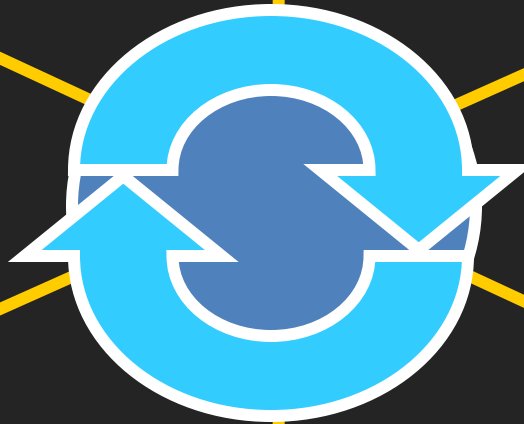
**Advanced Explosive  
Material & IED  
Detectors  
(F2)**

**Mitigation  
Science &  
Technology  
(F4)**

**Unconventional  
Detection  
Approaches  
(F2)**

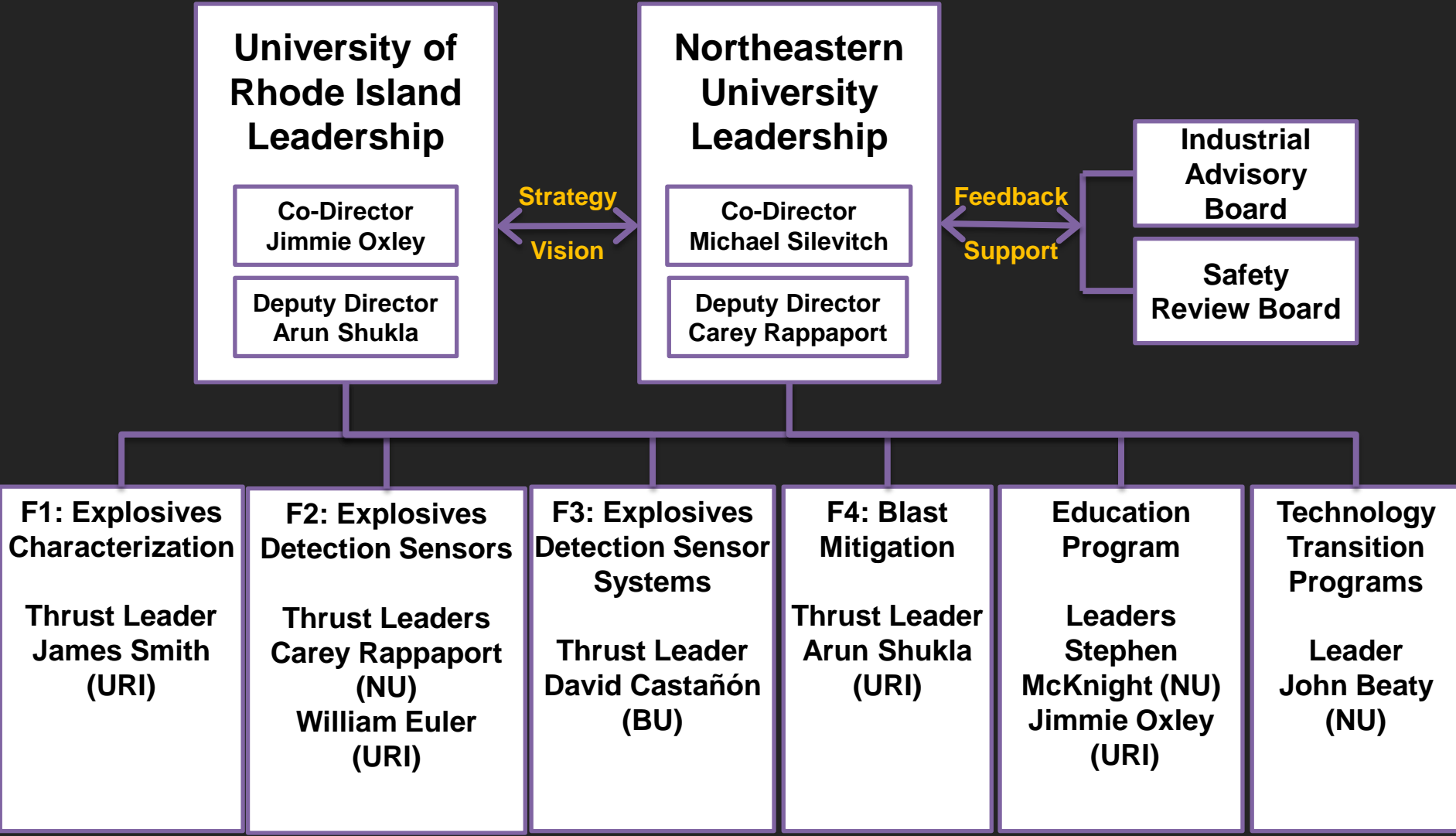
**Man-Machine  
Interface  
(F3)**

**Multi-Sensor  
Networks  
& Fusion  
(F3)**





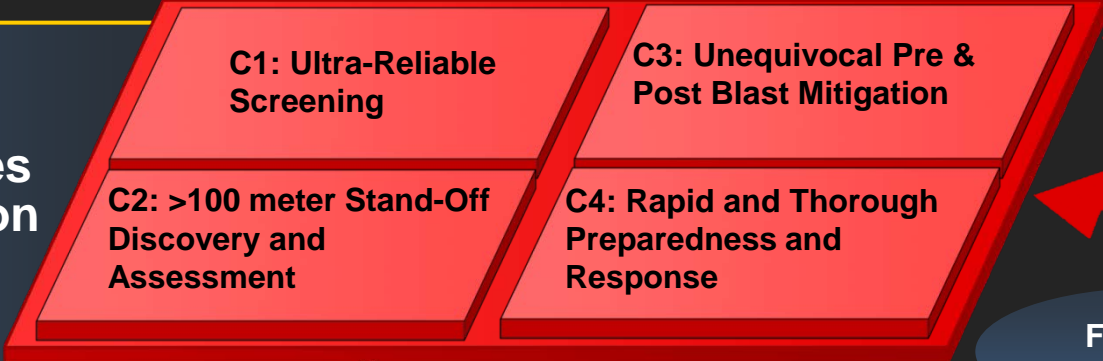
# The ALERT Organization Chart is Geared to Implementing the Mission of the COE





# ALERT Develops and Transitions Fundamental Research to Address Global Challenges

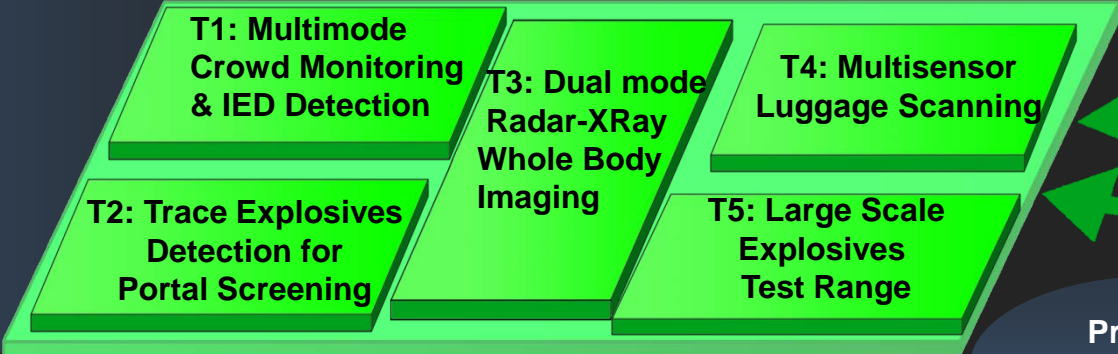
## Level 3 Grand Challenges & Next Generation Systems



Research Drivers

Fieldable Products

## Level 2 Technology Transition and Testbeds



Teaming with National Labs & Industry

Proof-of-Principle Tests of Research

## Level 1 Fundamental Science



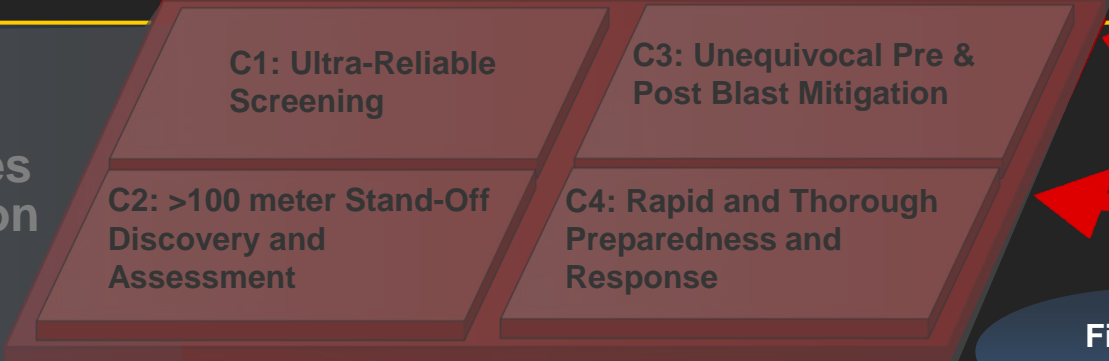
Research Barriers



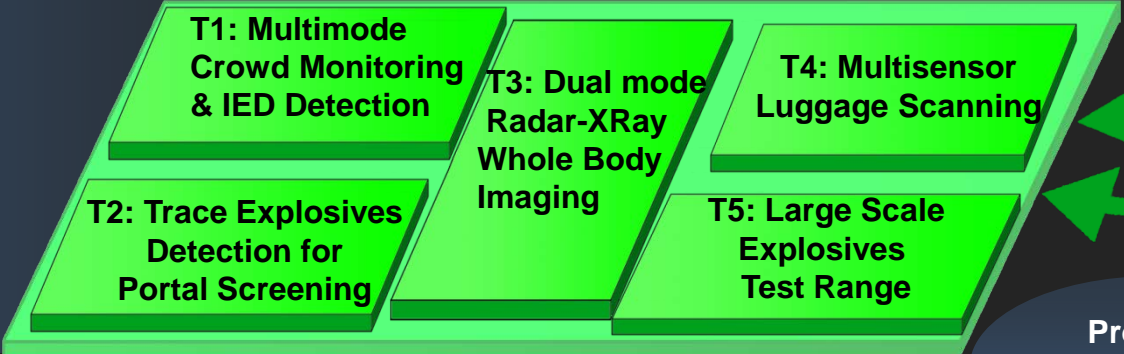


# The ALERT Three Level Structure Highlights the Importance of Technology Transition

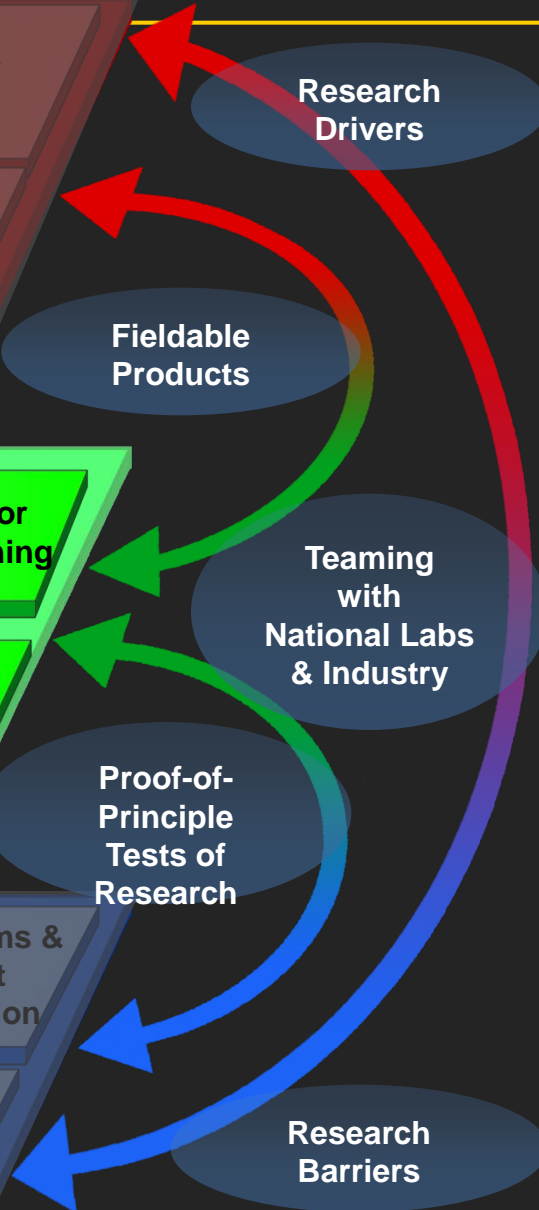
**Level 3**  
Grand Challenges  
& Next Generation  
Systems



**Level 2**  
Technology  
Transition and  
Testbeds



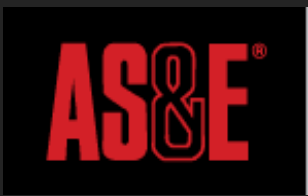
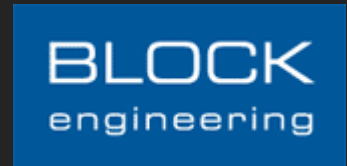
**Level 1**  
Fundamental  
Science







# A Key Element of the ALERT Mission: Technology Transition to Industry & Government Partners





# Outcomes of the ALERT Transition Strategy: Major Economic Impact For Industrial Partners

**A Precursor of ALERT:  
HSARPA \$4.9 Million  
Portal Monitoring Prototype  
Northeastern Lead,  
with Raytheon & BTI**



**Advanced DHS  
Spectroscopic Portal  
\$400 Million  
Production Contract  
for Raytheon**



Northeastern





# The Camp Edwards Testbed: Now Producing Video Datasets for Transition

- Researchers have complete access to data
- No privacy restrictions because of the military site



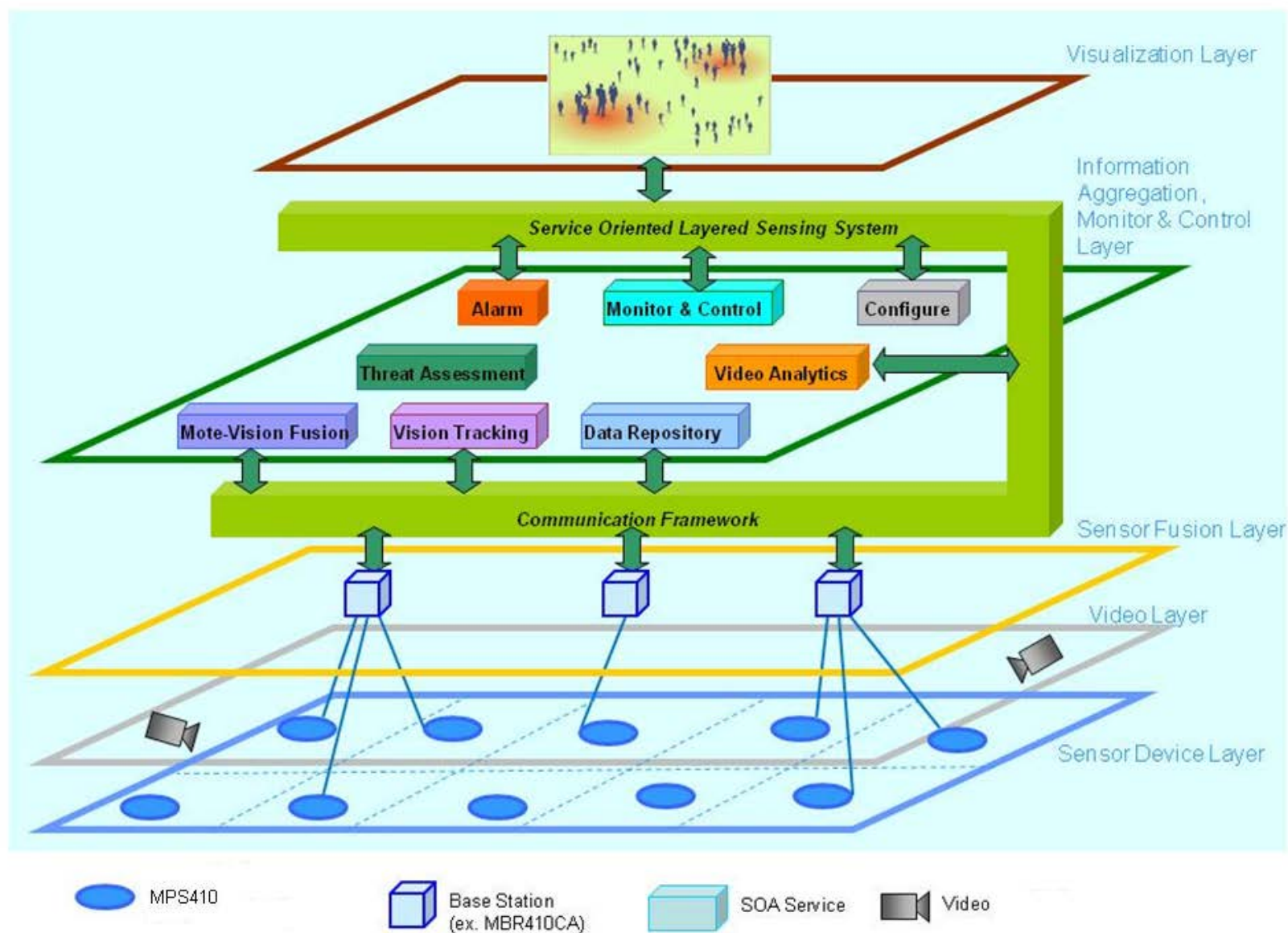
**Massachusetts**  
**National Guard**  
*The Nation's First*

**Raytheon**  
**SIEMENS**





# The ALERT Team is Currently Deploying A Multi-Mode Layered Sensing System at Camp Edwards





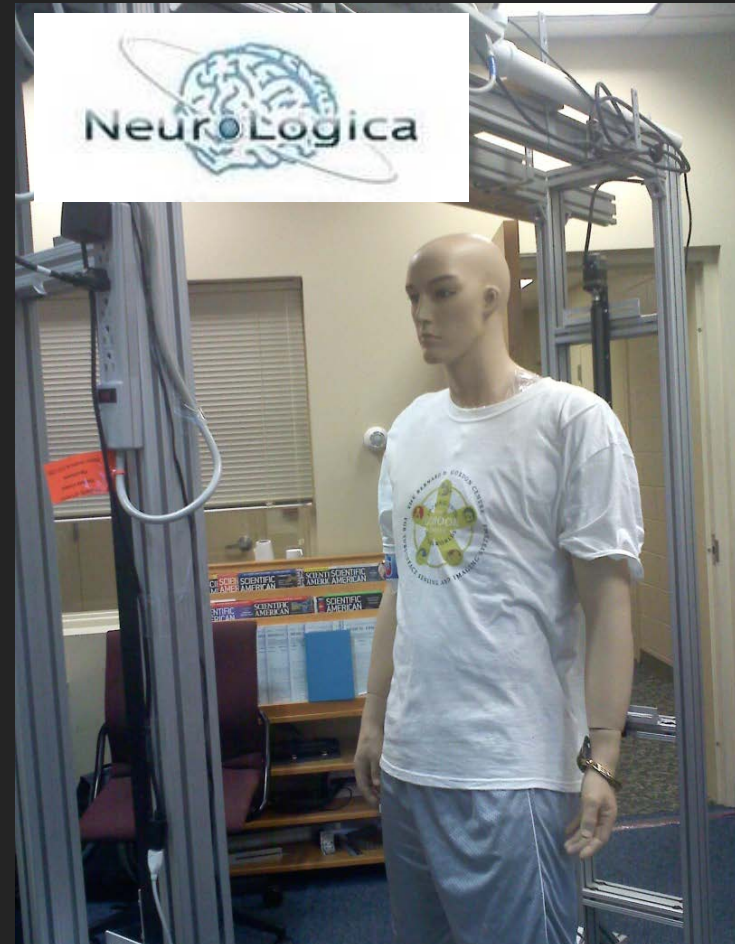


# Whole Body Imaging Testbed at Northeastern

## Goal: Improve portal security imaging



**AS&E donated SmartCheck® X-ray Backscatter based whole body imaging system.**

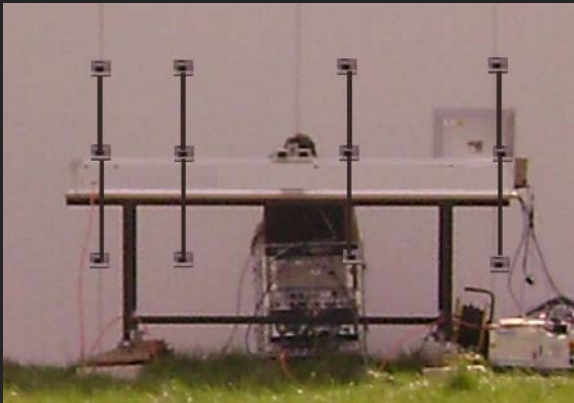


**Neurologica donated gantry to be combined with X-Ray Backscatter for multimodal imaging.**



# Next Generation Whole-Body Screening

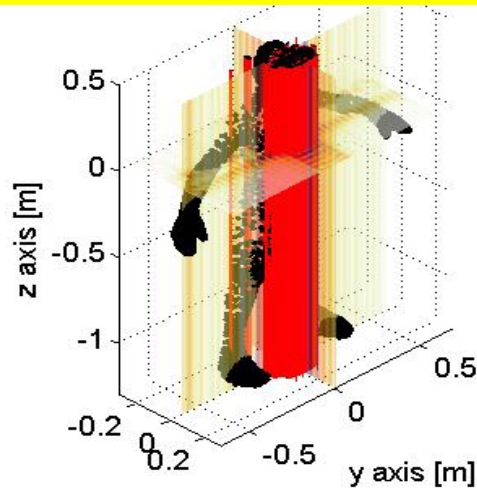
## Goal: To Identify Threats Under Clothing



Multiple radar systems under design, for use close-up and at a distance.

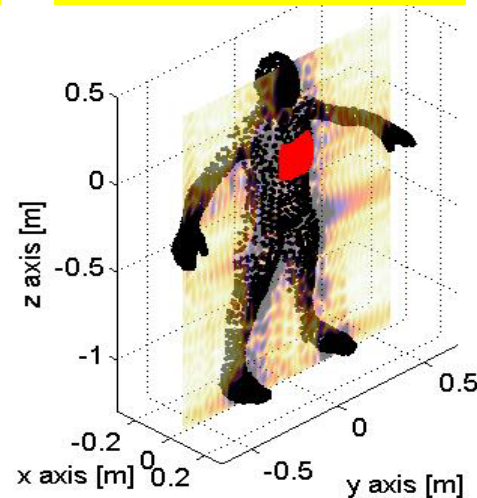


Current systems



2D image reconstruction

Our system



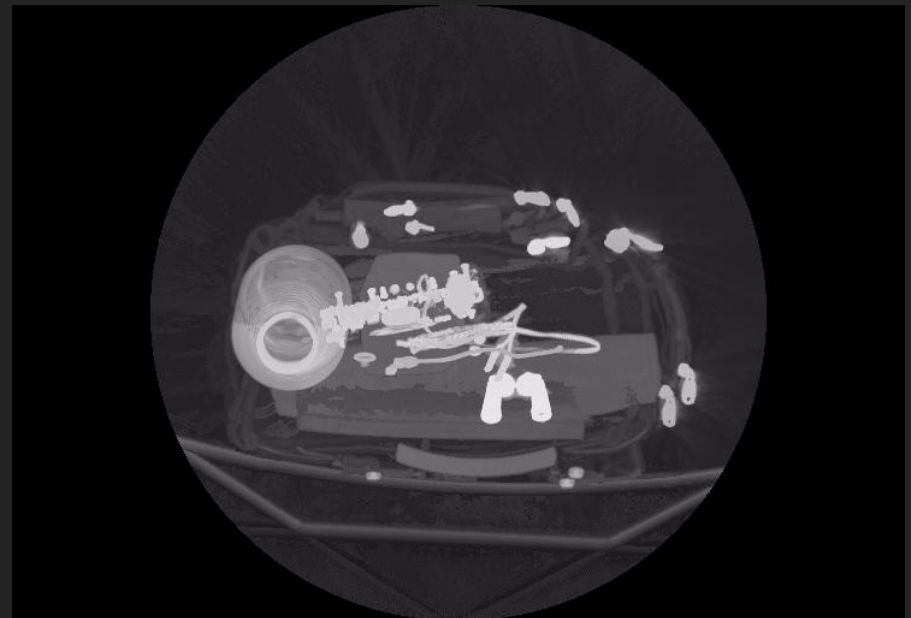
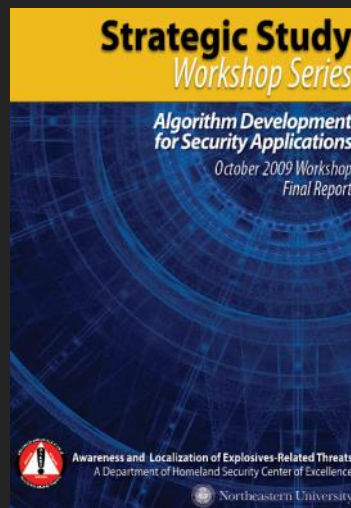
3D image reconstruction



# ALERT Strategic Study Workshops

Goal: To Identify Research/Capabilities Gaps

- Focused on ALERT Screening areas CT and Whole Body Imaging
- Brings together academia/government/industry
- Deliverable: reports and datasets that provide analysis of state-of-the-art and future directions for DHS consideration





# **ADSA Workshops Have Created A Vibrant Community Focused on Transition**

- **Combines Researchers, developers, vendors and Government representatives – networking key element**
- **ADSA01: Check-point algorithm gaps and future directions**
- **ADSA02: Implementation of segmentation grand challenge**
- **ADSA03: AIT gaps and future directions**
- **ADSA04: Reconstruction algorithms status and future directions**
- **ADSA05: Fusion of orthogonal technologies**
- **~200 people in database**
- **Final reports are excellent repositories of information useful for people entering the field**
- **Literature identified**
- **Many technical solutions identified**
- **Many operational issues surfaced and are being worked**





# AIT Projects: Aimed at Transition of Next Generation Advances

- **Cemented collaboration between academia, industry and National Labs**
  - AS&E Equipment donation and summer project
  - REVEAL student project
  - Three summer projects conducted with PNNL
  - Use of Sandia SSI datasets for MMW and XBS
    - Ground truth project with MGH
    - Applying radiological methods to assess coupon conspicuity
- **Follow on projects underway**
  - Focus on Fusion



# **Segmentation Challenge: Enables the Creation of Datasets and Assessment Metrics**

- **Implemented major recommendation from ADISA01 workshop**
- **Collaboration between ALERT and LLNL**
- **Funded by DHS via Basic Ordering Agreement**
- **Stream of commerce bags packed and scanned on medical CT scanner**
- **Five research groups funded**
- **Symposium on December 8<sup>th</sup> 2011**



# **DHS Funded Transition Initiatives Will Augment Ongoing Efforts**

- **Additional funding to Spark ALERT Efforts**
  - Announced by Dr. Eric Houser at ADSA05
- **Focal Areas**
  - **Video analytics**
    - Links with TSA
    - MassPort and Cleveland Airport
    - National Guard-Camp Edwards
    - Industry-Siemens
    - ADSA07 Focus
  - **CT reconstruction-Work with Vendors**
  - **Fusion-Applied to AIT efforts**
- **Emphasis on “E2E” (Engage to Excel)**
  - **New DHS Focus for the Centers of Excellence**



# Advanced Video Analytics: Ready for Transition



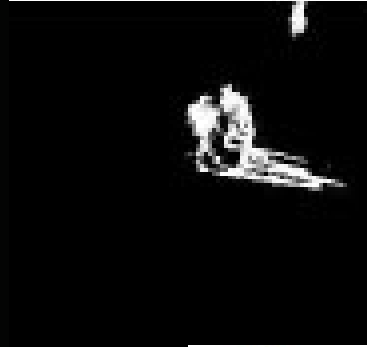
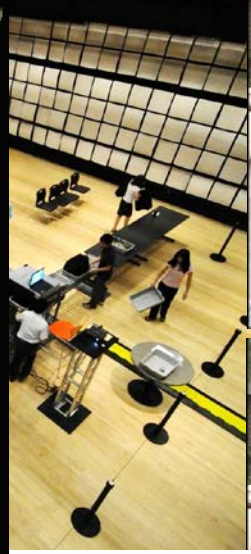
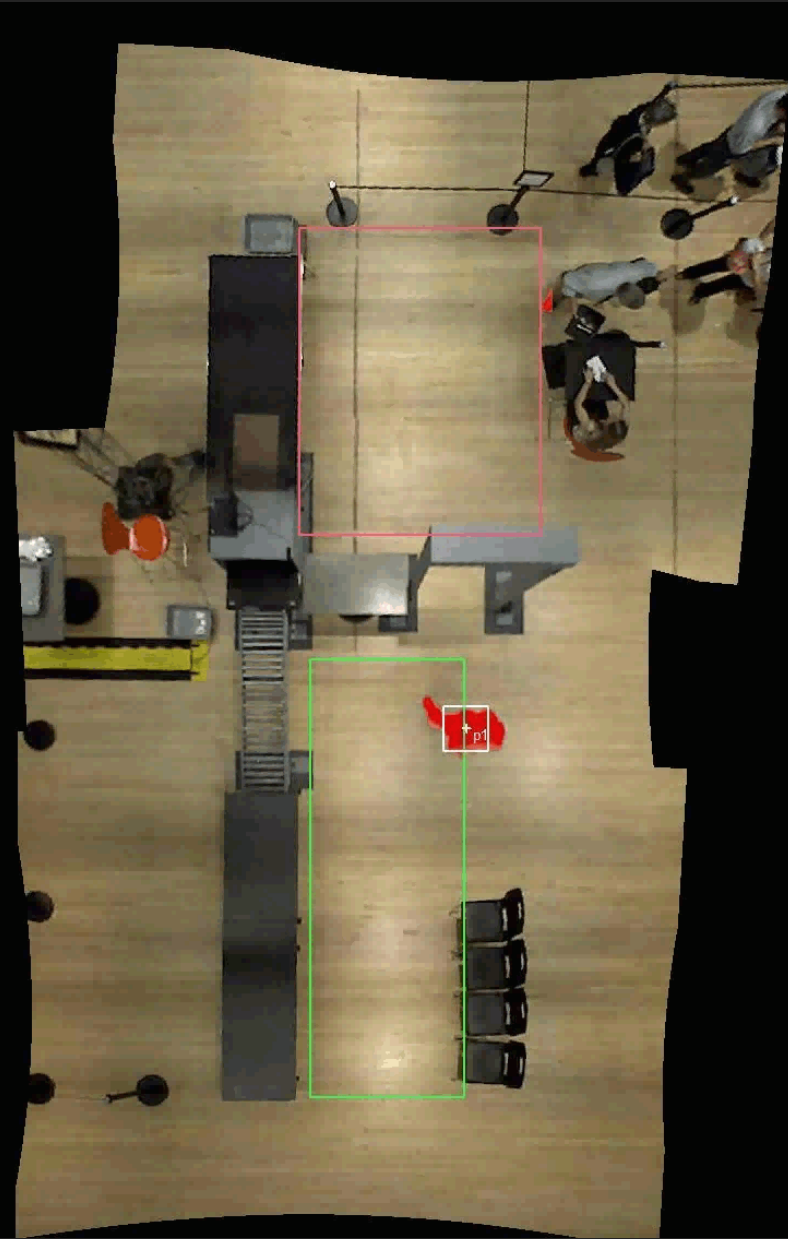
Times Square bombing attempt: Software identifies bomber





# Video Tracking is Useful in Many Scenarios

## Goal: To Improve Abnormal Behavior Detection



**APPLIED SCIENCE FOUNDATION  
FOR HOMELAND SECURITY**  
Public Safety • Research • Economic Development • Education

**Partnership with ASFHS  
to transition research**



# **Transition Is An Ongoing ALERT Effort: Student and Faculty involvement is Key**

- **Student at Purdue working with a vendor**
- **Student working on MMW at ALERT now a PNNL employee**
- **Students moving to industry (REVEAL, Analogic, AS&E)**
- **Professors consulting and sub-contracting to incumbent vendors**
- **Process in place enabling ALERT researchers to work with SSI materials**
- **Funds to industry from John Adams Innovation Institute spark collaboration with ALERT**



# Additional State Funding Supports MA Industrial Collaboration with ALERT



- John Adams Innovation Institute (JAI)
- Northeastern awarded \$1.6M
- Supports research transition to industry

**SIEMENS**

**Raytheon**

**AS&E<sup>®</sup>**

**BLOCK**  
engineering

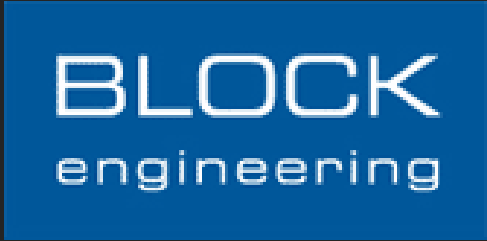


**TEXTRON** Systems



# JAll Funds Help ALERT Transition Research

## Goal: Build Economy, Aid Emergency Workers

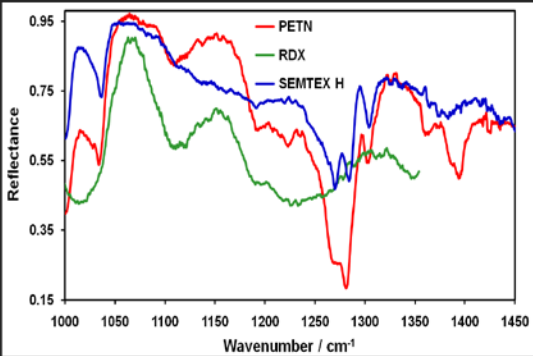
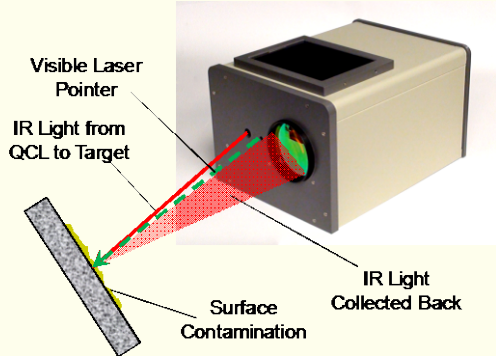


### Explosives Proximity Detector

ALERT research teams will test the capability of the quantum cascade laser unit to detect explosives, as well as develop algorithms to enhance detection.

### Mobile Device Operated Handheld Raman Spectrometer

Designed to be a handheld system that can detect and identify explosive materials. ALERT researchers are developing a database of explosives spectral signatures.







# Our Conferences and Events

## Promote Transition to a Wide Audience

### Research to Reality (R2R) Conferences

- Held In Yearly October
- ~ 400 Attendees
- Joint Presentations
  - Researcher + “Realist”







# Our Students: The Next Generation of Engineering Leaders





# ALERT: A Major DHS Resource For Research, Education and Transition to the Field

