



ALERT: Awareness and Localization of Explosives-Related Threats



Research Overview of the
DHS Center of Excellence
For Explosives Detection
Mitigation & Response

Michael Silevitch
Northeastern University
Co-Director





Three Major Objectives Form the Core of the ALERT Mission

- Perform **transformational research** in the areas of explosives detection, mitigation and response
- Create education programs that will **train students and career professionals** in the key technologies tied to defeating explosives related threats
- Develop **a network of national and international collaborators** who together with ALERT will be able to quickly respond to DHS needs



The ALERT Mission: Comprehensive Solutions to a Complex Threat

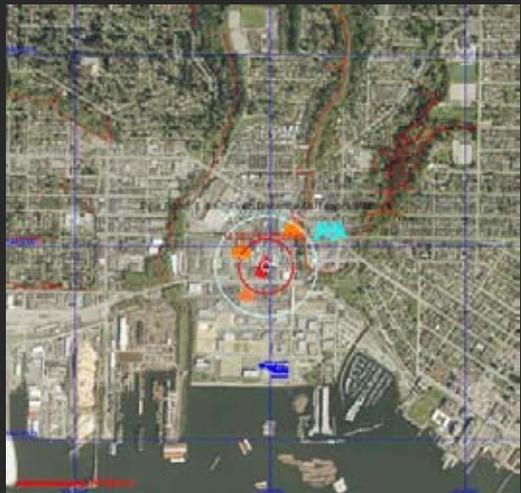
Detection



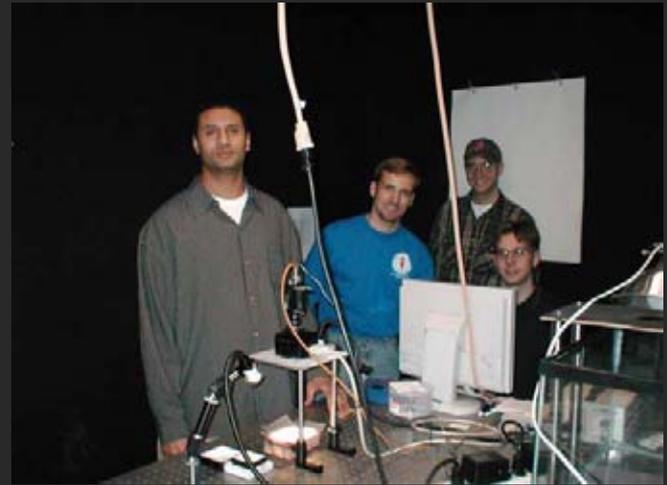
Mitigation



Effective Response



Education & Outreach





The ALERT Team Has The Expertise To Help DHS Combat Explosives Related Threats

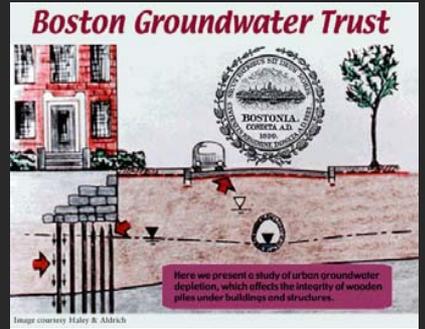
Initial Members of the Team Include

- **The Gordon Center for Subsurface Sensing and Imaging Systems – CenSSIS (NU, BU, RPI, UPRM)**
- **Chemistry and Advanced Materials Engineering- University of Rhode Island (URI)**
- **Remote Sensing and Chemistry (UPRM)**
- **Mining Eng. & EM Compatibility Laboratory (UMR)**
- **The Institute for Shock Physics (WSU)**
- **Chemical Eng. Dept. And Forensics Center (TTU)**
- **Chemistry and Aero- Cal Tech**
- **Chemistry- New Mexico State**

- **Other Academic Colleagues (Tufts, Harvard,...)**
- **National Labs (INL, LLNL, LANL, SNL)**
- **Over 10 Initial Industrial Partners**



A Key Element of our Strategy Collaboration With Industrial Partners





Additional Funding from State will Support Mass. Industrial Collaboration With ALERT



MASSACHUSETTS
TECHNOLOGY
COLLABORATIVE

John Adams **Innovation** Institute

- \$400K-\$600K per year for 4 years
- Supports MA Industry to Work on Demonstration Projects
- 1:1 Industrial Matching Funds Required
- ALERT will be the Conduit for this pool of funds



The ALERT Team Has Access to the Facilities Needed To Accomplish Its Mission

Key Facilities

- **URI Explosives and Forensics Labs**
- **URI Advanced Mitigative Materials Lab**
- **UMR EM Compatibility Lab**
- **NU EM, Optical and IR Sciences Labs**
- **NU-BU-RPI Computer Vision Labs**
- **RPI Center for THz research**
- **UPRM Remote Sensing Lab**
- **WSU Shock Physics Institute Facilities**
- **National Labs-NEXESS**
- **Industrial test facilities**



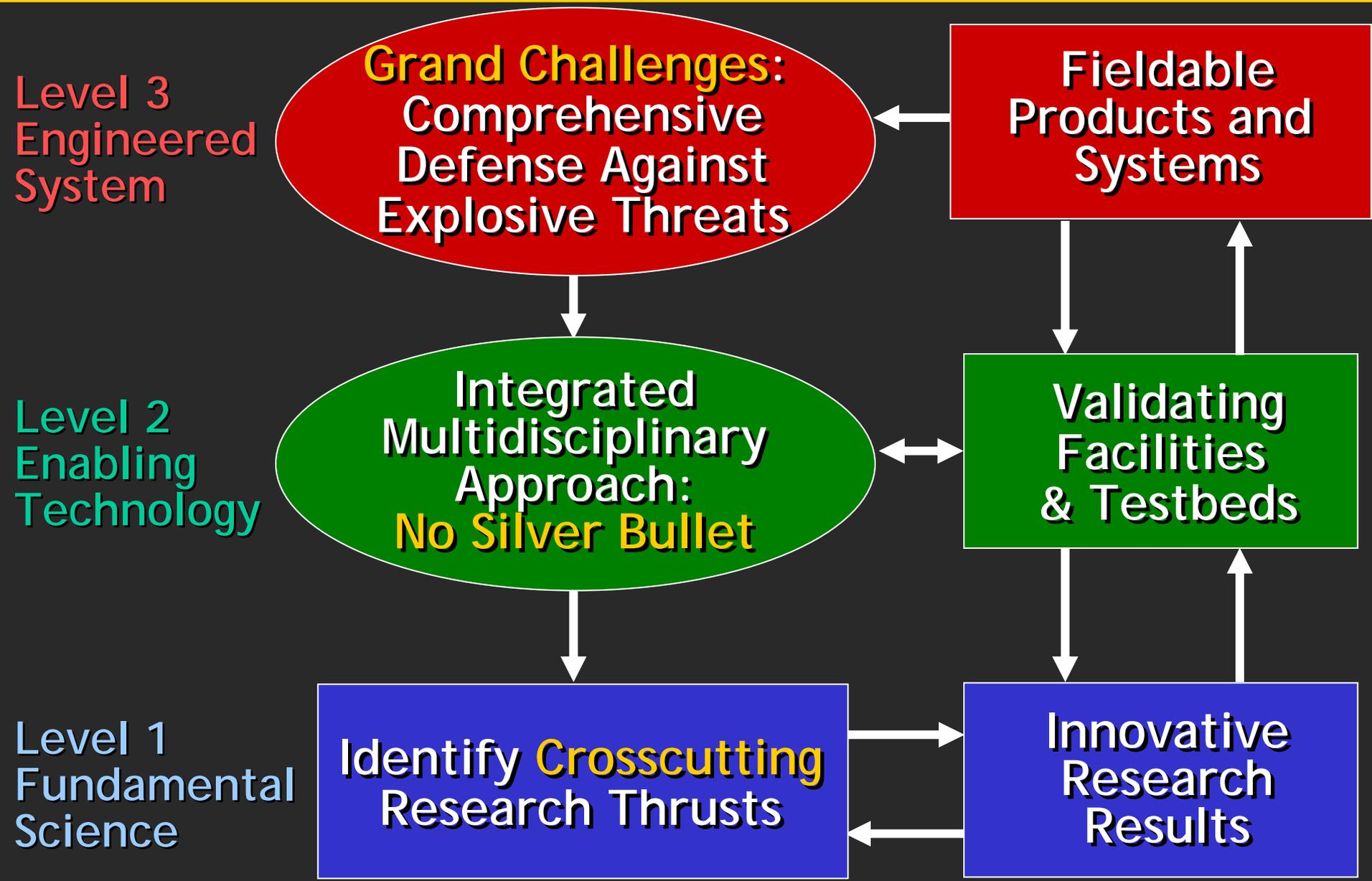
The ALERT Team Has The Relevant Expertise To Do the Job!

Selected supporting research programs

| | | | |
|-------------|---|---------------------|--|
| NSF | NU-BU-RPI-UPRM: Center for Subsurface Sensing and imaging Systems (CenSSIS) | \$ 36M 10 years | Finding "Hidden Things" |
| DHS | NU-Bubble Technologies | \$ 5M 10 Months | Nuclear Portal Detector prototype |
| DoD | UMR: Center for Electromagnetic Compatibility | \$ 2M 5 Years | Alternate IED Detonation signatures |
| DoD | UPRM: Lab. For Applied Remote Sensing & Image Processing | \$ 0.5M 3 Years | Hyperspectral IED Detection |
| DOE, DoD | WSU: Institute for Shock Physics | \$ 20M 10 years | Properties of High Explosives under high pressure and temp. |
| DoD | UMR: Explosives Center and MNE Dept. | \$ 4M 8 years | Characterization, Mitigation and Neutralization of Explosives & IEDs |
| DHS | NU-RPI-Raytheon-American Science and Engineering-Siemens-PPT | \$ 1.7M 8 months | Multi-Mode Suicide Bomber Detection |
| DHS/ TSL | URI | \$.4M 2 Years | Canine Training Aids |
| DHS, DoD | RPI Center for TeraHertz Research | \$ 8M 4 years | Advanced THz technology |
| DoD MURI | BU Lead PI | \$ 6M 5 Years | Multi-sensor Target Recog. |
| NSF | NU-UPRM: Integrated Graduate Education and Research | \$ 3M 5 Years | Non Destructive Diagnosis of Aging Civil Infrastructure |



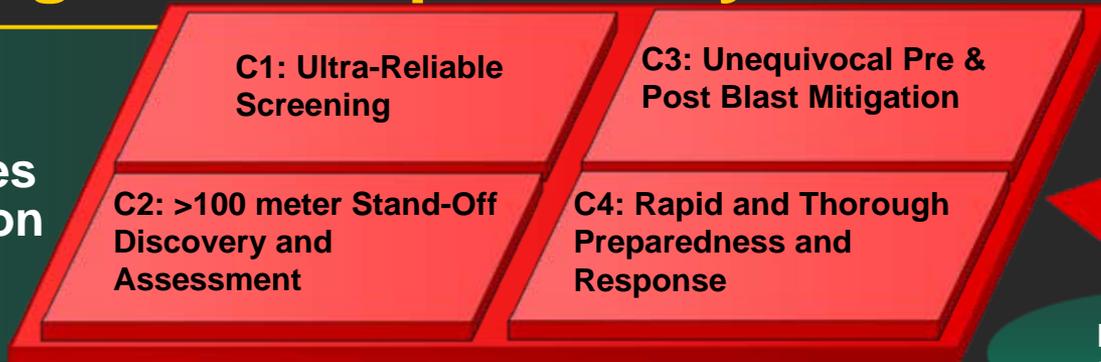
A Top Down Approach Enables ALERT To Create A Coherent Strategy of Operations





The Three Level Structure Shows The Strategic Interdependency of ALERT Efforts

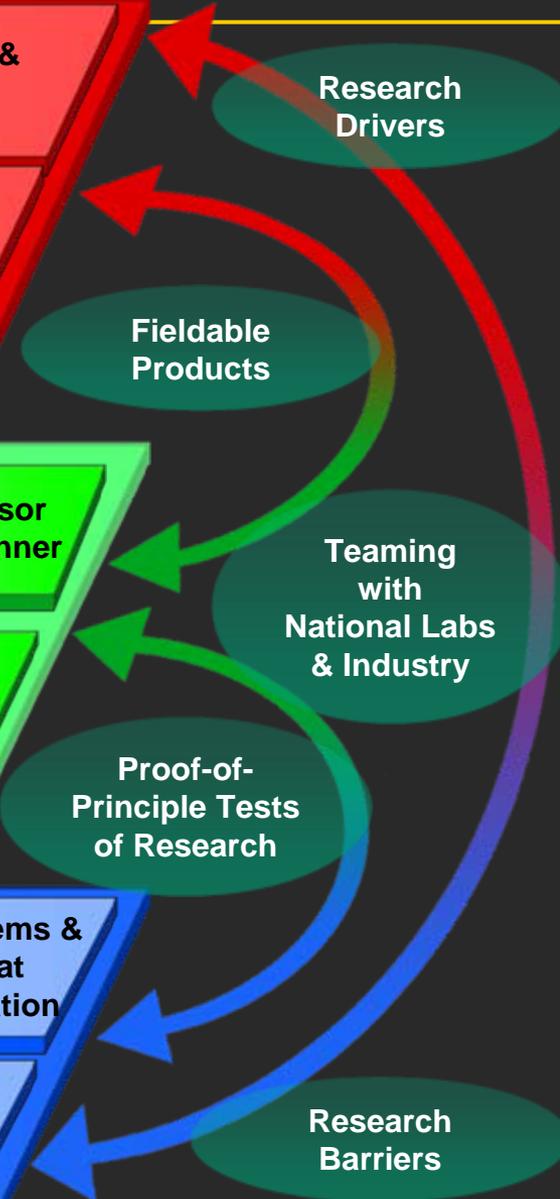
Level 3 Grand Challenges & Next Generation Systems



Level 2 Enabling Technology Solutions



Level 1 Fundamental Science





Addressing The Grand Challenges Inspires the ALERT Team and Guides Its Research Program

■ C1: Ultra-Reliable Screening



Field Deployable THz Spectrometer



mini-Z won 1st Lemelson-Rensselaer Prize \$30,000



ANALOGIC





Addressing The Grand Challenges Inspires the ALERT Team and Guides Its Research Program

- C2: > 100 meter Stand-off Discovery and Assessment

Backscatter Searchlight- Long Range Imaging **AS&E**

- Working with DARPA
 - Coded Aperture approach
 - 50-80 meter ranges
 - "Dynamic Reconstruction"

Initial Study for US Army
RDECOM/DARPA

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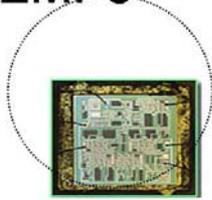
Addressing The Grand Challenges Inspires the ALERT Team and Guides Its Research Program

■ C3: Unequivocal Pre and Post Blast Mitigation



Neutralization with EMPs

ElectroStatic Discharge Generator



Microelectronics are susceptible to EMPs and ESD and can be disabled

Materials Analysis



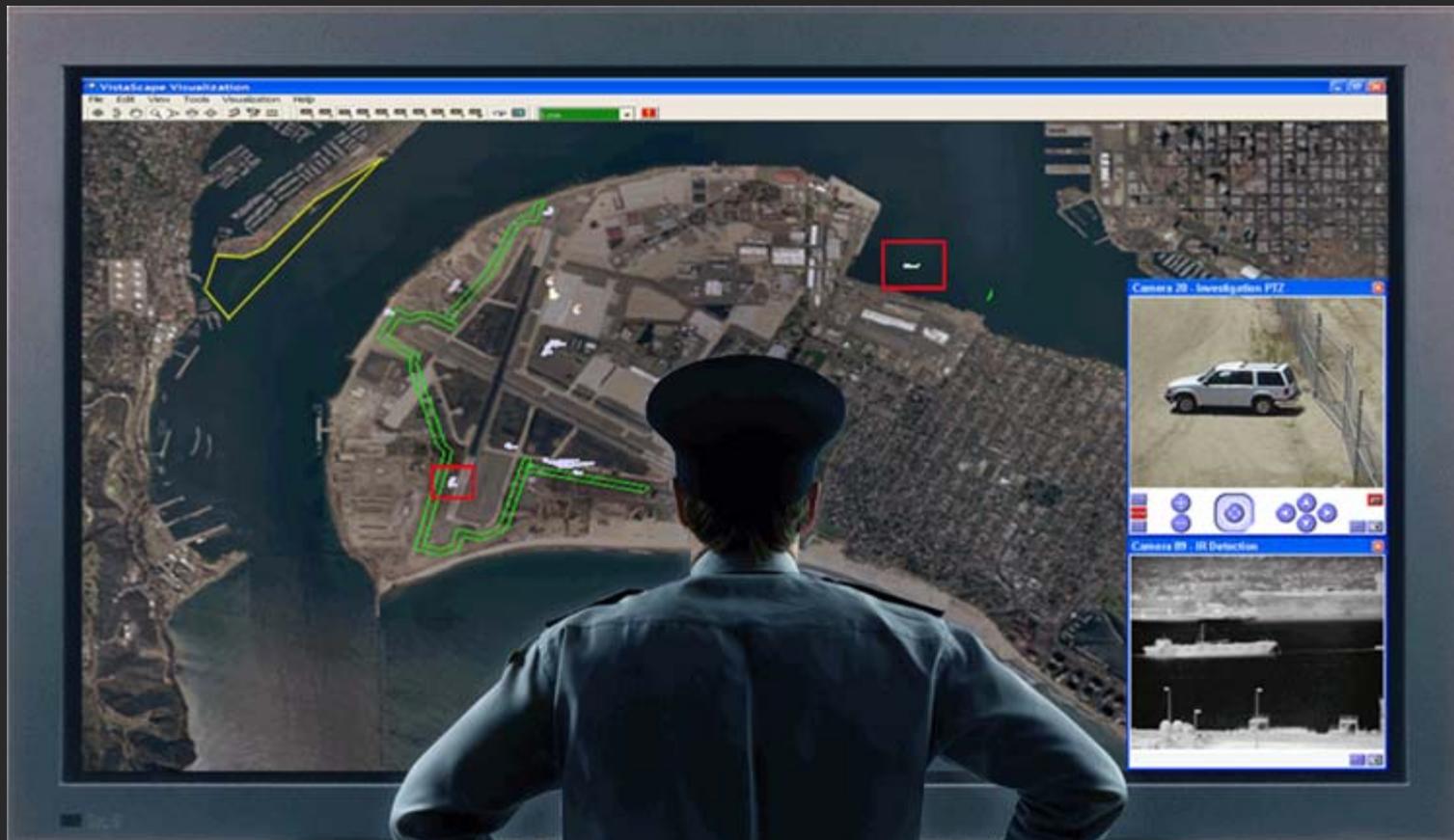
High-power Electromagnetic Pulse Generator





Addressing The Grand Challenges Inspires the ALERT Team and Guides Its Research Program

- C4: Rapid and Thorough Preparedness and Response





The ALERT Fundamental Science Program: A Multidisciplinary and Integrated Approach

Chemical & Physical
Characterization
Of Explosives
(F1)

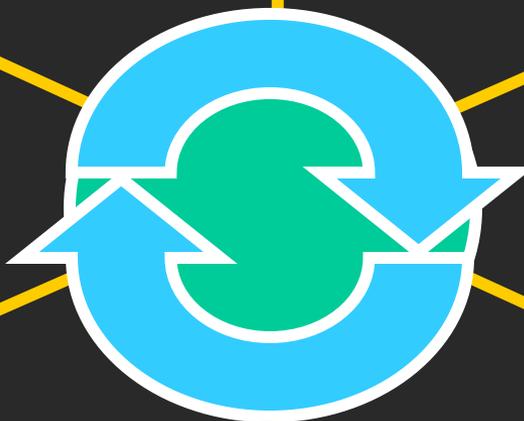
Advanced Explosive
Material & IED
Detectors
(F2)

Mitigation
Science &
Technology
(F4)

Unconventional
Detection
Approaches
(F2)

Man-Machine
Interface
(F3)

Multi-Sensor
Networks
& Fusion
(F3)

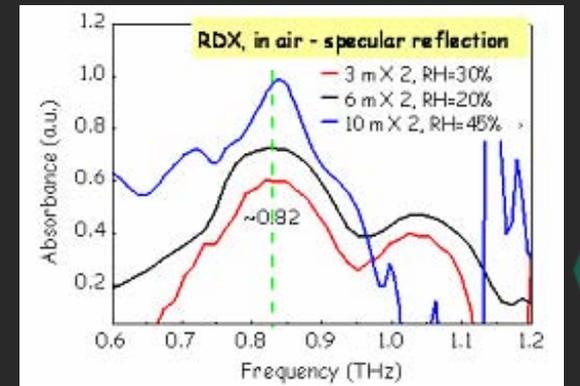




\$1.7 M Phase I DHS Project Is A Foundation For The ALERT Standoff Detection Testbed "T1"



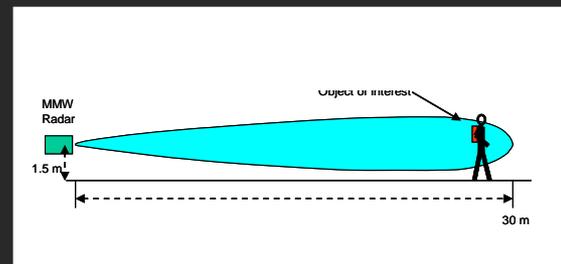
AS&E
ZBV Van & X-ray Sensor



RPI
THZ Explosive detection

Northeastern University

Proposal Lead
Winning Science
Multi-Mode
Video
Radar
X-Ray
THz
Sensor Fusion



NU, Raytheon, & PPT
MMW Radar metal detection

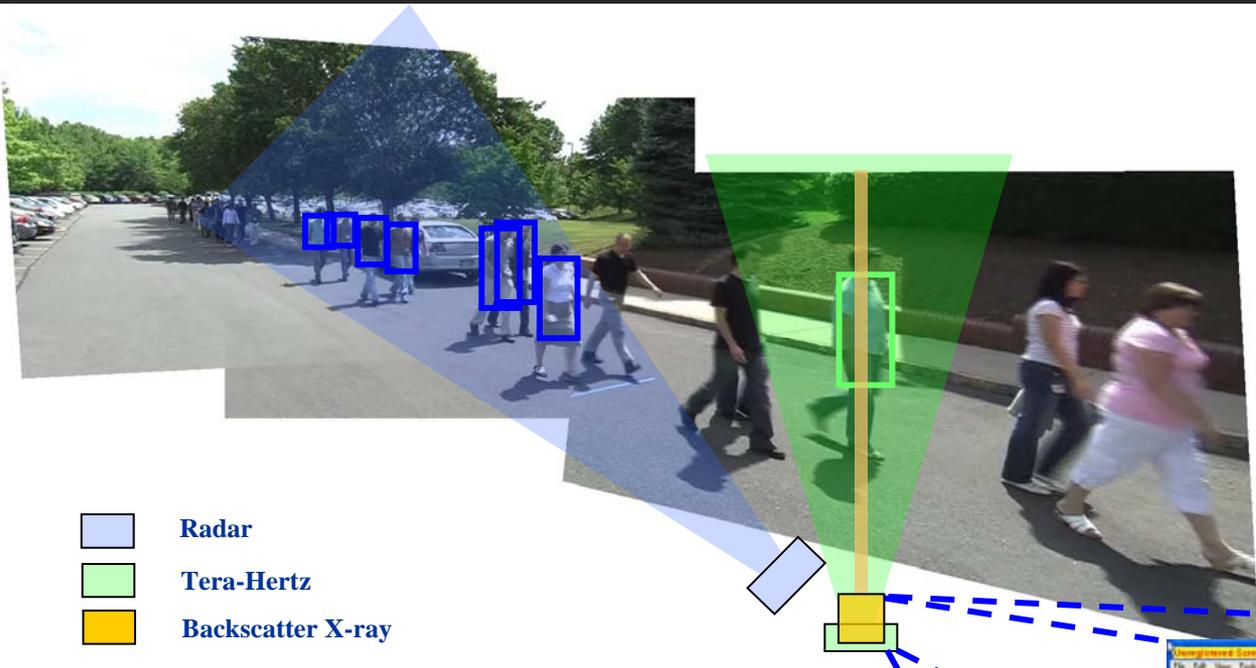


Siemens & NU
Intelligent Video & Data Fusion

Multi-mode Detection of Suicide Bombers At Distances > 50 Meters



ALERT Testbeds are the Vehicle to the Field



-  Radar
-  Tera-Hertz
-  Backscatter X-ray



Requires Integration of Fundamental Science **and** Industrial/Nat'l Lab Collaboration



The ALERT Team Has the Ability to Bring High Impact Research to The Field

HSARPA \$4.9 Million
Portal Monitoring Prototype
NU as Prime Contractor



Advanced DHS
Spectroscopic Portal
\$500 Million
Production Contract

Required Fundamental Science Contributions

- Spectral Classification
- Pattern Recognition
- Noise Reduction
- Computational Modeling

Transitioned Research to Industry
For Prototype Development



ALERT: A Major DHS Resource In the War Against Terrorism

