Non-Line-of-Sight Detection

George Pappas

8 August 2017
Agenda

• Person borne IEDs
• Vehicle borne IEDs
• Booby-trapped structures
• Small quantities of explosives
  - e.g., explosives in portable electronics
• Portable power source detection
• Summary
Person Borne IEDs

• Checkpoint
  - Multiple solutions have been developed
    ▪ IR imaging, mm wave imaging, THz imaging, mm wave polarimetry, magnetometry, hyperspectral trace detection, swipe trace detection
  - Issue: What combination of sensors provides the performance, cost, footprint and throughput for any given installation

• Unstructured environment
  - Multiple personnel with different orientations
    ▪ Identify individual and focus sensors
    ▪ Ensure all individuals are examined in all orientations
  - Longer range sensors required

• Sensor for use by dismounts
  - Examine approaching personnel
  - Scan individuals in environment
Vehicle Borne IEDs

• Checkpoint
  - Multiple solutions have been developed
    ▪ Forward and backscatter X-ray systems,
      Vehicle and Cargo Inspection System (VACIS),
      Muon and electron detection, hyperspectral trace
detection systems, Radiation Detectors, Nuclear
Quadrupole Resonance detection
  - Issue: What sensor, or combination of sensors, provides the
    performance, cost, footprint and throughput for any given installation

• Detection during VBIED transit
  - Covert sensors
    ▪ Protection of deployed sensors
  - Tracking vehicles leaving suspicious sites
  - Vehicles avoiding checkpoints
  - Observing driver characteristics (biometrics)
  - Non-lethal vehicle stopping
Booby Trapped Structures

• Examples of types of bobby traps
  - Trip wire initiated explosives, PIR initiated devices, pressure plate under rug, etc.

• Small UAV
  - Mapping single level has been demonstrated
  - Multiple level mapping may be desirable
  - Detecting booby traps from small UAV is difficult

• Small UGV
  - Must be sacrificial
  - Possible equipment
    - Infrared imager
    - Backscatter x-ray
    - Manipulator arm
Small Quantities of Explosives

• Potential problem
  - Insurgent smuggling small quantities of explosives into a facility for later assembly into an IED

• Problems with existing solutions
  - X-ray: does not identify material, only provides shape and indication of approximate atomic weight
  - Swipe: insurgents are likely to understand the necessity of ensuring all surfaces are clean
  - Canine: Packaging to ensure there is no escaping vapor

• Possible solutions
  - Nuclear quadrupole resonance – currently too slow for small quantities but novel antenna can mitigate effect of noise
  - Neutron activation – currently too slow for small quantities, but novel, high flux neutron generator can reduce time to detect
Portable Power Source Detection

- Chemical detection
  - X-ray
    - provides image and
    - relative strength of reflected energy
  - Nuclear Quadrupole Resonance
    - Identifies chemical
    - Cannot penetrate metallic enclosure
  - Neutron activation
    - Identifies chemical
    - Short range and long integration time

- Connecting wire detection
  - 1 m and longer wires are detectable
  - Require techniques to detect shorter wires
Summary

- **JIDO Interest Areas**
  - Novel approaches to detecting PBIEDS in an unstructured environment
  - Man portable, low SWAP sensors for PBIED detection
  - Sensors that can be disguised as part of a city’s infrastructure for scanning driver characteristics or vehicle contents
  - Low SWAP sensors for detecting booby traps
  - Sensors for the detection of small quantities of explosives
  - Sensors for the detection of portable power sources