

Non-Line-of-Sight Detection

George Pappas

8 August 2017



HELPING WARFIGHTERS ADAPT

JIDO
JOINT IMPROVISED-THREAT DEFEAT ORGANIZATION



UNCLASSIFIED

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

UNCLASSIFIED



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 booby 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

