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Through-the-Wall Sensors (TTWS) for Law Enforcement: Use Case Scenarios

(Version 1.3)

**DOJ Office of Justice Programs
National Institute of Justice
Sensor, Surveillance, and Biometric Technologies (SSBT)
Center of Excellence (CoE)**



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1.0 INTRODUCTION

The National Institute of Justice (NIJ) Sensor, Surveillance, and Biometric Technologies (SSBT) Center of Excellence (CoE) has prepared a summary of scenarios for the use of Through-The-Wall Sensors (TTWS) by law enforcement and emergency response practitioners. The scenarios are presented within a defined framework and consistent structure so as to aid in end-user application and requirements analysis, as well as provide a foundation for laboratory and field test and evaluation efforts by both the community and its technical support organizations.

A technology need has been identified by NIJ for first responders to be able to sense the presence of persons through visually obscure barriers. The ability to sense the presence of individuals through common building materials can be useful during rescue operations, law enforcement operations, and other tactical scenarios. Firefighters may be able to use the ability to detect individuals to more quickly clear dangerous areas (e.g., buildings that are on fire could be more quickly checked for trapped survivors), rescue personnel may be able to use TTWS to more easily locate survivors after a building collapse, and law enforcement personnel may be able to use TTWS to enhance situational awareness during tactical operations (e.g., building clearance, hostage threat situations).

As with any new technology, detailing and understanding the relevant applications and operating requirements is essential prior to acquisition and deployment. TTWS has gathered increasing attention and interest from the law enforcement and emergency response communities. This report aims to educate practitioners on possible use-case scenarios and aid in evaluation, acquisition, and training related to deployed TTWS.

NOTE: This report is a companion to a market survey (<https://www.justnet.org/pdf/00-WallSensorReport-508.pdf>) and a report detailing best practices and lessons learned (<https://www.justnet.org/pdf/ThroughWallSensorBestPractices-508.pdf>), both previously published by the SSBT CoE.

1.1 About NIJ SSBT CoE

The NIJ SSBT CoE is a center within the National Law Enforcement and Corrections Technology Center (NLECTC) System. The CoE provides scientific and technical support to NIJ's research and development (R&D) efforts. The Center also provides technology assistance, information and support to criminal justice agencies. The Center supports the NIJ Sensor and Surveillance portfolio and the Biometrics portfolio. The Centers of Excellence are the authoritative resource within the NLECTC System for both practitioners and developers in their technology area(s) of focus. The primary role of the Centers of Excellence is to assist in the transition of law enforcement technology from the laboratory into practice by first adopters.

1.2 Basic Principles of Operation

TTWS devices utilize radar signals to penetrate barriers and detect the presence of stationary and moving targets. The electromagnetic signal is transmitted in a pulse that travels through space to reflect off barriers and objects. The amount of signal that is reflected by and transmitted through a given object depends on its material composition, density, and thickness. For example, concrete is more difficult to transmit through than plywood. The range to structures and targets is determined by the amount of time a given pulse takes to return to the device. Movement is detected by measuring a shift in the reflected signal's frequency, also known as a Doppler Shift. Movement as small as breathing or body swaying while standing can often be detected through 6"+ of common building materials.

There is an inherent trade-off that most devices must make between range, size, complexity, and information. Devices are typically either simplified one-handed units designed for short range (0 – 15 meters) or two-handed mobile or fixed position units for long range (0 – 20+ meters). In addition, the level of detail provided to the operator is typically simple range and movement reporting for smaller short-range units or information on multiple targets, wall locations, and angular position for larger units. However, more detailed displays include more opportunities for signal interference or more complicated radar signatures. The level of training and operator experience required to operate different units effectively is usually linked to the level of information being provided by the system. Although these descriptions are generalization and may not apply to all available TWS devices, they provide the appropriate context and expectations for end-users interested in utilizing TTWS in the field.

NOTE: Because of the fundamental nature of radar (i.e. electromagnetic signals), TTWS devices **cannot penetrate solid metal** surfaces, objects or barriers regardless of thickness. As a result, many scenarios described within do not include situations involving vehicles because of the difficulties in imaging them. For example, a Hostage Event could include a hostile suspect and civilian within a vehicle (e.g. van), but because of the metal nature of the structure, TTWS is not applicable. This restriction will also extend to mobile homes and trailers with metal walls/siding.

2.0 DISCLAIMERS

1. This project was supported by Award No. 2010-IJ-CX-K024, awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect those of the Department of Justice.
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3. All legal aspects regarding expectation of privacy issues, probable cause, warrants, and any other operational law enforcement procedures should be researched by agencies and their officers in accordance with local, state, and federal laws prior to the implementation of technology described herein.
4. Organizations and individuals should seek legal counsel before operating through-the-wall systems. These devices are subject to Federal Communications Commission (FCC) regulations under Title 47, Parts 15 and 90 of the Code of Federal Regulations (CFR).

3.0 COMMERCIAL SYSTEMS (FCC-CERTIFIED)

A summary of the commercially available FCC-certified TTWS systems suitable for law enforcement, emergency response, and tactical applications is provided here for ease of reference and comparisons. Key characteristics and parameters are assembled in Table 3-1, with explanations of the fields below.

- **Product Name and Manufacturer**
- **Unit Cost** is the cost in U.S. dollars of a single unit with supporting material (if needed) for operating the device in the field.
- **Training** indicates whether training is included for the operation of the instrument.
- **Operating Range** is the manufacturer stated range that the device can detect a target without attenuating barriers, unless otherwise noted. “Without attenuating barriers” was chosen as the base for this parameter because signal frequencies, barrier properties, and signal properties all effect range in differing dependencies.
- **Field of View** indicates the angular width that the device is able to detect targets.
- **Weight** is the weight of the device as it would be operated
- **Battery Life** (where applicable) is the length of operational time that the device can be operated on one set of fully charged (or fresh) batteries.
- **Frequency** is the frequency or frequency range that the device uses to form the signal used for target detection.

Table 3-1 Commercially Available TTWS in the U.S.

Product Name	Mfg.	Unit Cost	Training	Operating Range ¹ (meters)	Field of View (degrees)	Weight (lbs)	Battery Life	Frequency (GHz)
Range-R	L3	\$6,000 ²	Included	15.25	160	1.2	400 uses	3.18 – 3.42
Xaver 100	Camero -Tech	\$9,000	Included	20 ³	120	1.2	3 hrs	3 – 10
Xaver 400	Camero -Tech	\$47,500	Included	20	120	7	2.5 - 4.5 hrs ⁴	2 – 10

¹ The effective operating range to a target through a barrier is dependent on the barrier material composition, signal composition/shape, and output frequency(s).

² Range-R Link with wireless monitoring and control costs \$9,000

³ The pre-production model described in the SSBT CoE market survey possessed a range of 8 meters

⁴ Dependent on the number of batteries installed in the system during operation.

4.0 SCENARIO DEFINITION SCHEME

1. Scenario Parameters
 - a. Environment Location – Indoor, Outdoor, Urban, Suburban, Rural
 - i. Indoor vs. Outdoor – Location of Operator and Device
 - ii. Urban, Suburban, Rural – Composition of exterior landscape
 - b. Structure Type – Residential, Industrial, Commercial, Vehicle, None
 - i. None = No structure involved; operation outside against foliage
 - c. Hostile Targets – Yes, No, Unknown
 - i. Does the operator have knowledge of an active threat?
 - d. Multiple Targets – Yes, No, Unknown
 - i. Does the operator know the number of persons in the scan area?
 - e. Collateral Targets – Yes, No, Unknown
 - i. Is there a mixture of hostile and friendly persons in the scan area?
 - f. Interference – Active, Structural, Environmental
 - i. Active = Efforts by target to obfuscate detection (e.g., Aluminum foil on windows)
 - ii. Structural = Aspects or components of buildings that interfere
 - iii. Environmental = Surrounding or interior objects that interfere (e.g., trees, oscillating fans)
2. Device Operation
 - a. Sensor Range – Short, Long
 - i. Short = 0 – 15 meters
 - ii. Long = 16 + meters
 - b. Device Placement – Wall Contact, Standoff
 - c. Possession – Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: High, Medium, Low
 - b. ... Low False Positive Rate: High, Medium, Low
 - c. ... Low False Negative Rate: High, Medium, Low
 - d. ... Accurate Target Location: High, Medium, Low
 - e. ... Accurate Target Number: High, Medium, Low

5.0 USE CASE SCENARIOS

Research into the operational use of TTWS, including engagement with law enforcement practitioners, has identified thirteen (13) possible use case scenarios for the technology. These scenarios have subsequently been grouped into five (5) generic scenario types. Definitions for the specific scenarios can also be found in APPENDIX A: USE CASE SCENARIOS - SPECIFIC. The scenarios were the outcome of discussions with practitioners at various events, demonstrations, and meetings (see Section 7.0 REFERENCES). In these engagements, the SSBT CoE gathered qualitative information on the use and function of the devices, how the systems could potentially be leveraged in real-world criminal justice situations, and the operational importance/priorities of various performance factors. These scenarios have been described utilizing the parameters and ratings detailed in the previous section.

1. Surveillance
2. Tactical Breach & Clear
 - a. Hostage Event
 - b. Active Shooter
 - c. Respond to High-Threat Emergency Call
3. Search & Rescue
 - a. Search & Rescue in Fire Building
 - b. Search & Rescue in Collapsed Building
 - c. Search & Rescue in Vehicle Accident
4. Area Search
 - a. Serving Search Warrant
 - b. Respond to Building Alarm or Trespassing/Burglary Call
 - c. Serving Arrest Warrant
 - d. Suspect Pursuit Outdoors
 - e. Missing Prisoner Searches
5. Checkpoint Vehicle Search

5.1 Surveillance

Description: Law enforcement conducts surveillance on a location to obtain information on activity and persons. May involve covert or overt observation. May be performed as prelude to active engagement or tactical operations (e.g., monitoring building prior to tactical entry).

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: Unknown
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: Yes, No
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: Medium
 - d. ... Accurate Target Location: Medium
 - e. ... Accurate Target Number: High

Comments:

- TTWS surveillance could be well suited to surveillance of a building with a known or suspected underground tunnel exit.

5.2 Tactical Breach & Clear

Description: Officers and/or tactical units rapidly enter a building, sweep for targets, and eliminate or apprehend threats.

Examples: Hostage Event, Active Threat, Response to High-Threat Emergency Call

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: Yes
 - d. Multiple Targets: Yes, Unknown
 - e. Collateral Targets: Yes, Unknown
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: Medium – High
 - b. ... Low False Positive Rate: Medium – High
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: High

5.3 Search & Rescue

Description: Emergency responders arrive at a scene that involves a dangerous building or accident. The area is searched for persons in need of rescue or medical attention.

Examples: In Fire Building, In Collapsed Building, At Vehicle Accident

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: No
 - d. Multiple Targets: Yes, No, Unknown
 - e. Collateral Targets: No
 - f. Interference: Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: Medium – High
 - b. ... Low False Positive Rate: Low – High
 - c. ... Low False Negative Rate: Medium – High
 - d. ... Accurate Target Location: Medium – High
 - e. ... Accurate Target Number: Low

5.4 Area Search

Description: Law enforcement searches an area for concealed suspects attempting to hide or elude discovery.

Examples: Serving a search warrant, Response to building alarm or trespassing/burglary call, Serving arrest warrant, Suspect pursuit outdoors, Missing prisoner searches

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: Yes, No, Unknown
 - d. Multiple Targets: Yes, No, Unknown
 - e. Collateral Targets: No, Unknown
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Low – High
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: Medium – High
 - d. ... Accurate Target Location: Low – High
 - e. ... Accurate Target Number: Low – High

5.5 Checkpoint Vehicle Search

Description: A checkpoint or installation access point searches cargo in vehicles for concealed travelers. To be used after a vehicle is flagged for detailed processing or in high security situations. Examples include scanning the cargo in a truck trailer or a mass of dirt or gravel in the back of a dump truck.

1. Scenario Parameters
 - a. Environment Location: Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Vehicle
 - c. Hostile Targets: Unknown
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: Unknown
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short
 - b. Device Placement: Standoff
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Low
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: Medium
 - d. ... Accurate Target Location: Low
 - e. ... Accurate Target Number: Low

Comments:

- Because metal can interfere or block TWS signals, use will be limited to larger volumes which can have open access. For example, scanning down the length of an open trailer compartment, but not from outside the vehicle.
- Due to the need for accessing the interior of the vehicle, the use-case assumes that high speed or volume throughput process is not a requirement.
- A standard sized shipping container is either 20' or 40' in length.
- Some cargo trailers utilize heavy canvas cloth enclosure walls, and therefore will be susceptible to TTWS penetration and imaging.

6.0 CLOSING

TTWS technology has increased in maturity and accessibility significantly over the last ten years, such that its use in domestic law enforcement and emergency response operations is both feasible and beneficial. However, before practitioners can leverage the capabilities of these systems, it is important that they understand the relevant use-case scenarios and the underlying requirements and limitations of those situations. TTWS is not the right solution for every encounter or application, but there are many, across a wide range of parameters and descriptions, where the enhanced situational awareness provided by these systems can improve operational practice, officer safety, and protection of the public. This report aims to contribute to the proper selection, training, and implementation of TTWS by the first responder community.

7.0 REFERENCES

- ManTech Advanced Systems International, *Through-the-Wall-Sensors for Law Enforcement: Market Survey*, <https://www.justnet.org/pdf/00-WallSensorReport-508.pdf> (October 2012).
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- L-3 CyTerra Corporation, *Range-R® Through the Wall Radar*, <http://www.range-r.com/> (September 2012).
- AKELA Inc., “*Through the Wall Standoff Detection and Tracking of Individuals*,” Presented at the NIJ Annual Conference (June 17, 2012; Arlington, VA).
- NIJ Sensors Technology Working Group Meeting (April 19 – 20, 2011; Arlington, VA).
- Raytheon TTWS Demo (August 22 – 24, 2011; Atlanta, GA).
- The Critical Incident Preparedness (TCIP) Conference (August 30 - September 1, 2011; National Harbor, Maryland).
- NIJ Law Enforcement Training Institute (LETI) Fall 2011 (September 19 – 21, 2012; Annapolis, MD).
- Biometric Consortium Conference (BCC) (September 27-29, 2011; Tampa, FL).
- NIJ Rural LETI (December 5 – 8, 2011; Annapolis, MD).
- High Intensity Drug Trafficking Area (HIDTA) West Meeting (February 13 – 15, 2012; El Paso, TX).
- Mock Prison Riot 2012 (May 6 – 9, 2012; Moundsville, WV).
- NIJ LETI Summer 2012 (June 26 – 28, 2012; Annapolis, MD).
- NIJ LETI Fall 2012 (September 11 – 12; Annapolis, MD).
- L-3 Range-R® Training (June 13, 2012; Fairmont WV).
- Law Enforcement Technology Demonstration (July 25, 2012; Fairfax County VA).
- AKELA Training (August 30, 2012; Santa Barbara, CA).
- Mistral Security Xaver Training (September 13, 2012; Camp Dawson, WV).

APPENDIX A: USE CASE SCENARIOS - SPECIFIC

A-1

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A.1 Surveillance

See Section 5.1

A.2 Tactical Breach & Clear

A.2.1 Hostage Event

Description: Tactical unit responds to hostage-taking event inside of a building. The unit surveys the scene and then rapidly breaches the building to secure the hostage, eliminate threats, and apprehend suspects. The unit clears all rooms in the building.

1. Scenario Parameters

- a. Environment Location: Indoor, Urban, Suburban, Rural
- b. Structure Type: Residential, Industrial, Commercial
- c. Hostile Targets: Yes
- d. Multiple Targets: Yes
- e. Collateral Targets: Yes
- f. Interference: Active, Structural, Environmental

2. Device Operation

- a. Sensor Range: Short, Long
- b. Device Placement: Wall Contact, Standoff
- c. Possession: Mobile, Fixed

3. Importance of...

- a. ... Fast Time To Acquire: High
- b. ... Low False Positive Rate: High
- c. ... Low False Negative Rate: High
- d. ... Accurate Target Location: High
- e. ... Accurate Target Number: High

A.2.2 Active Shooter

Description: Officers and/or tactical units respond to an emergency call that a suspect is actively attacking civilians. Units perform a high alert sweep and clear to locate all active threats and eliminate them.

1. Scenario Parameters
 - a. Environment Location: Outdoors, Indoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: Yes
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: Unknown
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: High
 - b. ... Low False Positive Rate: High
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: High

A.2.3 Respond to High-Threat Emergency Call

Description: Officers respond to an emergency call involving a high-threat suspect. The area is searched and secured; suspects are located and taken into custody.

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: Yes
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: Unknown
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: High

A.3 Search & Rescue

A.3.1 Search & Rescue in Fire Building

Description: Emergency responders arrive at a building that is on fire. Presence, location, and number of persons within the building are unknown. Persons may be prone, injured, or unconscious. Responders intend on entering the building, or directing on-sight personnel to persons in need of rescue.

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial
 - c. Hostile Targets: No
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: No
 - f. Interference: Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: High
 - b. ... Low False Positive Rate: High
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: Low

A.3.2 Search & Rescue in Collapsed Building

Description: Emergency responders search the rubble and structure a collapsed building to locate survivors. Person may be injured, trapped, or unconscious.

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial
 - c. Hostile Targets: No
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: No
 - f. Interference: Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile, Fixed
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: Low

A.3.3 Search & Rescue in Vehicle Accident

Description: Officers arriving on the scene of a traffic accident search surrounding terrain for victims who may have been thrown from the crashed vehicle. Person may be injured, prone, or unconscious.

1. Scenario Parameters
 - a. Environment Location: Outdoor, Suburban, Rural
 - b. Structure Type: None
 - c. Hostile Targets: No
 - d. Multiple Targets: Yes, No, Unknown
 - e. Collateral Targets: No
 - f. Interference: Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Standoff
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Low
 - c. ... Low False Negative Rate: Medium
 - d. ... Accurate Target Location: Medium
 - e. ... Accurate Target Number: Low

A.4 Area Search

A.4.1 Serving Search Warrant

Description: Officers serve a search warrant at a building and conduct a search for evidence. All persons on the premises are secured and all rooms and empty spaces are searched.

1. Scenario Parameters
 - a. Environment Location: Indoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial
 - c. Hostile Targets: No
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: No
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short
 - b. Device Placement: Wall Contact
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Low
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: Medium
 - d. ... Accurate Target Location: Medium
 - e. ... Accurate Target Number: Low

A.4.2 Respond to Building Alarm or Trespassing/Burglary Call

Description: Officer responds to an alarm of trespassing/burglary call. A search is done of the premises to determine whether there is anyone present.

1. Scenario Parameters
 - a. Environment Location: Indoor, Outdoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial, None
 - c. Hostile Targets: Unknown
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: No
 - f. Interference: Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short
 - b. Device Placement: Wall Contact, Standoff
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: Medium
 - e. ... Accurate Target Number: Medium

A.4.3 Serving Arrest Warrant

Description: Officers arrive at a location to serve an arrest warrant on a suspect and take the suspect into physical custody. No known active threat. Suspect may be designated as dangerous. Suspect may attempt to hide, conceal, or elude detection and capture.

1. Scenario Parameters
 - a. Environment Location: Indoor, Urban, Suburban, Rural
 - b. Structure Type: Residential, Industrial, Commercial
 - c. Hostile Targets: Unknown
 - d. Multiple Targets: Unknown
 - e. Collateral Targets: Unknown
 - f. Interference: Active, Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short
 - b. Device Placement: Wall Contact
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: High
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: High

A.4.4 Suspect Pursuit Outdoors

Description: Officers pursue a fleeing suspect outdoors and perform an area sweep to locate the target. Person may be prone, stationary, or concealed behind plants or trees. May take the form of a coordinated manhunt search.

1. Scenario Parameters
 - a. Environment Location: Outdoor, Suburban, Rural
 - b. Structure Type: None
 - c. Hostile Targets: Yes
 - d. Multiple Targets: Yes, No
 - e. Collateral Targets: Unknown
 - f. Interference: Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short, Long
 - b. Device Placement: Standoff
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: High
 - e. ... Accurate Target Number: High

A.4.5 Missing Prisoner Searches

Description: A prisoner is missing within a corrections facility and believed to be eluding officers. A search is performed throughout the facility with other inmates confined to cells.

1. Scenario Parameters
 - a. Environment Location: Indoor, Urban
 - b. Structure Type: Industrial
 - c. Hostile Targets: Yes
 - d. Multiple Targets: Yes, No
 - e. Collateral Targets: No
 - f. Interference: Structural, Environmental
2. Device Operation
 - a. Sensor Range: Short
 - b. Device Placement: Wall Contact
 - c. Possession: Mobile
3. Importance of...
 - a. ... Fast Time To Acquire: Medium
 - b. ... Low False Positive Rate: Medium
 - c. ... Low False Negative Rate: High
 - d. ... Accurate Target Location: Low
 - e. ... Accurate Target Number: Low

A.5 Checkpoint Vehicle Search

See Section 5.5

APPENDIX B: ACRONYMS AND ABBREVIATIONS

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ACRONYM	DESCRIPTION
CFR	Code of Federal Regulations
CoE	Center of Excellence
DOJ	Department of Justice
FCC	Federal Communications Commission
LETI	Law Enforcement Training Institute
NIJ	National Institute of Justice
NLECTC	National Law Enforcement and Corrections Technology Center
R&D	Research and Development
SSBT	Sensor, Surveillance and Biometric Technologies
TTWS	Through-the-Wall Sensors
U.S.	United States

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