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Under the Science and Technology Directorate, the National Urban Security Technology Laboratory (NUSTL) manages the SAVER program,– with the participation of emergency responders – performs objective operational assessments of commercially available equipment.

SAVER knowledge products provide information about equipment that falls under the DHS Authorized Equipment List (AEL) categories and focuses on two questions for the responder community: "What equipment is available?" and "How does it perform?"

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Science and Technology

WALK-THROUGH SCREENING SYSTEMS FOR MASS CASUALTY THREATS

Walk-through screening systems can detect concealed mass-casualty weapons carried by attackers without significantly impeding pedestrian traffic flow. They can also enhance safety in crowded public areas by deterring would-be attackers. Unlike high security checkpoints where individuals remove their bags, coats or metal objects, these walk-through screening systems allow people to be screened without stopping. This equipment falls under the Authorized Equipment List (AEL) reference number 15SC-00-PPSS titled "Systems, Personnel/Package Screening."

Overview

Walk-through screening systems can enhance security at "soft target" locations, such as transit hubs or event venues, that may have otherwise relaxed security measures. These systems are designed to detect concealed weapons, such as firearms and large knives, and can be configured not to alarm on innocuous items, such as cellphones and keys.

Figure 1 Walk-Through Metal Detector
Image credit: CEIA USA Ltd.

Technology Considerations

When choosing a system, parameters such as detection sensitivity, the ability to detect a particular class of threat item, should be considered. The other parameter to weigh is throughput, the rate at which a system screens people. A product with a higher sensitivity may have better detection performance for smaller threat items but also alarms on non-threats. This reduces the effective throughput of the system as individuals must remove items from their pockets and security personnel must adjudicate false alarms. Conversely, a product with a lower sensitivity may have a lower false alarm rate and higher throughput but may not detect smaller threat items. Many screening systems have adjustable sensitivity settings so users can configure the size of the object that will trigger an alarm to their specific applications.

Walk-through screening systems are available in various designs to suit different use cases. Some applications require an easily transportable system that can operate on battery power for temporary deployment – from a few hours to a single day - for special events in public venues or random screenings at transportation hubs. For long-term screening applications, a system may be set up at venue entrances or integrated with building infrastructure.

All screening systems require personnel for operation and alarm resolution. While a screening portal itself typically requires only one person to operate, a screening lane may require three or more: one person to guide people through the portal, one to operate it, and one to conduct follow-on screening if a threat item is detected, as well as any additional security personnel as needed.

Technology Types

Metal Detectors

Walk-through metal detectors (WTMDs) detect and analyze changes to a magnetic field caused by a metal object. The magnitude of the detection signal is proportional to the object's mass and size and varies with the conductive and magnetic properties of different metals and the object's orientation relative to the detection field. WTMDs provide an audible and/or visual alert to operators when a potential threat item is detected. Some indicate the location of the item to facilitate follow-on screening to address the threat.

Two different types of metal detection systems are available. Active WTMDs use electrical circuits to generate a magnetic field between two side panels and measure changes in the field to detect both ferromagnetic and non-ferromagnetic metal items. Passive WTMDs use the earth's magnetic field and have a difficult time detecting non-ferromagnetic metals, such as copper, aluminum, zinc, and brass.

WTMDs may be susceptible to ambient electromagnetic inference from large moving metal objects – such as elevators, escalators, revolving doors, and trains – or proximity to large static ferromagnetic materials, such as iron beams. Some systems have built-in electronics to mitigate such interference.

Imaging Systems

Imaging systems for screening people employ millimeter waves (MMW) that pass through clothing but not the human body. Active systems emit MMW signals that illuminate the subject to detect and analyze the reflections. Passive MMW systems detect and analyze natural emissions of MMW energy by the human body.

Active MMW systems may detect a wide range of threats and may require people to stop in the portal for a short period of time. As such, active systems may not be suitable for locations with high foot traffic and may be better suited to facilities with stricter security needs such as a courthouse or power utility building.

Figure 2 Detection interface for passive MMW systems
Image credit: Thruvision Ltd.

Passive MMW systems are designed as standoff detectors rather than as traditional portals that screen people as they walk through the sensors' area of inspection. The dimensions of a passive system's area of inspection depend on its sensor's angular field of view and the standoff distance from the person being screened. Passive MMW systems are less sensitive than active MMW systems, especially at longer standoff distances.

Relevant Standards

The American Society for Testing and Materials is launching a conformity assessment program based on *ASTM F3566-22 Standard Performance Specifications and Test Methods for Walk-Through Metal Detectors* [1], which will allow manufacturers to submit their systems for independent, third-party evaluation.

The Institute of Electrical and Electronics Engineers' *IEEE N42.59 Standard for Measuring the Imaging Performance of Active Millimeter-Wave Systems for Security Screening of Humans* [2] addresses the quality of images to be processed by an automated threat recognition algorithm.

References

[1] ASTM International, "ASTM F3566-22 Standard Performance Specifications and Test Methods for Walk-Through Metal Detectors Used in Safety and Security," 2022.

[2] IEEE, "PN42.59 Standard for Measuring the Imaging Performance of Millimeter-Wave Systems for Security Screening of Humans," 2021. [Online]. Available: https://standards.ieee.org/ieee/N42.59/11515.