Homeland Security
Science and Technology

TechNote

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, contact the SAVER Program Support Office.

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Explosives Detection Portals

Walk-through and drive-through explosives detection portals are used to screen people or vehicles entering secure areas at airports, nuclear power plants, military bases, and other locations that may be at a heightened risk for terrorist attack. Some portals are also capable of detecting concealed weapons, narcotics, or other items. Explosives detection portals may be based on one of several different technologies, including trace explosives detection, backscatter X-ray detection, and millimeter and submillimeter wave detection.

Technology Overview

Trace explosives detection portals are based on the premise that individuals who have handled explosives are likely to be contaminated with microscopic residues of explosives particles. It is by detecting these residues that individuals carrying concealed explosives are identified; portals of this type may also be capable of detecting narcotics. The subject standing in the portal is exposed to jets of air emitted by an array of nozzles arranged from floor to head level, which dislodge residual explosives particles from clothing, shoes, hair, and other body parts. These particles are carried by the flow of air within the portal to an ion mobility spectrometry (IMS) detector, a highly sensitive analytical device that is widely used at airports to screen baggage for traces of explosives and narcotics. When the IMS detector identifies that an explosives compound is present, the portal operator is automatically notified. Trace explosives detection portals are commercially available only as walk-through versions (Figure 1) for screening people, not as drive-through versions for screening vehicles.

Figure 1. A Trace Explosives Detection Portal
Photo Courtesy of Morpho Detection, Inc.

Backscatter X-ray detection portals are essentially cameras that use X-rays to create images of the subject in the portal. Both walk-through and drive-through portals are commercially available. Unlike medical X-ray machines that create an image from the X-rays transmitted through the subject, backscatter X-ray detection portals create an image using X-rays that are scattered back towards the X-ray source by the subject. The intensity with which an object backscatters X-rays depends on its density and chemical composition. In backscatter X-ray images of people, clothing is essentially transparent, while concealed explosives, narcotics

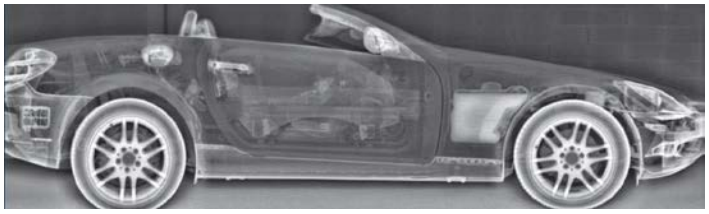

Figure 2. A Backscatter X-ray Image of a Passenger Vehicle
Photo Courtesy of Nucsafe, Inc.

packages, and hidden weapons are visible, because they backscatter X-rays with a different intensity compared to the subject's skin. X-ray backscatter images of vehicles can reveal explosives, narcotics, and weapons, even when they are concealed by metal automobile components or are hidden inside tires (Figure 2).

Millimeter wave (MMW) and submillimeter wave (SMW) detection portals are essentially cameras that obtain images of subjects using non-ionizing electromagnetic radiation. Millimeter wave and submillimeter wave detection portals image subjects using wavelengths in the 1 to 10 millimeter and 0.1 to 1 millimeter ranges, respectively.

MMW and SMW portals are available only as walk-through models for screening people. They may be based on active or passive detection techniques. Active detection portals illuminate the subject with MMW or SMW radiation and create an image by collecting the radiation reflected back toward the radiation source. Passive millimeter wave detection portals create an image of the subject using MMW and SMW radiation that is naturally present. A person standing in a passive detection portal naturally emits MMW and SMW radiation and also reflects MMW and SMW radiation received from his or her surroundings; an image is created by collecting the radiation received from the subject by these two mechanisms. Clothing is fairly transparent to MMW and SMW radiation, while concealed explosives, narcotics packages, and hidden weapons stand out, because they reflect and emit MMW and SMW radiation with different intensities compared to the subject's skin.

Use Considerations

***Privacy Concerns*:** The use of portal screening systems using imaging techniques, whether X-ray backscatter, millimeter wave, or submillimeter wave, has encountered public resistance over privacy concerns because the images obtained reveal anatomical details of their subjects.

At airports where imaging portals are in use, the U.S. Transportation Security Administration (TSA) gives passengers the option to be searched by the pat-down technique, although this option is not required under U.S. law. The TSA reports that 99 percent of passengers choose to be screened by an imaging portal rather than by pat-down. Most imaging portals now incorporate automated image processing software that reduces the level of anatomical detail in the image displayed to the portal operator. This software may automatically detect threat objects and mark their locations on the reduced resolution images seen by the portal operator (Figure 3).

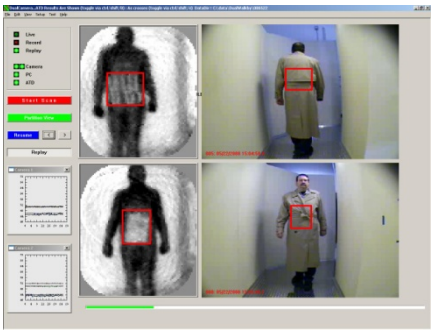

Figure 3. Active Millimeter Wave Detection Portal Images
Photo Courtesy of Millivision, Inc.

Health Issues: Some individuals may have medical conditions that preclude them from being screened with an imaging portal. For instance, individuals unable to stand still with their arms above their heads in order to be properly imaged, and some people with medical implants, are screened by the pat-down method at TSA checkpoints.

Public acceptance of backscatter X-ray portals has met resistance because they subject people to low doses of ionizing radiation, which may slightly increase their risk of developing cancer. Commercially available models are typically designed to meet the American National Standard Institute's ANSI N42.17 standard for radiation dose received from security screening systems using X-rays. In an X-ray backscatter portal meeting this standard, the radiation dose received during a single scan is equivalent to a few minutes of a high-altitude passenger jet flight.