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 unbiased operational tests 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).

Information provided by the SAVER Program will be shared nationally with the responder community providing life- and cost-saving assets to federal, state, and local responders.

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, please see the SAVER Web site or contact the SAVER Program Support Office.

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This SAVER TechNote was prepared by the Space and Naval Warfare Systems Center, Charleston, for the SAVER Program.

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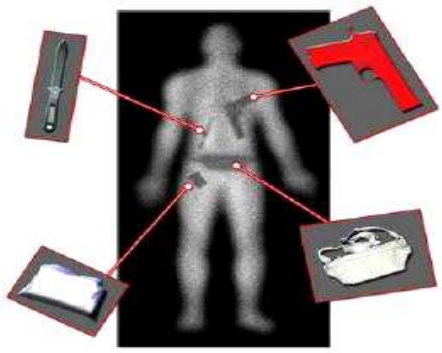
Passive Millimeter Wave Detection Systems

Current security screening relies heavily on X-ray machines and magnetometers to detect possible contraband materials in baggage or on individuals. These devices have been available since the 1970s and have served as the primary means of screening at security checkpoints. New technologies are being developed that may be better at detecting increasingly sophisticated threats such as dangerous gels, non-metallic guns and knives, or explosives concealed on an individual.

One technology that has made progress in detecting various types of concealed items is passive millimeter wave detection. It is a technology that can detect a variety of concealed threats without exposing subjects to radiation. There are two types of millimeter wave detection systems—active and passive. Both are capable of "seeing through" clothing and can quickly scan individuals to identify possible threats.



Passive Millimeter Wave Image

Active millimeter wave detection systems emit a relatively low amount of radiation, about the same amount as a cell phone, in order to detect concealed objects. Passive millimeter wave detection systems, however, detect the millimeter waves that are naturally emitted by the objects, the body, and the surrounding environment—effectively avoiding any personnel safety issues that may be presented by active millimeter wave and X-ray-based systems.

Numerous benefits make passive millimeter wave detection systems appealing. Some of the most notable benefits include:

- Ability to detect metals, plastics, ceramics, liquids, gels, and other materials.
- Real-time threat detection.
- No emitted radiation.
- Fast, non-interactive identification of individuals who require additional screening.
- Less need for profiling subjects and conducting random searches.

Technology Overview

Passive millimeter wave detection systems use the natural emission of millimeter wave energy by objects to create an image. Millimeter waves are naturally occurring forms of electromagnetic energy ranging from approximately 30 Gigahertz (GHz) to 300 GHz. With a wavelength of

1 millimeter to 2 centimeters, the energy wave is longer than visible light and able to pass through clothing.

Humans emit a large amount of millimeter wave energy. However, metals, plastics, or composite materials that are frequently used in weapons, have a lower amount of millimeter wave emissions and a high reflectivity of ambient energy. These energy wave differences along with the environmental temperature difference, allow the system to detect and create a passive millimeter wave image that can reveal the location of the concealed item on an individual.

System packages are usually comprised of various pieces of hardware and accompanying software. Depending on the system (handheld, stand-off, or walkthrough/portal), in addition to a millimeter wave detector, the hardware may include a video camera, computer, and display screen (see examples this page). The software contains the algorithms used for the detection capability of the system. Systems can operate alone or be integrated into an overall security plan.

Handheld Unit

Stand-off Unit

Walkthrough/Portal Unit

Depending on the product, the system may display images and alerts differently. Image displays from the system may be millimeter wave images (see previous page), photographic overlays provided by a video camera component of the equipment, or outlines or silhouettes of a body with no anatomical detail. The system may alert operators to the general location of the concealed item by highlighted boxes, simple indicator lights, or other visual or audible signals. Indicator lights and audible signals do not typically provide detailed information about what the detected object is or where it is located. Systems using these simple alarms require an operator to further investigate the source of the alarm.

Passive millimeter wave detection systems are relatively expensive, ranging from approximately $17,000 to $290,000 depending on the type of unit. Systems currently available have detection .80–100 GHz. However, systems are entering the market that operate in the terahertz frequency and are able to provide operators with better imagery of the concealed item and at greater distances.

Applications

Since passive millimeter wave detection systems can automatically detect the presence of weapons and contraband without the preliminary need for personal interaction, systems can be deployed or installed at any area where security screening is desired. With their screening throughput capabilities and real-time imaging, passive millimeter detection systems are well-suited for settings where a large number of people must be screened, such as transportation hubs, border security checkpoints, correctional facilities, and courthouses.

In order to understand the practical application of the equipment in the field, the Transportation Security Administration (TSA) has initiated pilot projects of passive millimeter wave detection systems at a rail station in New Jersey, a cruise line terminal in the Northeast region, and the Staten Island Ferry terminal. These pilot projects will provide operational experience to teach operators and public safety officials how the systems can be incorporated with other tools and resources available to security personnel.

Challenges

Passive millimeter wave detectors provide detailed images of concealed items found under a subject's clothing. While these images are not as detailed as some other imaging technologies, individuals and organizations have voiced privacy concerns about the use of these systems. In an effort to preserve individual privacy, some systems can blur anatomical details. Blurred images, however, may be less useful to the operator trying to identify a possible threat. In addition, TSA is considering screening and analyzing images in a private room, separating the operators from the individual being screened.

Looking Ahead

Manufacturers hope to be able to provide public safety and security personnel equipment with longer detection ranges and improved contraband detection.

Resources

TSA— www.tsa.gov/approach/tech/millimeter_wave.shtm

National Research Council: Assessment of Millimeter-Wave and Terahertz Technology— www.nap.edu/catalog.php?record_id=11826