Advanced Imaging Technology
Safety and Health Program

October 19, 2011
The Council on Ionizing Radiation and Measurements (CIRMS)
**Mission**: The Transportation Security Administration protects the Nation’s transportation systems to ensure freedom of movement for people and commerce.

**Vision**: The Transportation Security Administration will continuously set the standard for excellence in transportation security through its people, processes, and technology.
Evolving Threats

- TSA has continuously enhanced layers of security since 9/11:
  - Cockpit doors
  - Improved baggage, carry-on, and passenger screening procedures and technologies
  - Behavior detection programs
- As a result, the threat is being driven to smaller items artfully concealed on persons with informed adversaries exploiting our social norms
  - Home-made explosives
  - Non-metallic threats
The Benefits of Advanced Imaging Technology

- Improves security effectiveness by displaying metallic and non-metallic anomalies.
- Enhances passenger experience by minimizing need for physical pat-downs.
- Ensures privacy by placing the security officer viewing the image in a remote location, using privacy filters, and not having capability to store or transfer images.
- Improves security effectiveness by reducing physical fatigue of security personnel and improving their effectiveness through training and image detection technique.
- Is a highly effective security tool. In fact, the technology has led to the detection of more than 300 prohibited, illegal or dangerous items at checkpoints nationwide since January 2010.
50 Years of Advanced Imaging Technology

National Laboratories and the FAA study AIT for use in passenger screening

National Academy of Science publishes report that includes AIT safety

Piloted at London's Heathrow Airport

Manufacturers use AIT technology to create custom fit jeans.

Tested at London's Paddington station

TSL Testing

JHU/APL validates the Rapiscan Secure 1000 SP is below the radiation dose per screening requirements

Piloted at Amsterdam's Schipol Airport

Piloted at the UK's Manchester Airport

American College of Radiology says Scans are "negligible dose"

TSA accelerates nationwide AIT roll-out & independent radiation surveys

Significant international AIT deployment

TSIF Dosimetry Study & FDA Study

2011

2010

2009

2008

2007

2006

2004

Test trials conducted at airports in Canada and Australia

2009

2008

2007

2006

2004
Active Millimeter Wave Technology

L-3 Provision (Active Millimeter Wave)

- Uses non-ionizing electromagnetic radiation to generate an image based on the energy reflected from the body.
- The three-dimensional image of the body is displayed on a monitor for analysis.
- Ideal for identifying both metallic and non-metallic threats.
- TSA has deployed nearly 250 systems.
- Millimeter wave technology that TSA uses is safe for passengers. In fact, the energy emitted is 1000 times less than limits set by the International Commission on Non-ionizing Radiation Protection (ICNIRP).
General-Use Backscatter X-ray

- Relies on a narrow, X-ray beam scanned over the body’s surface at high speed. X-rays that are reflected back from the body and other objects placed or carried on the body, is converted into a computer image of the subject and displayed on a remote monitor.

- TSA has deployed approximately 250 systems.

- Various independent evaluations determine the reference effective dose below 0.05 microSv (5 microrem) per screening.

- At a minimum, radiation surveys are conducted in accordance with ANSI/HPS N43.17-2009.
General-Use Backscatter X-ray

- U.S. Army Public Health Command performs ANSI/HPS N43.17 complaint radiation safety surveys.
- All systems surveyed to date are in compliance with the dose limits specified in ANSI/HPS N43.17-2009.
- The U.S. Army Public Health Command certified health physicists have performed a dosimetry study to evaluate radiation doses to both passengers and system operators. The results of the study confirm that the systems comply with the radiation dose requirements of the ANSI/HPS N43.17 standard and that radiation doses, to both the passenger being screened and the system operators, are in compliance with N43.17-2009 and are extremely small.
USAPHC Testing of Personnel Security Screening Systems

• Individual Screened
  – General-Use: 0.25 μSv (25 μrem) per screening
  – Limited-Use: 0.01 mSv (1 mrem) per screening
  – 0.25 mSv (25 mrem) per year

• Operator’s/Bystanders Annual Limit
  – 1 mSv (100 mrem) per year

• Inspection zone – operators and bystanders outside inspection zone during screening
Background

• Purpose: Evaluate potential dose to individual being screened and operator’s of personnel security screening systems (at boundary of the inspection zone)

• Field measurements
  – Short term
  – At or near background
  – Near minimum detection capability of the instrument

• Dosimeter study requires
  – Very large number of screenings
  – Automated method for initiating screenings
Test Setup – Repetitive Screening

- Robotic solution
- 93,105 screenings
- ~ 2 weeks
Test Setup – Phantom Dose to Subject

- 190 lbs. of water arranged to resemble the basic shape of a person were placed on a wooden rack for 93,105 screenings.

- OSL dosimeters were mounted on the phantom facing the radiation source.
Summary

• The data show that the dose per screening is well below the maximum permitted for a general-use system under the ANSI standard (maximum of 0.045 microsieverts (or 4.5 microrem) which is well below the limit of 0.25 microsieverts (or 25 microrem)).

• Even using the maximum dose measured at any point on the phantom, a person could receive over 5,000 screenings every year without exceeding the annual radiation dose limit. This would require an average of 15 screenings every day of the year.
Dose to Operators
Entrance Side and Exit Side
Summary Deep Dose Equivalent

• Potential doses to operators of these systems are extremely small

• At the maximum throughput, the doses to operators are well below the public dose limits/recommendations

• Communicating these small doses to the operators is a challenge
TSA recently began installing new software, also referred to as Automated Target Recognition (ATR) on every millimeter wave machine in U.S. airports. The software is designed to enhance privacy by eliminating passenger-specific images and instead depicting anomalies detected during the screening process on a generic outline of a person that is identical for all passengers.

By eliminating the image of an actual passenger and replacing it with a generic outline of a person, passengers are able to view the same outline that the TSA officer sees. Further, a separate TSA officer will no longer be required to view the image in a remotely located viewing room. By removing this step of the process, AIT screening will become more efficient, expanding the throughput capability of the technology.

Operators are presented with a clear message when anomalies are NOT detected.
Qualified Technology

• Before TSA purchases technology, TSA communicates safety and health requirements to manufacturers through procurement specifications and engineering reviews.

• The advanced imaging technology (AIT) meets national safety and consensus standards and has been validated by third parties.

• Systems are tested prior to deployment, upon installation, and while deployed, tested in accordance with applicable standards.
Operations and Maintenance

• Once installed, TSA ensures the required manufacturer’s preventive maintenance is performed by qualified personnel

• Only trained operators are authorized to perform AIT screening functions

• System and Image quality checks are performed:
  • Daily
  • After power is restored
  • After system maintenance
AIT safety related information is posted to the TSA public website at:
http://www.tsa.gov/research/reading/index.shtm

• Response to Center for Study of Responsive Law inquiry on people screening, Center for Devices and Radiological Health, Food and Drug Administration, November 5, 2010

• White House Office of Science and Technology Policy Statement on AIT Safety

• TSA AIT Safety Study Memo

• Johns Hopkins University Applied Physics Laboratory, Radiation Safety Engineering Assessment Report for the Rapiscan Secure 1000 in Single Pose Configuration, October 2009 and August 2010

• Assessment of the Rapiscan Secure 1000 Body Scanner for Conformance with Radiological Safety Standards, July 21, 2006

• Radiation Surveys for the Rapiscan Secure 1000 Single Pose
Learn more about AIT safety:
http://www.tsa.gov/approach/tech/ait/safety.shtm
Security Screening Checkpoint Signage

Millimeter Wave Detection

What does this technology do?

Use of this technology is optional. If you choose not to be screened by this technology, you will receive a thorough pat down.

Backscatter X-ray Technology

Use of this technology is optional. If you choose not to be screened by this technology, you will receive a thorough pat down.

Prepare for Security

Remove all items and place in carry-on or bin.

Your safety is our priority
www.tsa.gov
Since TSA began using imaging technology over 98 percent of passengers have chosen to be screened by the technology over alternative procedures.
Questions