

# TRANSPORTATION SECURITY ADMINISTRATION



## Advanced Imaging Technology Safety and Health Program



October 19, 2011

The Council on Ionizing Radiation and Measurements (CIRMS)

# TSA Mission & Vision

**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

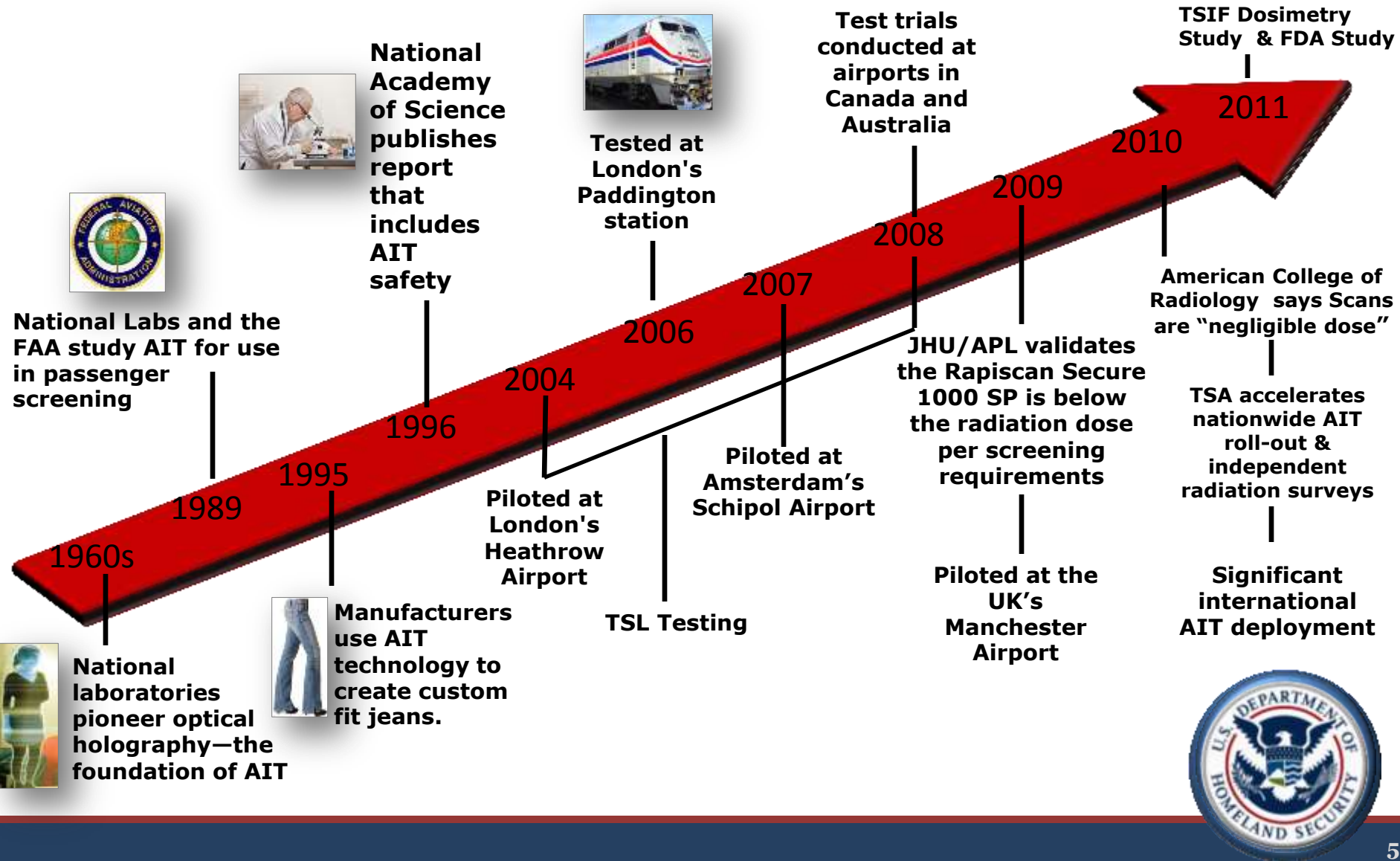


# The Benefits of Advanced Imaging Technology

- *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



# 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

Rapiscan Secure 1000 SP (Backscatter)



- 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

Rapiscan Secure 1000 SP (Backscatter)



- 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 this 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  $\mu$ Sv (25  $\mu$ rem) 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

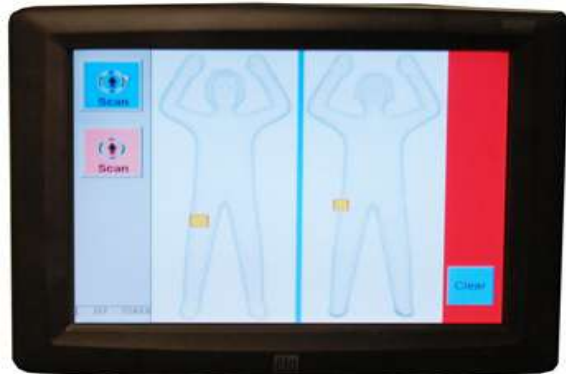
- Potential doses to operators of these systems are extremely small
- At the maximum throughput, the doses to operators are well below the public dose limits/recommendations
- Communicating these small doses to the operators is a challenge

# Automatic Target Recognition (ATR)

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 screen signifying specific location(s) on the passenger when anomalies **ARE** detected.



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



# TSA - Public Communications

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



# TSA - Public Communications

Learn more about AIT safety:

<http://www.tsa.gov/approach/tech/ait/safety.shtm>


The screenshot shows a web browser window displaying the TSA website. The page title is "Safety" under the "Advanced Imaging Technology" section. The header includes the TSA logo and the slogan "Your Safety Is Our Priority". A navigation menu is visible with options like "Who We Are", "For Travelers", "What We Do", "Join Us", "Our Approach", "Media Room", and "Research Center". The main content area features a large image of a woman in a white lab coat, with the text "Learn About Safety Features of AIT". To the right of the image is a sidebar with links: "Imaging Technology Home", "How It Works", "Safety", "Privacy", "Frequently Asked Questions", and "More Information". Below the image, there is a paragraph stating: "Advanced imaging technology is safe and meets national health and safety standards. Backscatter technology was evaluated by the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH), the National Institute for Standards and Technology (NIST), and the Johns Hopkins University Applied Physics Laboratory (APL). All results confirmed that the radiation doses for the individuals being screened, operators, and bystanders were well below the dose limits specified by the American National Standards Institute (ANSI). For comparison, the energy projected by millimeter wave technology is thousands of times less than a cell phone transmission. A single scan using backscatter technology produces exposure equivalent to two minutes of flying on an airplane. Note: Advanced imaging technology screening is safe for all passengers, including children, pregnant women, and individuals with medical implants." At the bottom, there is a list of links for further information, including "Click here to learn about built-in safety features of backscatter imaging technology" and "Click here to read a recent Archives of Internal Medicine report on the risks of imaging technology".



# Security Screening Checkpoint Signage

## Millimeter Wave Detection

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




**What does this technology do?**  
Millimeter wave imaging technology provides advanced security by enabling officers to detect metallic and non-metallic threats without physical contact. Millimeter wave imaging technology is safe for all passengers, including children and pregnant women. The technology emits 10,000 times less radio frequency energy than an average cell phone. Additional information about imaging technology is available at [www.tsa.gov](http://www.tsa.gov).

**Your safety is our priority**  
[www.tsa.gov](http://www.tsa.gov)

Transportation Security Administration

## Millimeter Wave Detection

**What do officers see?**



Male Front and Back Female Front and Back


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## 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.




**What does this technology do?**  
Imaging technology enables officers to detect concealed items without physical contact. Maximum privacy images are viewed in a remote location and are not saved or stored. Backscatter technology is voluntary for all passengers. Alternative screening is available. The machine is safe with exposure to radiation levels equivalent to 2 minutes in an airplane. Additional information about imaging technology is available at [www.tsa.gov](http://www.tsa.gov).

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## Backscatter X-ray Technology

**What do officers see?**



Female Front and Back Male Front and Back

**Backscatter technology is optional and alternative screening is available for all passengers.**  
**Image technology:** enables officers to detect concealed items without physical contact. **Maximum privacy:** images are viewed in a remote location and are not saved or stored. The machine is safe with exposure to radiation levels equivalent to 2 minutes in an airplane.

**Your safety is our priority**  
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## Prepare for Security

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




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# Passenger Acceptance



Since TSA began using imaging technology over 98 percent of passengers have chosen to be screened by the technology over alternative procedures.



# Questions

