Airport Body Scanners: The Role of Advanced Imaging Technology in Airline Passenger Screening

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September 20, 2012

Congressional Research Service
7-5700
www.crs.gov
R42750

Summary

Responding to the need to reliably detect explosives, bomb-making components, and other potential security threats concealed by airline passengers, the Transportation Security Administration (TSA) has focused on the deployment of whole body scanners as a core element of its strategy for airport checkpoint screening. TSA has deployed about 700 of these scanners, known as whole body imagers (WBI) or advanced imaging technology (AIT), at airports throughout the United States, and plans to have 1,800 in place by the end of FY2014. AIT systems include two technologies: millimeter wave systems and X-ray backscatter systems.

AIT directly addresses specific recommendations and mandates to improve the detection of explosives on passengers. However, the deployment of these systems has generated a number of concerns. Although polling data indicate that the American public generally accepts the use of body scanners for passenger screening, various stakeholders have expressed concerns over privacy, potential health risks, and delays in getting through security. Concerns have also been raised regarding screening individuals with special needs, the overall effectiveness of current technology, screener staffing requirements, and TSA's deployment strategy.

While TSA voluntarily applies a number of privacy measures (such as viewing AIT images remotely and providing alternative pat-down screenings on request), U.S. law does not specifically require these actions. Beyond these existing procedural measures to protect privacy, TSA is working toward the eventual elimination of human image viewers, replacing them with automated target recognition (ATR) technology to detect potential threats. If ATR eliminates the need for most image viewers, as expected, this could reduce TSA staffing requirements. However, this depends to an extent on the alarm rate for ATR, since TSA procedures require alarms to be resolved by labor-intensive pat-down searches.

ATR is currently being deployed on all newly acquired millimeter wave systems and is being retrofitted into already deployed millimeter wave systems. It has not been announced whether a similar system will be implemented for X-ray backscatter imagers. The availability of ATR on millimeter wave units, coupled with continued public perceptions of potential health concerns associated with X-ray backscatter systems, appear to be key factors influencing TSA's approach to focus future acquisitions and deployments on millimeter wave systems.

Bills under consideration in the 112th Congress, including the Aircraft Passenger Whole-Body Imaging Limitations Act of 2011(H.R. 1279) and the Checkpoint Images Protection Act of 2011 (H.R. 685), address privacy and health safety concerns. Additionally, the Transportation Security Administration Authorization Act of 2011 (H.R. 3011) contains a provision that would require all deployed AIT systems to have ATR capabilities and any image retention capabilities to be disabled. Lastly, the Restoring Integrity and Good-Heartedness in Traveler Screening Act, or the "RIGHTS Act" (S. 2207), would address concerns over the processing of passenger complaints regarding TSA procedures and improve assistance to passengers needing special accommodations at screening checkpoints.

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Policy Background

A long-standing challenge for aviation security is the need to reliably detect explosives and bomb-making components concealed under clothing. The Aviation and Transportation Security Act of 2001 (ATSA; P.L. 107-71) mandated 100% explosives detection screening of checked baggage. However, ATSA did not specifically address the threat posed by bombs carried in the aircraft cabin. Terrorist plots, including a December 2001 attempted shoe-bombing incident, the August 2004 downing of two Russian airliners, the August 2006 liquid explosives plot in the United Kingdom, the December 2009 attempted bombing of a Delta-Northwest flight from Amsterdam on approach to Detroit, and the May 2012 discovery of a similar plot orchestrated by terrorist operatives in Yemen, have served to focus policy attention on the threat to civil aviation posed by concealed improvised explosive devices.

In 2004, the 9/11 Commission recommended that the Transportation Security Administration (TSA) and Congress give priority to improving the detection of explosives on passengers. The commission further recommended that, as a start, all individuals selected for secondary screening at airport checkpoints undergo explosives screening.[1] Mirroring the 9/11 Commission recommendation, the Intelligence Reform and Terrorism Prevention Act of 2004 (IRTPA; P.L. 108-458) directed TSA to give high priority to developing, testing, improving, and deploying airport checkpoint screening technologies to detect nonmetallic, chemical, biological, and radiological weapons, as well as explosives on passengers and in carry-on items.

In 2004, initial field trials of walk-through explosives trace detection portals, or "puffer" machines, revealed reliability problems, leading TSA to suspend further deployment of and investment in these systems. TSA instead moved forward with the evaluation and eventual system-wide deployment of whole body imaging (WBI) technologies, which TSA also refers to as Advanced Imaging Technology (AIT) systems. In contrast to the "puffer" machines, AIT systems do not search for traces of explosive materials. Instead, they generate images that can reveal anomalies underneath passenger clothing, allowing detection of concealed items, such as explosives, detonators, and both metallic and nonmetallic weapons.

In response to the failed December 25, 2009, attempted bombing of a Detroit-bound international flight using an improvised explosive device, TSA accelerated its investment in AIT. Currently, TSA uses AIT systems for primary screening of both randomly selected and targeted passengers in conjunction with walk-through metal detector screening. Passengers selected for AIT screening may elect to either submit to the AIT scan or alternatively undergo a pat-down by a trained same-sex TSA screener.

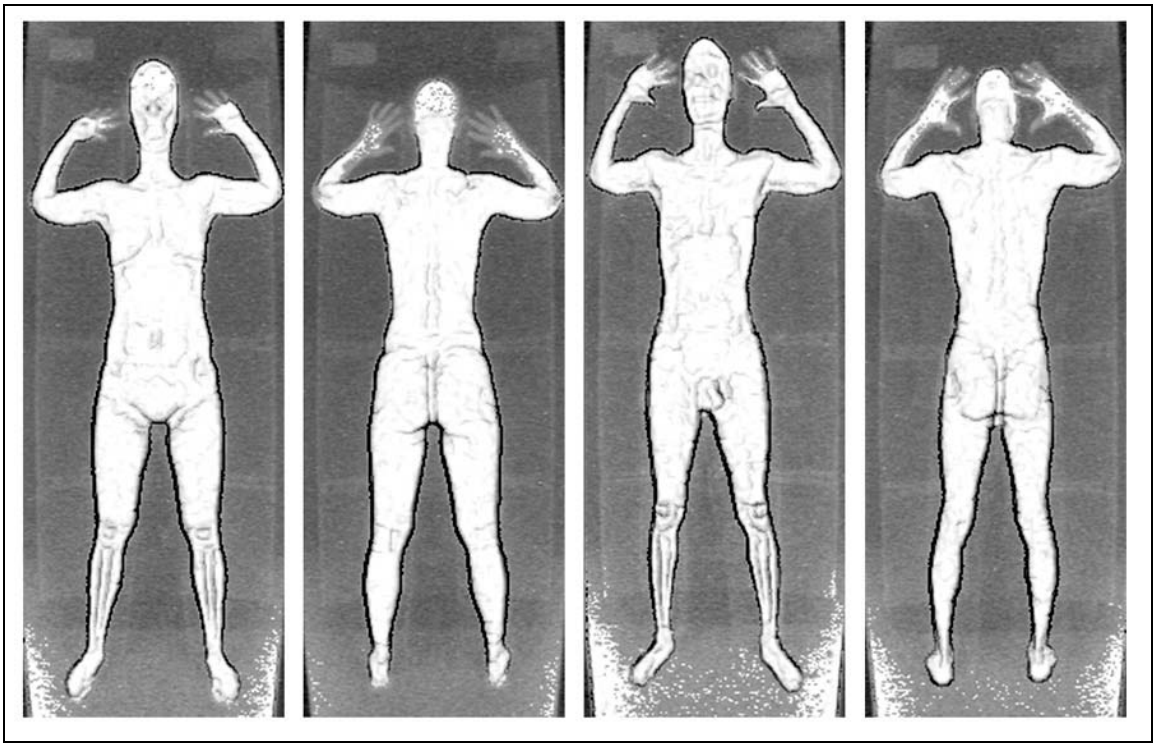
[1] National Commission on Terrorist Attacks Upon the United States, *The 9/11 Commission Report* (Washington, DC: U.S. Government Printing Office, 2004).

History and Development

Since 2007, TSA has been procuring and deploying two competing AIT technologies for screening airline passengers: X-ray backscatter and millimeter wave imaging systems.

X-ray backscatter systems use a low-intensity X-ray beam that moves at high speed to scan the entire surface of the body. The first body scanners using low-intensity X-ray backscatter technology were developed in the early 1990s. The X-ray backscatter systems currently used by TSA have evolved from these early commercial versions, having significantly improved resolution as well as special privacy algorithms that generate front and back images similar to chalk outlines (see **Figure 1**). TSA implemented "chalk outline" filtering, known as a privacy algorithm, to allay privacy concerns, as raw, unfiltered X-ray backscatter images resemble high-resolution photographic negatives. Trained TSA screeners review these filtered images.

Figure 1. Typical X-Ray Backscatter Images of a Female (Left) and Male (Right) with Privacy Algorithm Applied

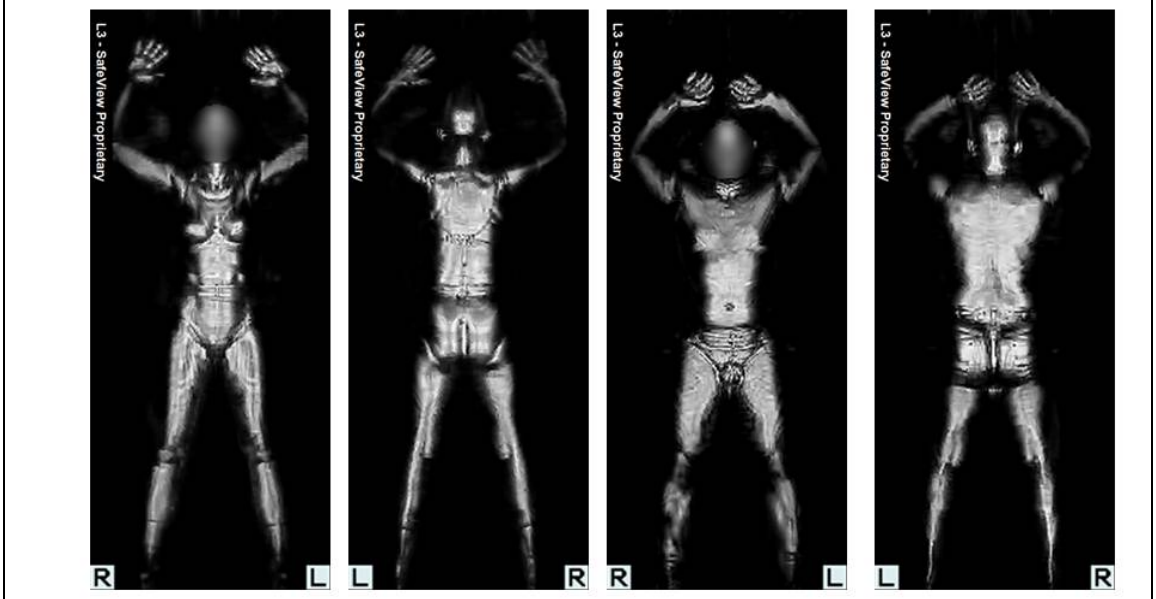


Source: Transportation Security Administration.

Millimeter wave imaging systems emit non-ionizing electromagnetic radio waves in the millimeter wave (30-300 gigahertz) spectrum to render images of what lies directly underneath clothing and near the skin. Deployed systems generate images that look like photographic negatives (see **Figure 2**). Privacy filters are applied to these images to selectively blur faces. Millimeter wave systems are capable of generating a 3-D view by scanning the full 360 degrees around an individual. This 3-D scan renders front and back images that are viewed by trained TSA screeners. However, TSA is currently field testing automated target recognition (ATR) algorithms that are intended to eventually replace human image analysis of millimeter wave images (see **Figure 3**). TSA is currently retrofitting deployed units, and all future millimeter wave

systems procured by TSA will come with ATR. ATR is described in further detail in the discussion of "Privacy Concerns."

Figure 2. Typical Millimeter Wave Images of a Female (Left) and Male (Right) with Facial Blurring Applied



Source: Transportation Security Administration.

Deployment and Operational Use

As of August 2012, TSA had deployed about 700 AIT units at more than 180 of the roughly 450 commercial passenger airports. TSA currently plans to acquire and deploy a total of 1,800 units throughout the country by the end of FY2014. Once all FY2012 funds are expended, TSA projects that it will have acquired 1,250 units, about 69% of the planned total.

The acquisition cost per unit is about $175,000. In addition, TSA incurs costs associated with installing and maintaining AIT systems, training personnel, and operating the deployed units. TSA hired and trained an additional 8,000 screeners through FY2011 to meet the anticipated workload increases associated with operational deployment of the first 1,000 AIT units. These additional operational costs can add substantially to the overall cost of deploying and operating AIT. Inferring from TSA statements, the annualized cost for purchasing, installing, staffing, operating, supporting, upgrading, and maintaining checkpoint AIT systems currently sums to about $455 million and will increase to about $1.17 billion once the planned 1,800 units are fully

deployed.[2] This equates to roughly $655,000 annually per deployed AIT unit. TSA argues that, at about 1,000 deployed AIT units, the operating cost translates to roughly $1 per traveling passenger.[3] However, this figure does not reflect the cost per scan because only a small percentage of passengers undergo a whole body scan. As TSA does not divulge the percentage of passengers screened using AIT, the cost per scan cannot be accurately estimated. TSA selects passengers for AIT screening using both random and targeted selection techniques. TSA considers the specific selection methods to be sensitive security information, and this information is not made public.

Initially, TSA procurements of X-ray backscatter units were greater, but more recently TSA has acquired larger numbers of millimeter wave systems. As of February 2012, roughly 44% of total AIT deployments were X-ray backscatter units, but that percentage had dropped to about 35% by August 2012. Public perceptions of possible health risks associated with X-ray backscatter systems, coupled with technological advances in second-generation millimeter wave systems that will replace human observers with automated threat detection capabilities, may have influenced TSA toward favoring millimeter wave systems over X-ray backscatter systems.

Problems and Concerns with Use of Body Scanners

TSA cites several independent polls indicating widespread public support and understanding of the need for and use of AIT. The polling data indicate that about 75% to 80% of Americans support the use of AIT at airport checkpoints.[4] Nonetheless, AIT remains controversial. Among respondents expressing concerns regarding the use of full-body scanners in a 2010 Travel Leaders study, roughly 48% raised privacy issues, 27% worried about potential known or unknown health risks, and about 20% expressed concerns over delays in getting through security.[5] Concerns have also been raised over screening individuals with special needs, the effectiveness of the technology, screener staffing requirements, and TSA's deployment strategy.

Privacy Concerns

TSA use of AIT has met with objections from privacy advocates, such as the American Civil Liberties Union (ACLU), that have urged Congress to ban the use of whole body imaging technologies as a method for primary screening on the basis that "[p]assengers expect privacy underneath their clothing and should not be required to display highly personal details of their bodies."[6]

[2] CRS analysis based on Gale Rossides, Acting Administrator, Transportation Security Administration, "Advanced Imaging Technology—Yes, It's Worth It," *DHS Blog*, April 1, 2010, available at http://blog.dhs.gov/2010/04/advanced-imaging-technology-yes-its.html. TSA has not made public any detailed lifecycle cost estimates to explain how these annualized costs were determined or what assumptions were made regarding typical useful service life of AIT units and the estimated costs of maintenance and repairs.

[3] Ibid.

[4] See Transportation Security Administration, *More Information: Advanced Imaging Technology*, available at http://www.tsa.gov/approach/tech/ait/reading.shtm.

[5] George Dooley, "Travel Leaders Study: Consumers OK with Airport Security," *Travel Agent Central*, April 8, 2010, available at http://www.travelagentcentral.com/airline-policies/travel-leaders-study-consumers-ok-airport-security-20779.

[6] Statement of Timothy D. Sparapani, ACLU Legislative Counsel, Before the Senate Committee on Commerce, (continued...)

Privacy arguments have been raised against other airport screening procedures in the past, but have not been accepted by the courts. Courts characterize a routine search conducted at an airport security checkpoint as a warrantless search, generally not subject to the constitutional prohibition against "unreasonable searches and seizures" by the federal government. In a 1973 ruling, the 9th Circuit Court of Appeals found such a warrantless search, also known as an administrative search, to be acceptable if it is "no more intrusive or intensive than necessary, in light of current technology, to detect weapons or explosives," if it is confined to that purpose, and if individuals may avoid the search by electing not to fly.[7]

In more recent case law, the 9th Circuit Court of Appeals ruled in 2007 that airport searches of passengers are reasonable and do not require consent, as "… requiring that a potential passenger be allowed to revoke consent to an ongoing airport security search makes little sense in a post-9/11 world. Such a rule would afford terrorists multiple opportunities to attempt to penetrate airport security by 'electing not to fly' on the cusp of detection until a vulnerable portal is found."[8]

The Supreme Court, however, has not specifically considered whether airport screening searches are a constitutionally reasonable form of administrative search. Moreover, the courts have not specifically considered whether the use of AIT, as either a routine or a risk-based screening method, warrants any special consideration under the law because of its capabilities and surrounding privacy concerns. More specific policy and legal analysis in the current context may be needed to address whether AIT screening and alternative screening procedures, such as pat down searches of individuals, are no more intrusive or intensive than necessary.

Since deploying AIT, TSA has sought to allay privacy concerns by implementing policies affecting both technology and operational procedures. Specifically, TSA policy requires that image storage capabilities be disabled on all fielded AIT units. TSA also has set up remote imaging locations, so that TSA screeners viewing an image are not able to see the person being scanned. TSA policy forbids TSA employees from taking any image recording devices into these remote viewing areas. Finally, TSA installed privacy filters that, depending on the technology, either blur facial features or render a less detailed image similar to a "chalk outline" of the entire body.

Despite these safeguards, reports of alleged abuses have surfaced. In February 2012 it was reported that several female passengers have levied complaints against TSA, claiming that they were told to go through the scanners, sometimes multiple times, apparently because they were attractive.[9] TSA responded that it is not policy to scan passengers multiple times.[10] Concerns have been raised regarding the selection of children for AIT screening, including concerns over the viewing of their images, potential health effects, and safety when the child is separated from

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Science, and Technology, Regarding the U.S. Transportation Security Administration's Physical Screening of Airline Passengers and Related Cargo Screening, April 4, 2006.

[7] *United States v. Davis*, 482 F.2d 893-908 (9th Cir. 1973).

[8] *United States v. Aukai*, 497 F.3d 955-963 (9th Cir. 2007), p. 959.

[9] Frances Romero, "Is the TSA Targeting Attractive Women?," *Time News Feed*, available at http://newsfeed.time.com/2012/02/16/is-the-tsa-targeting-attractive-women/.

[10] "TSA Officers Focus on Security, Not Good Looks," *The TSA Blog*, February 15, 2012, available at http://blog.tsa.gov/2012/02/tsa-officers-focus-on-security-not-good.html.

parents or guardians during the screening process.[11] While TSA has modified screening procedures for children (12 years of age and younger), it does not exclude them from possible selection to undergo either AIT screening or a pat-down search. If selected, the child and/or her or his parent(s) or accompanying guardian(s) may choose the method of screening.

In FY2011, TSA began installing Automated Target Recognition (ATR) software in its deployed millimeter wave machines, both to allay continuing concerns regarding privacy and to improve screening efficiency. With the introduction of ATR, TSA is working toward the eventual elimination of human image viewers. In the future, TSA plans to rely primarily or exclusively on ATR for threat detection, which automatically reviews and analyzes images for concealed threats. In 2011, TSA upgraded all deployed millimeter wave scanners with ATR software. The ATR algorithms are currently undergoing operational evaluations in which they are being tested side-by-side with existing image review procedures. The ATR displays show only a generic body outline identifying locations of potential concealed threats rather than a full body image. If no threats are detected, the ATR monitor displays no image and an "OK" appears on screen against a green background (see **Figure 3**). TSA plans to include ATR capabilities in all future millimeter wave AIT procurements.[12] TSA has not announced whether a similar system will be developed or implemented for X-ray backscatter imagers.

Figure 3. Millimeter Wave Automated Target Recognition (ATR) Display

Source: Transportation Security Administration.

Health Concerns

The ionizing radiation generated by X-ray backscatter systems has led to policy debate and some public concern over possible human health impacts. Ionizing radiation has been linked to various forms of cancer. TSA contends that the levels of ionizing radiation emitted by certified X-ray backscatter systems are well below those considered unsafe for human exposure. According to the vendor, X-ray backscatter systems in use by TSA deliver a radiation dose that is less than 15% of the Federal Drug Administration (FDA) allowable single dose limit of 25 microrem. DHS claims

[11] Leonora LaPeter Anton, "Airport Body Scanners Reveal All, But What About When It's Your Kid?" *Tampa Bay Times*, July 18, 2010.

[12] Department of Homeland Security, Transportation Security Administration Aviation Security, Fiscal Year 2013 Congressional Justification.

that the radiation exposure from a single X-ray backscatter image is equivalent to exposure from naturally occurring radiation received during two minutes flying at altitude aboard a commercial airliner and notes that passengers may opt out of the screening.[13]

The X-ray aperture in certified backscatter units is very small, measuring roughly 1/28th of a square inch. While the device emits continuously through this aperture for the duration of the scan, it moves rapidly horizontally and vertically to image the entire human body over a span of about 10 to 20 seconds. Safety measures including redundant monitors and automatic shutdown circuits turn off the X-ray generation if any abnormal conditions are detected—for example, if the X-ray beam is not moving properly.[14]

TSA-approved backscatter systems comply with American National Standards Institute (ANSI) radiation safety standards and have been evaluated by FDA's Center for Devices and Radiological Health, the National Institute of Standards and Technology, and the Johns Hopkins University Applied Physics Laboratory. These independent evaluations concluded that TSA-certified X-ray backscatter units meet national health and safety standards.[15]

Nonetheless, controversy over exposure to X-ray backscatter persists. In April 2010, faculty members from the University of California, San Francisco, including prominent researchers in biochemistry, biophysics, X-ray imaging, and cancer research, expressed their concerns in a letter to President Obama's assistant for science and technology, John P. Holdren. They suggested that while the radiation dose received from X-ray backscatter imaging would be safe if it were distributed throughout the body, it is instead concentrated only on the skin and underlying tissue, such that "the dose to the skin may be dangerously high."[16] The letter stated that older travelers and those with compromised immune systems may be at particular risk; that some females may be at higher risk of developing breast cancer; that the potential health effects on children, adolescents, pregnant women, and fetuses have not been fully assessed; that the proximity of the testicles to the skin raises concerns over possible sperm mutation; and that the effects on the cornea and the thymus gland have not been determined. It also cautioned that a system malfunction could potentially cause a very high radiation dose to be concentrated on a single spot. TSA and FDA provided a lengthy response to the letter, asserting that the potential health risks from full-body screening using approved systems are minuscule, and that extensive independent data confirm that the systems do not present significant risk to public health.[17]

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[13] Department of Homeland Security, Office of Health Affairs. *DHS Fact Sheet: Advanced Imaging Technology (AIT) Health & Safety*, available at http://www.tsa.gov/assets/pdf/ait_fact_sheet.pdf.

[14] Rapiscan Systems. *Rapiscan Secure 1000® Series Safety Features*, available at http://www.rapiscansystems.com/media/uploaded/collateral/Rapiscan_Secure_1000_Safety_Features-061411.pdf.

[15] Department of Homeland Security, Office of Inspector General, *Transportation Security Administration's Use of Backscatter Units*, February 2012, OIG-12-38.

[16] John W. Sedat, Ph.D., Marc Shuman, M.D., David Agard, Ph.D., and Robert Stroud, Ph.D., Letter to Dr. John P. Holdren, Assistant to the President for Science and Technology, April 6, 2010, available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/ucsf-jph-letter.pdf.

[17] Department of Health and Human Services, Food and Drug Administration, Center For Devices and Radiological Health, Letter to Dr. John P. Holdren from John L. McCrohan, Deputy Director for Technical and Radiological Initiatives, and Karen R. Shelton Waters, Deputy Assistant Administrator/ Chief Administrative Officer, Transportation Security Administration, October 12, 2010, available at http://www.whitehouse.gov/sites/default/files/microsites/ostp/fda-backscatter-response.pdf.

More recently, an independent scientific review of certified X-ray backscatter units by the European Union's Scientific Committee on Emerging and Newly Identified Health Risks concluded that while "[t]he expected health detriment will probably be very close to zero for any scanned person, … at the population level the possible effect cannot be ignored …"[18] While the study could not meaningfully evaluate risk for special groups within the population, it raised concern over a higher risk related to exposure in childhood.

The European Union's Legal Framework for Airport Body Scanners

The European Union (EU) has responded to privacy and health concerns related to AIT by enacting strict laws governing the use of these systems, including a ban on the use of body scanners that emit ionizing radiation. The EU's legal framework sets common standards for the use of body scanners at European airports. In November 2011, the EU adopted rules that prohibit the storage, retention, copying, printing, or retrieval of body scanner images. The EU rules further require that images be viewed in a separate location, and require that the individual be informed of the screening procedures and given the option to opt out and undergo an alternative screening method. While TSA employs similar procedures in the United States, these measures are not specifically required under U.S. law. The EU rules also ban body scanners that use X-ray technology citing concerns over possible health and safety risks.[19] This restriction prohibits the use of X-ray backscatter machines at EU airports. The laws and restrictions apply to passenger screening for U.S.-bound flights from the EU and have been a matter of considerable interest in negotiations with EU policymakers. Moreover, the measures enacted by the EU may serve to bolster arguments for more comprehensive legislation in the United States regarding the routine use of AIT for airline passenger screening and related privacy protections and health and safety considerations.

The millimeter wave systems used by TSA do not emit ionizing radiation. Millimeter wave scanners therefore have not raised the same health concerns as X-ray backscatter systems. A recent statement by the International Commission on Non-Ionizing Radiation Protection found that, while it recommends limiting human exposure to non-ionizing radiation, human exposures from body scanners currently in use are about $1/10^{th}$ of its recommended guidelines for the general public.[20]

Screening Individuals with Special Needs

TSA asserts that it makes accommodations for individuals with a variety of special needs, usually arising from medical conditions and the use of wearable or implanted medical devices. However, various incidents indicate that TSA does not always provide special accommodations and does not always follow these procedures for individuals with special needs. For example, in May 2012, a diabetic teenager reported that an AIT system damaged her insulin pump while she was being screened at the Salt Lake City International Airport, after a TSA screener reportedly told her that it would not be a problem to undergo AIT screening despite a doctor's note explaining that the sensitive medical device should not go through the body scanner.[21]

[18] Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), *Health Effects of Security Scanners for Passenger Screening (Based on X-ray Technology)*, Brussels, Belgium: European Commission, April 26, 2012.

[19] European Commission, "Aviation Security: Commission Adopts New Rules on the Use of Security Scanners at European Airports," Press Release, Brussels, Belgium, November 14, 2011.

[20] International Commission on Non-Ionizing Radiation Protection, "ICNIRP Statement—Health Issues Associated With Millimeter Wave Whole Body Imaging Technology," *Health Physics, 102*(1), pp. 81-82, January 2012.

[21] "TSA Agents Destroy Teen's $10K Insulin Pump," Fox News Fox Nation, May 9, 2012, available at
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TSA informs passengers that individuals should ask for a pat down inspection if a medical doctor has advised them not to undergo AIT screening because it may affect the functioning or calibration of a wearable or implanted medical device. TSA has created an optional disability notification card that allows individuals to discreetly advise TSA screeners of a health condition, disability, or medical device that may affect screening. TSA has also established TSA Cares, a toll-free hotline (1-855-787-2227) for individuals with disabilities and medical conditions to discuss screening procedures and coordinate checkpoint support when necessary.

Passenger Throughput and Security Delays

Despite poll data indicating that roughly 20% of those concerned about AIT expressed specific concern over increased passenger delays, it does not appear that AIT screening has had any significant effect on delays. This is likely attributable in large part to the fact that TSA selects only a small percentage of passengers for AIT screening. In addition, TSA can choose to reduce the number of passengers selected for AIT screening when backlogs occur. Although passengers, if selected for additional screening, can opt for either an AIT scan or a pat down, the AIT is considerably faster, taking about 20 seconds to complete, compared to about 2 minutes for a physical pat down.[22] TSA reports that more than 99% of passengers selected for additional screening choose to be screened by AIT technology over the alternative,[23] suggesting that AIT is perceived as relatively quick and hassle-free.

Scanner Effectiveness

The effectiveness of screening technology can be measured in terms of its ability to accurately detect threats while minimizing false alarms. In operational settings there is a tradeoff between detection and false alarms. False alarm rates are easily measured in operational settings, but detection rates cannot be precisely known because of uncertainty over what may have gone undetected. AIT systems, like all other TSA-certified screening technologies, undergo certification testing performed by the Department of Homeland Security (DHS) Independent Test and Evaluation section of the Transportation Security Laboratory, a component of the DHS Science and Technology Directorate. TSA, in coordination with the Transportation Security Laboratory, sets certification criteria, which are not made public.

Although the effectiveness criteria and parameters for AIT are not public information, outside experts are divided about the effectiveness of AIT systems. For example, it remains unclear whether a whole body scan would have detected the explosives used in the 2009 Christmas Day bombing attempt.[24] Of particular concern is the possibility that terrorists could use concealment

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http://nation.foxnews.com/tsa/2012/05/09/tsa-agents-destroy-teens-10k-insulin-pump.

[22] U.S. Government Accountability Office, "Aviation Security: TSA Is Increasing Procurement and Deployment of the Advanced Imaging Technology, but Challenges to This Effort and Other Areas of Aviation Security Remain." Statement of Steve Lord, Director, Homeland Security and Justice Issues, Before the Subcommittee on Transportation Security and Infrastructure Protection, Committee on Homeland Security, House of Representatives, March 17, 2010, GAO-10-484T.

[23] Transportation Security Administration, *Advanced Imaging Technology (AIT): Innovation and Technology*, available at http://www.tsa.gov/approach/tech/ait/index.shtm.

[24] U.S. Government Accountability Office, *Better Use of Terrorist Watchlist Information and Improvements in Deployment of Passenger Checkpoint Technologies Could Further Strengthen Security*, GAO-10-401T, January 27, (continued...)

tactics to evade detection by AIT. Modeling by independent researchers, based on publicly available performance estimates, found that certain items—including types of explosives used in past terrorism attempts targeting aircraft—could be difficult, if not impossible, to detect using X-ray backscatter systems at current radiation exposure levels. The researchers concluded that "[e]ven if exposure were to be increased significantly, normal anatomy would make a dangerous amount of plastic explosives with tapered edges difficult if not impossible to detect."[25] The researchers did not model the performance of millimeter wave systems, and CRS is not aware of similar evaluations of millimeter wave systems of the type deployed at airports.

Additionally, the DHS Office of Inspector General has raised concerns over the adequacy of TSA's on-the-job training to operate AIT units and inconsistencies in the use of calibration procedures to ensure appropriate image quality.[26] The adequacy of training and image quality can both have significant impacts on the overall effectiveness of AIT. TSA currently provides for eight hours of on-the-job training in addition to classroom instruction, and offers screeners additional time to achieve proficiency if needed. While TSA has issued standard procedures for the operation, testing, and maintenance of all AIT equipment, the DHS Office of Inspector General uncovered inconsistencies at various airports in the application and enforcement of these procedures. The DHS Office of Inspector General formally recommended that TSA conduct an assessment to determine appropriate on-the-job training requirements and develop controls to ensure that AIT systems calibrations, particularly for backscatter units, are conducted consistently and documented properly according to established standard operating procedures.[27]

TSA Workload and Staffing Requirements

Presently, TSA assigns three screeners per AIT unit for each shift. Through FY2011, TSA hired an additional 8,000 screeners to meet the anticipated workload demands associated with the deployment of the first 1,000 AIT units.

TSA anticipates that the migration to ATR will relieve some screener staffing requirements. The anticipated use of ATR in place of human image viewers will eliminate the screener who views and analyzes images in a remotely located viewing room, in most cases. This could reduce system-wide operational staffing for AIT systems by as much as one-third. However, the effect of this on overall TSA staffing is uncertain, as TSA may need additional staff for secondary screening to resolve potential threat detections identified by the ATR software. The potential increased need for secondary screening to resolve ATR alarms will depend on both detection and false alarm rates for the ATR algorithms compared to those rates for human image viewers. This information is not publicly available.

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[25] Leon Kaufman and Joseph W. Carlson, "An Evaluation of Airport X-ray Backscatter Units Based on Imaging Characteristics," *Journal of Transportation Security*, published online November 26, 2010, available at http://www.springerlink.com/content/g6620thk08679160/.

[26] Department of Homeland Security, Office of Inspector General, *Transportation Security Administration's Use of Backscatter Units*, February 2012, OIG-12-38.

[27] Ibid.

TSA's Deployment Strategy

As noted previously, TSA seeks to acquire 1,800 AIT units by the end of FY2014. At present the U.S. aviation system includes about 2,300 screening lanes at roughly 450 commercial passenger airports. However, only about 180 of these airports currently have AIT machines. At some of these airports, AIT is not fully deployed to all terminals and all checkpoints. Even at full operating capacity, not all airports and not all screening lanes will be equipped with AIT under TSA's plan. TSA is deploying systems according to a risk-based prioritization strategy that gives highest priority to the largest airports, those that fall into security category X and category I.[28] Even at full operating capacity, many smaller airports will not have AIT. This creates the possibility that terrorists could attempt to board planes at smaller airports to avoid body scanners they might expect to encounter at larger airports, just as some of the 9/11 terrorists originated their trips at the small airport in Portland, Maine and transferred to other flights in Boston without additional screening.

Related Legislation

Although TSA has put in place policies and procedures to address concerns regarding AIT scanning, these measures are not tied to specific statutory mandates and could be modified in the future without legislative action. A number of related bills have been introduced in the 112th Congress. However, none of these bills has moved out of committee.

The Aircraft Passenger Whole-Body Imaging Limitations Act of 2011 (H.R. 1279) would require the National Academy of Sciences to determine that AIT does not pose a threat to public health, and would require the use of privacy filters or other privacy-protecting technology, before AIT could be used for passenger screening. It would further restrict AIT or pat-down screening from being used as a primary screening method. The bill would also prohibit and establish penalties for storing, transferring, sharing, or copying AIT images. The Checkpoint Images Protection Act of 2011 (H.R. 685) would establish penalties for the unauthorized recording or distribution of security screening images, while the Transportation Security Administration Authorization Act of 2011 (H.R. 3011) would require TSA to certify that ATR software is installed on all deployed AIT machines, and that image retention capabilities on all such machines are disabled.

Also, the Traveler Screening Act, or the "RIGHTS Act" (S. 2207), would require the TSA Ombudsman's office to better track public complaints about screening, determine best practices to resolve frequent passenger complaints, resolve passenger complaints, and field advance notification calls from individuals with special needs to arrange for accommodation at screening checkpoints. This bill would also require the TSA Ombudsman to appoint TSA employees to serve as passenger advocates at all of the busiest (Category X) airports. Under the conditions specified in the bill, individuals selected as passenger advocates must not have been subject to disciplinary action by TSA and would be required to receive special training in conflict resolution as well as sufficient medical training to recognize legitimate complaints and concerns regarding medical conditions and disabilities.

[28] TSA classifies commercial passenger airports using five security risk categories—X, I, II, III, and IV—based primarily on levels of commercial passenger activity.

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