Promoting the Adoption of Meaningful Aviation Security Measures

Vulnerability of Automated Millimeter Wave Imaging Technology: An Unintended Consequence of "One Size Fits All" Checkpoint Screening

Universal deployment of automated advanced imaging technology (known as AIT with ATR) is being justified by the TSA's need to defend against a real threat to airlines and passengers from terrorists carrying improvised explosive devices (IEDs) under their clothing or in their footwear, as in the failed Christmas Day 2009 and the 2001 "Shoe Bomber" attacks. This paper addresses the unintended consequences of the introduction of the technology within the current "One Size Fits All" screening regime of the United States and most other nations.

In reaction to the Christmas Day 2009 event, full body screening AIT was proposed as a solution in early 2010 (after TSA test and evaluation programs going back to 2007 or earlier) but AIT and associated changes in manual body searches (pat downs) were soon met with a politically unacceptable level of public discomfort as well as budgetary and staffing problems related to the additional Transportation Security Officers (TSOs) required to analyze AIT images. Inspection time and space constraints related to the use of remote imaging stations caused additional operational and financial problems for the TSA.

The TSA thus is embarking on an alternative solution to the problem: adding Automated Threat Recognition (ATR) to AIT. ATR replaces the AIT's problematic "naked" images of passengers, which caused many objections by the affected passengers and privacy advocates, with an outline figure that has no anatomical detail. It also reduces the number of pat downs. ATR does this, however, at the cost of a considerable reduction of the AIT's already marginal ability to detect IEDs or their components. Even more risk will result from removing metal detectors and relying instead on the ATRs' inadequate ability to detect weapons as well as IED components, as the TSA now intends.

The concerns are twofold. The first is that AIT is not capable of providing comprehensive identification of well-concealed explosives or weapons on a passenger. The second is that ATR when applied to the already poor spatial and/ or contrast resolution of AITs will further degrade its detection capability. Our position is as follows:

1) Millimeter wave AIT is not an explosives detection system. It is a low resolution imaging system that has inherent limitations and gaps in coverage and detection. If used on its own as a primary means of detection, AIT could allow an IED, IED components or a weapon through a checkpoint.

2) Due to current inherent AIT imaging limitations and resulting issues with the areas of the body that cannot be effectively screened, it is dangerous to use these units without a metal detector. There are so many ways (the specifics of which are known but are not discussed here) to get weapons and certain IED components through that the use of mm wave AIT without metal detectors compromises security. An example of this is an incident at DFW airport in February 2011: http://www.nbcdfw.com/news/local/TSA-Agent-Slips-Through-DFW-Body-Scanner-With-a-Gun-116497568.html

3) The alarm rate on automated mm wave AIT was originally over 70% in various tests in Europe, due partly to incomplete divesting by passengers, but also due to the presence of image artifacts that cause the ATR algorithms to alarm. Again, AIT with ATR is not an Explosives Detection System (EDS) and when the sensitivity is increased to detect small items (like the 80 grams of PETN in the Christmas Day 2009 incident), the potential for rejecting passengers based on smaller harmless image artifacts would increase the rejection rate. Human factors research and operational experience tell us that this will tend to have negative effects on the trust that operators place in the system.

ATR has not yet been deployed with the higher spatial resolution backscatter x-ray AITs, but the TSA has announced that airport trials should begin on such systems in the fall of 2011.

4) It has been reliably reported from within TSA that the rationale for deploying ATR is that the detection rate (validated by the recent field tests) is comparable to that produced by directly analyzing the AIT images. However, the detection rate for small IEDs using operators was already dangerously low. Congressman John Mica of Florida described security problems based on classified DHS red team reports he had seen on AIT detection rates in a congressional hearing on March 16, 2011. His remarks are in this video clip from those hearings: http://debsnews.com/96841/2_vsP3zdyOvqpF4B

5) The US Government Accountability Office (GAO) was concerned about AIT's detection of small IEDs as recently as December of last year: http://www.cnsnews.com/news/article/its-unclear-if-airport-body-scanners-wil

6) The knowledge and assumptions about AIT stated here have been validated by the scientists and inventors involved in the design of the systems (who, for various reasons, cannot or will not be quoted or identified) as well as with years of Association members' experience working with mm wave and x-ray backscatter AIT in airports and live tests around the world.

A respected technical expert in this field who observed operations at Reagan National Airport while the trials of mm wave ATR were underway recently summed up these assertions. Upon overhearing from a TSO (while transiting through the checkpoint) that the AIT was going to be switched to automated mode, he sat in an area immediately adjacent to the checkpoint and observed the operation for an hour.

The observer counted true false positives (an alarm where there is no anomaly present) in the region of 45% (almost half of the passengers inspected). Additionally, about 5% of the passengers had an object that would produce an alarm (such as a cell phone) on their persons. The ATR was being used in only one lane of the checkpoint's four lanes. Currently, every other lane at DCA is equipped with AIT/ATR. Had it been used in all the lanes, the queue for screening would have been intolerably long.

As reported in the German press on July 30, 2011, trials there of automated mm wave at the Hamburg Airport conducted over a 10-month period by the German Police (http://www.dw-world.de/dw/article/0,,15278872,00.html) produced the following results:

- The units triggered alarms in seven out of ten cases overall
- Upon re-scanning after divesting, the alarm rate was 35% in the 730,000 cases where this was done
- "The scanners have been rejected by federal police until the software is improved and more effective models are made available."

Our extensive experience implementing automated detection systems is that for most applications an alarm rate in excess of 20% severely compromises the trust that operators place in the technology and hence reduces the effectiveness of an overall system unless another orthogonal technology can be used to reduce the alarm rate.

In addition, using current generation AITs in place of walk through metal detectors (WTMDs) gives terrorists a short cut way to get commercial grade electronic or chemical detonators through a checkpoint without setting off any type of alarm. Given that Richard Reid's and Umar Farouk Abdulmutallab's bombs failed to explode only due to faulty homemade detonators (as well as the intervention of courageous crew and passengers), accepting such vulnerability carries a real and dangerous degree of risk.

Despite the reasons indicated here as causes for concern, this use of ATR may be the best that the TSA can do within the bounds of its present security philosophy and approach to preboard screening of passengers. However, it should serve only as a temporary measure. A much higher probability of detecting weapons, IEDs and their components would be achieved by implementing the risk-based screening approach that has been proposed by the International Air Transport Association's Checkpoint of the Future. This strategy would first pre-screen and sort passengers into three categories of risk. The passengers would then be screened according to their risk categories in high security, normal security, and Registered Traveler (now known in the USA as Trusted Traveler) checkpoint lanes. The high security lanes would employ body scanning, metal detection, and other detection technologies in an integrated, inter-communicating system. Such as system would be tested and proven to prevent IEDs and weapons likely to be used by terrorists from being taken through the checkpoint. Due to costs and operational restrictions such a system could not be deployed in the present one-size-screens-all arrangement, but it is certainly achievable **now** by the risk-based Checkpoint of the Future.

To summarize, in the absence of a viable and comprehensive Checkpoint of the Future plan in the United States (including an integrated High Security Lane in addition to Trusted Traveler) the universal implementation of AIT with ATR is of considerable concern. In light of Secretary of Homeland Security Napolitano's recent statements (Associated Press/Washington Post July 21, 2011) to the effect that "terrorists continue to target aviation more than any other potential vulnerability", regulators around the world need to combine AIT with effective complementary technologies in a risk-based strategy, in order to protect the traveling public from both the kinds of attempted attacks we have already experienced as well as future, potentially more skilful attempts to destroy passenger airliners.