U.S. DEPARTMENT OF HOMELAND SECURITY:

SHEPHERDING TECHNOLOGIES ACROSS THE VALLEY OF DEATH

It's hard being a regulator, especially in the aviation security space. Unlike other security entities, for the Transportation Security Administration (TSA), and their counterparts overseas, media criticism is a daily occurrence. For sure, there are times when the system fails to deliver either a quality service or serve up a healthy dose of common sense, yet, behind the scenes, government agencies are trying to make air travel safer whilst improving passenger facilitation. While human factors cannot be underestimated, few would argue that the deployment of effective and efficient security technologies is key to preventing the next aerial atrocity. But how are technologies assessed and what is the process of taking a concept through to being certified for deployment? ***Philip Baum*** *visited the Transportation Security Laboratory in New Jersey and the TSA Systems Integration Facility in Virginia in order to better understand the U.S. Department of Homeland Security's approach to qualifying solutions to combat terrorist attacks against aviation.*

Is it certified by the TSA? Is it a qualified product? These are questions often posed by potential buyers to manufacturers of security screening technologies. Naturally, in the US, they are questions asked out of necessity. However, around the globe, TSA certification is regarded as a seal of quality and, regardless as to whether a country has flights to the US or not, such approval can be a pre-requisite to procurement. Equipment Qualification is actually a three step processes executed by the Department of Homeland Security (DHS), the first two stages of which, being at the Transportation Security Laboratory (TSL) and at the TSA's Systems Integration Facility (TSIF), are the subject of this article.

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The U.S. Department of Homeland Security's (DHS) Transportation Security Laboratory (TSL) was established in the wake of the destruction of Pan Am flight 103 over Lockerbie in 1988. The technologies it assesses are those which can be deployed for the detection of prohibited items on the person or contained within carry-on baggage, checked luggage or cargo. In other words, the TSL's remit does not cover access control, surveillance or data analysis technologies which might be deployed to safeguard aviation.

Indeed, TSL does not work exclusively with the TSA. Since 2002 it has been a part of the DHS' Science and Technology Directorate whose overall mission is to "strengthen America's security and resiliency by providing knowledge, products and innovative technology solutions for the Homeland Security Enterprise." As such TSL provides services to the Customs and Border Protection (CBP) agency, the Federal Emergency Management Agency (FEMA), and the United States Coast Guard, as well as to TSA.

The first product TSL certified for explosive detection was in 1994 (an X-ray based explosive detection system). Over the years, a range of technologies have been evaluated for deployment; some, such as thermal neutron analysis (TNA), showed great promise but were later deemed unsuitable for deployment, whilst others, such as quadrupole resonance, still offer hope.

Dr. Susan Hallowell is the dynamic Director of the TSL and regards the laboratory's role as being there to "shepherd technologies across the Valley of Death". In other words, there are some great concepts out there in both the academic and manufacturing worlds, and it is up to TSL to assist in taking a prototype technology along the road to deployment. So many good ideas fall short, often as the inventor has not understood either the evolving threat or the practical technology deployment and passenger facilitation challenges that airports face.

There are basically three stages to a technology being certified for deployment. The TSL performs the first stage and determines whether the technology can do what its manufacturers claim it can do. Is it mission effective? And, if it is, can it also safely perform those tasks with a low false alarm rate? So, if, for example, a technology claims to be able to detect TATP, can it do so AND can it do so without alarming on a whole range of other harmless substances? Furthermore, if a product is able to detect a threat without a high false alarm rate, the TSL also has to consider whether the range of threats the product can detect is broad enough. So if a product can detect TATP 100% of the time, but only TATP and no other threats, it will be regarded as being too limited for further consideration.

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Once it has been determined that a solution is effective, and if it is a product designated for use in aviation security, the second stage is performed at the TSA's Systems Integration Facility (TSIF), where the extent to which it is operationally deployable is assessed.

The third stage is when the product goes for live Operational Testing at an airport.

The TSL has an excellent working relationship with all the major technology suppliers, and the US government also has a Small Business Innovation Research (SBIR) programme that encourages domestic small businesses to develop solutions for commercialisation. The DHS is actually mandated to allocate 2.5% of its research and development budget to SBIR grants. Consequently, the opportunity exists for fledgling companies and the academic community to explore today the solutions that may become the gold standard in aviation security technology tomorrow.

In addition, the DHS and the US Department of Defense agencies also appeal to the manufacturing industry for solutions through Broad Agency Announcements. These are competitive solicitation procedures used to obtain proposals for basic and applied research. Both the TSL and TSA review resulting submissions. 'Industry Days' are also conducted at which government agencies can spell out their requirements and provide a 'wish list' to companies actively developing screening solutions.

A manufacturer interested in having a solution assessed by TSL enters a process known as a Technology Optimisation Partnership. In the beginning, the TSL has a "look see" whereby the manufacturer will be given initial feedback as to the TSL's assessment as to the product's viability. The next stage is that of Readiness Assistance during which manufacturers are given samples of threats in order that they can fine-tune their technologies for Readiness Testing (a sort of pre-exam), when the TSL actually tests the product and provides explicit feedback to the manufacturer. These stages can take anything from ten days to two years or more to pass through; the speed is usually dependent upon the manufacturer rather than on government bureaucracy.

Once the Readiness Testing has been accomplished, the manufacturer has an opportunity to act upon the feedback given by the TSL before submitting the product for formal testing and evaluation, known as certification or qualification testing. During this process, the manufacturer is not involved in the test and evaluation at all. They simply deliver the system to the laboratory, set it up, verify that it is functioning correctly, train the operators, walk away and await the outcome.

TSL's work focuses on both bulk and trace detection of explosives. In respect of trace, it is not only a question of ensuring that a product can detect a broad range of threats with a very low false alarm rate, but also of ensuring that traces can be picked up from surfaces characteristic of air transportation, rather than off sterilised laboratory slides. As a result, TSL applies traces of explosive threats to material test surfaces such as cardboard, being frequently used for packaging goods for carriage by air cargo.

Over the years a number of items carried by the travelling public have produced false alarms with detection technologies, which can slow the screening process down. For example, the high phosphorous and calcium content in human remains may be detected as they have a similar average atomic number to some explosive materials. This

Dr. Susan Hallowell, Director of the TSL is one reason why the TSL is keen to ensure that false alarm rates are very low. TSL's scientists work with TSA to replicate the alarm situation, then work with industry to eliminate that discrepancy if possible.

The laboratory is located close to Atlantic City...a city better known for gambling and risk taking. Dr. Hallowell's team, however, take no risks. By nature, certain quantities of explosives have to be retained on site and, therefore, safety drills are of critical importance. The explosives are stored in bunkers, no testing is conducted using real explosives when thunderstorms are taking place and personnel are grounded to avoid static.

The local community does have a role to play in testing advanced imaging technologies (AIT). Known, trusted individuals from Atlantic City environs, together with staff from the laboratory itself, are often used for trials. This is important as each AIT is tested using people of different body masses. Certain threat materials cannot be concealed upon a live person and for such testing the TSL uses body phantoms. A mannequin manufactured by John Hopkins University, out of a material that replicates human skin, is currently in use.

The TSL spends considerable time manufacturing concealed threats that can be used in the assessment process of a broad range of technologies. TSL's simulant development lab looks like a cross between a chef's kitchen and a school chemistry class!

Every machine that is ever deployed in the field has a 'gold standard' version at the TSL, so that every time a component part is changed, the product can be speedily re-certified.

Dr. Hallowell may be a scientist and her focus may be on the analysis of technologies, yet it is patently apparent that she is also a 'people person'. She clearly understands the role of the screener in the security process and, even in her dealings within the laboratory itself, exudes the kind of common sense, rational and practical decision-making ability that it would be wonderful to use as a benchmark for screener performance. Sadly, that is not TSL's remit!

As aforementioned, once a product has undergone testing by TSL, it then has to be evaluated by the TSA's Systems Integration Facility (TSIF), which is located at Reagan National Airport serving Washington DC. TSIF's premises were purchased by the TSA from the Post Office in 2007, and the first tests commenced at the site in 2009. There are now approximately 150 TSA staff working at the site, although not all are involved in testing activities.

The testing carried out at TSIF is categorised as being Developmental Testing, whereby a simulated operational environment is created. The tests emulate real-life operations and technologies are often operated by Transportation Security Officers (TSOs) otherwise deployed to checkpoints throughout the USA. Throughput rates, speed of training and ergonomic issues are all evaluated, alongside the obvious threat detection capability of each system. On average, each technology is at TSIF for a month, two weeks of which are spent with TSOs participating in the evaluations.

The aim of the TSIF process is to certify a product as being ready for airport Operational Testing. In order to do that, one of the roles of TSIF is to evaluate the protocols for using any given product and the training that will be required for its operators. However, TSIF is also involved after a product has been certified and deployed as it continually monitors the challenges operators face and proposes upgrades and changes to manufacturers in respect of the machines themselves and to screeners as far as user protocols are concerned.

Currently manufacturers do not pay for their solutions to be evaluated at TSIF, but the TSA is keen to ensure that it does not become a free extension of manufacturers' R&D divisions.

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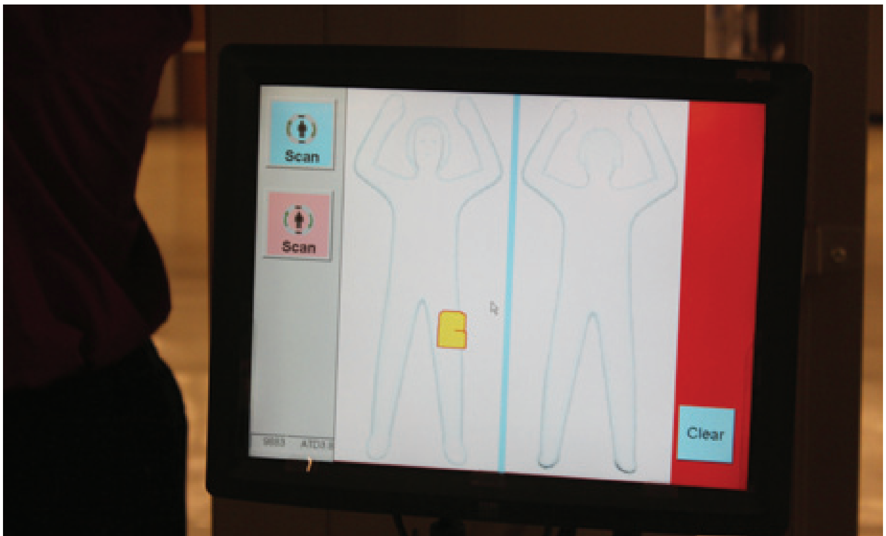
At TSIF, as at TSL different dedicated teams evaluate passenger, carry-on, checked baggage and cargo screening solutions. Passing the tests is not easy. For example, when it comes to trace detection, there are approximately 150 different requirements that have to be met. When it comes to deployment, assessments have to be made regarding costing and ability to complete on delivery within specified time periods. Even if a product is deemed to be safe, effective and deployable, TSIF will consider its potential for incremental improvements; so, will it, in the future, be able to detect a broader range of threats, or a smaller mass of a threat substance without having a negative impact on false alarm rates?

The checked baggage screening test area resembles the bowels of an airport...although considerably cleaner! Occupying some 23,000ft^2, the baseline configuration supports the operation of a minimum of two high-speed in-line EDS units performing Level 1 screening with up to three medium-speed EDS units performing Level 1 or Level 2 screening. As at a real airport, there is an EDS on-screen resolution room with multiplex capability, an EDS alarm resolution room and baggage handling system (BHS) control room.

TSIF, as an integration centre, examines how different technologies



TSIF's team is expending a lot of energy on the protocols for the use of advanced imaging technology.

operate in tandem with each other. Some are not, by nature, security solutions. The conveyor belts for the BHS are a case in point; TSIF plays its role in evaluating the potential for bags to be lost in the system. In their testing TSIF acquires considerable data, such as angle and size of bags, which can be used to improve the design and construction of the BHS of the future.

TSIF has huge quantities of carry-on and checked baggage which it uses to test the system. The bags, and their contents, are replaced every 6-18 months and additional bags (or cargo consignments) are added to reflect emerging threats. The vision of a risk-based screening system where bags may be subjected to different levels of screening depending on a risk score attributed to its owner is very much part of the plan and TSIF's facilities will have to be able to operationally test it. In respect of cargo, tests are carried out using a vast range of different produce that is frequently shipped by air.

Passenger and carry-on baggage screening solutions, along with credential/ID examination systems are all under evaluation. It is not surprising that TSIF's team is expending a lot of energy on the protocols for the use of advanced imaging technology (AIT). Albeit the huge advantages they offer over pat down searches by TSOs, TSA and TSL continually strive to improve the performance of this technology. Additionally, in order to protect individual privacy, screening officers do not look at real images of passengers being screened by AIT systems, but rather at avatars. Such is the debate about AIT that even the term 'avatar' seems to be problematic; some prefer 'cookie cutter', but TSA has now opted for the term 'human representative figure' which, I guess, is exactly what it is!

The entire set up was extremely impressive and the commitment to the research, development and testing of security technologies highly laudable. Certainly a good news story. In fact, the only fundamental problem with the process was one that the DHS itself recognises as a challenge – the inability to formally share information internationally.

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Semtex H crystal

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Certain data is considered 'classified' and not all of it can be shared with industry partners overseas, even with trusted governments. (There is, of course, collaboration with foreign counterparts, especially in Europe, Australia and Israel, but each of those states/regions also faces different threats.) Consequently, as the US authorities become aware of new and emerging threats, they can ensure that their technologies can mitigate such risks but they are not going to be able to tell private industry elsewhere around the globe. This makes the playing field in the US less than level as far as overseas manufacturers are concerned. In the same vein, the DHS is understandably guarded as to what mass of any one material they expect a technology to be able to identify – hardly the material for public consumption – so, as a result, many manufacturers do not even know what the detection standards are. But that is the name of the game; it is a reality and symptomatic of the very challenge we are all up against. Security is not fair.

And, as if to drive that point home, I was taken from TSIF to the Pentagon for a guided tour conducted by Bill Hopper, their Communications Manager. Aside from it being a fascinating touristic experience, it was also a sobering one. As here, at the very heart of America's defence infrastructure, they had witnessed firsthand just how unfair life can be.

At 9.37am on 11th September 2001, American Airlines flight 77 had been deliberately flown by suicidal terrorists into the Pentagon killing 184 people who were going about their daily lives. The Pentagon Memorial is now an eternal reminder as to what the stakes are and the challenges we all face.... and if that means the playing field is not level, then so be it. Whilst the 'Valley of Death' for manufacturing industry may be the place in which technologies fail to make the transition from prototype to deployment, in the real world it is the killing fields for those with misguided, twisted and fanatical viewpoints.

Philip Baum is the Editor of Aviation Security International.

Aviation Security International would like to thank all the staff at the Department for Homeland Security for their help in facilitating this review. In particular we would like to thank Dr. Susan Hallowell, Director of the TSL, Keith Goll, Director of the Operational Support Division at TSIF, Bill Hopper, Communications Manager at the Pentagon, Lisa Farbstein, Public Affairs Manager at the TSA and John Verrico, Chief of Media Relations at the Science and Technology Directorate of the US Department of Homeland Security.

TSIF's integrated checked baggage screening test area.