AVIATION SECURITY INTERNATIONAL

www.asi-mag.com

INCORPORATING LAUNCH ISSUE OF

COUNTER TERROR GAZETTE

www.ct-gazette.com

THE GLOBAL JOURNAL OF AIRPORT & AIRLINE SECURITY

Air Mail Security

ALSO:

CABIN BAGGAGE SCREENING

AVSEC & THE 2ND INTIFADA

INDUSTRY LEADERS OPINIONS

AVSEC WORLD 2010 PREVIEW

PRINCIPAL MEDIA SPONSOR TO:

AVSEC World 2010

ZAMBOANGA CITY AIRPORT BOMBING

SEE PAGE 2

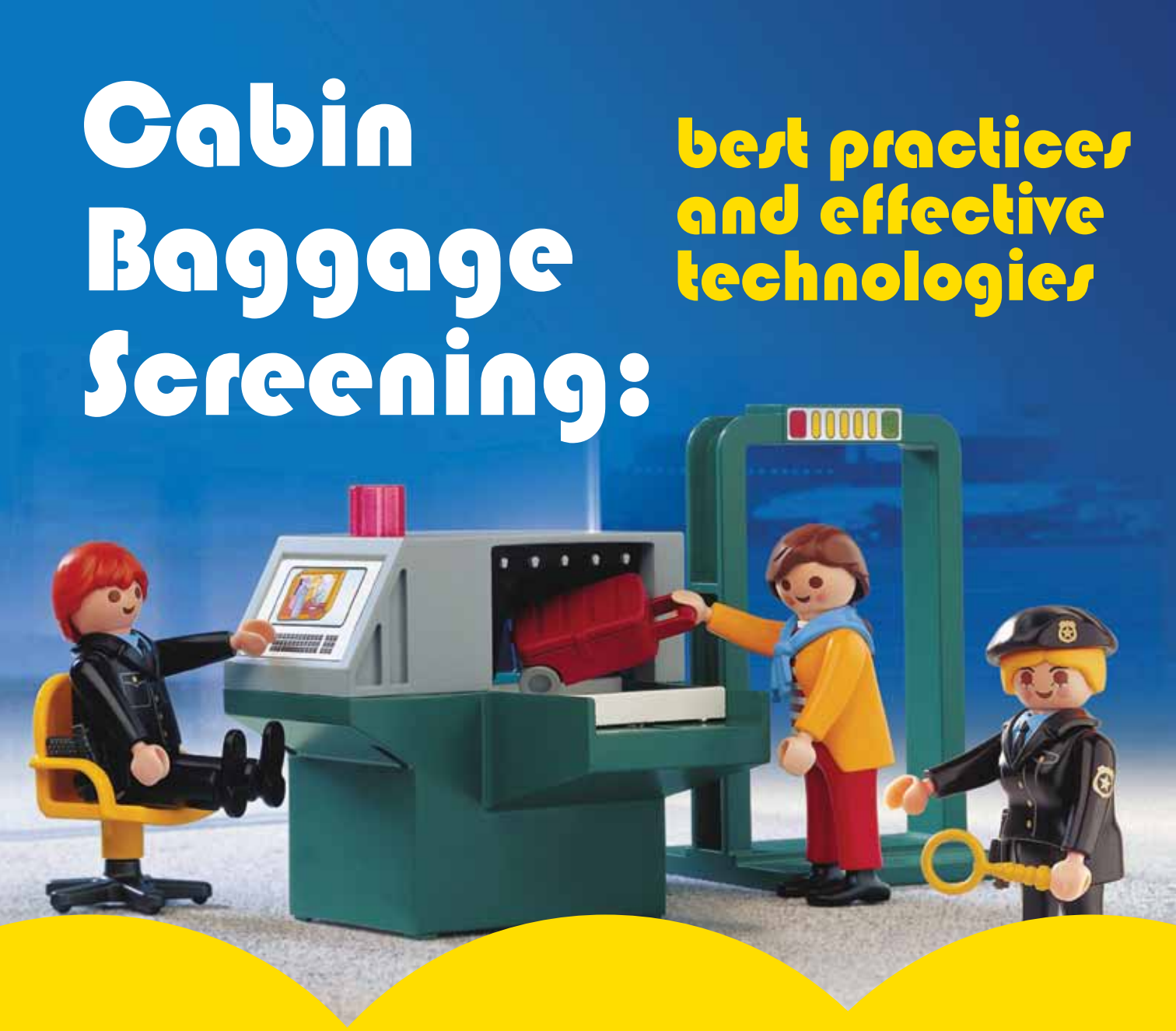
COUNTER TERROR GAZETTE

LAUNCH ISSUE

AUGUST 2010 VOLUME 16 ISSUE 4

Cabin Baggage Screening:

best practices and effective technologies



In spite of virtually every terrorist attack against civil aviation since Pan Am 103 – the Lockerbie bombing in 1988 - being initiated via the checkpoint, the world's authorities and airports have focused the vast majority of their financial and technical resources on checked baggage screening enhancements. Advances in explosive detection technology and the use of alternatives to standard X-ray, such as computed tomography and even Advanced Technology (AT) X-ray have only recently been applied to the far more difficult challenge of cabin bag screening. ***Steve Wolff*** *looks at the challenges surrounding the screening of cabin baggage, regulatory issues and technologies as well as processes being implemented today and what approaches, might, in the future, be applied to better protect against the loopholes that exist in the screening of carry-on bags at the checkpoint*

Left: (Credit: With kind permission of Geobra Brandstätter GmbH & Co. K G, Germany. PLAYMOBIL is a registered trademark of Geobra Brandstätter GmbH & Co. K G, for which also the displayed PLAYMOBIL toy figures are protected.)

In the United States, the investment in both cabin bag and passenger screening has been less than 10% of that spent on hold baggage screening. Even the 2009 American Recovery & Reinvestment Act (ARRA) targeted only $311 million at the checkpoint (for both bag and passenger screening) versus $689 million for checked baggage. According to TSA sources, the bulk of this funding will go to deploy liquids scanners and Advanced Imaging Technologies (AIT) for passenger screening.

This disparity is in spite of the checkpoint being terrorists' preferred entry point and presenting substantially more complex challenges. The checkpoint has to contend with disassembled bomb components and smaller threat masses as well as conventional weapons, none of which necessarily have to be on - or in - the same individual or bag. This compares to hold baggage, where Improvised Explosive Devices (IEDs), the primary threat, must be pre-assembled and terrorists cannot select their placement to inflict maximum damage.

To pass through the checkpoint, terrorists have a wide menu of explosives and fuel/oxidizer mixtures to choose from, which they combine with cleverly-configured (but fortunately so far ineffective) initiators, fuses, triggers and detonators. They've even shown a willingness to conduct chemistry on-board an aircraft – as in the case of Umar Farouk Abdulmutallab on Christmas Day 2009.

Regulatory Issues

Unlike hold baggage screening (HBS), there are no certification standards for cabin baggage screening aside from the limited issue of liquids. In the 1990s, Europe and the U.S. adopted different hold baggage screening standards and hence deployed different technologies, creating much friction. However, with cabin baggage screening there is a concerted effort underway to be consistent for liquids detection as well as the deployment of Advanced Technology (AT) X-ray systems, though there are signs that this drive towards "harmonisation" has its limits.

In 2009, the TSA met its self-imposed deadline for replacing the aging single view X-ray systems with AT devices from Smiths Detection and Rapiscan and Europe has adopted the same approach. This focus on pragmatism rather than setting and enforcing detection standards represents a philosophical departure for the TSA relative to HBS where only technologies that achieved certification were deployed. TSA is exploring the use of computer simulations to predict the effects of explosions on various aircraft and plans to use this tool to develop new baggage screening standards rather than relying on costly live explosive tests, which cannot come close to looking at the wide variety of explosives and scenarios. TSA will likely wait until such work is completed before formalising standards for new technologies. TSA's long-term goal is to harmonise standards between hold and cabin baggage screening requirements. In the meantime, the qualification process for AT systems is based primarily on image quality.

Aside from limited trials in the US and the UK, CT technology – the mainstay of HBS – is not being pursued for the checkpoint primarily for cost, speed, reliability and space reasons. It is likely that CT will play some role at the checkpoint (possibly combining hold and cabin baggage screening at smaller airports or to screen watch-list passengers) in the future, but there are no current plans to do so. In the meantime, with no driving force from the US Congress, the Obama Administration or the European Commission, ATs will remain the cornerstone of primary cabin baggage screening strategy for the foreseeable future, with the possible exception of liquids.

"...the 2009 American Recovery & Reinvestment Act targeted only $311 million at the checkpoint versus $689 million for checked baggage..."

Both the TSA and European authorities are keen to deploy scanners that will allow them to lift the unpopular "3-1-1" (3 fluid ounces – 100 ml - maximum per bottle, in 1 quart size clear plastic bag and only 1 bag per person) rule for liquids in carry-on bags. The European Commission has mandated that the "3-1-1" rule be

Ratec's EDS-5101K thermal neutron analysis hand baggage inspection system

"...if there is an incident, then given the superior detection capabilities of CT, it is likely that a major replacement strategy will occur on an accelerated basis..."

lifted in two stages, for transiting passengers in 2011 while originating passengers will need to wait until 2013. The TSA on the other hand is looking to screen only "allowed liquids", such as medication, and is not planning to remove the "3-1-1" rules any time soon.

The Technology

Multi-View AT X-ray adapted from HBS has now largely replaced the aging single-view X-ray systems in the US and Europe. How successful this will be from a detection perspective is unclear; the checkpoint threat is significantly tougher than for hold baggage, where, for several categories of explosives, ATs fell short in terms of false alarm rates and detection and were never deployed in the US. However, both the TSA and the Europeans now deem them suitable for cabin baggage screening; in the absence of anything more capable that meets operational requirements. The TSA's AT-2 programme aims to improve the detection algorithms, although not necessarily in the same manner as in Europe.

European regulators are working on cabin bag screening standards and will likely adopt a similar approach they used for hold bag screening; different levels of detection standards with planned obsolescence over several years, but the standards will include human factors attributes, such as Threat Image Projection (TIP), and Explosive Detection Systems (EDS) and liquids inspection will be less technology specific. This approach will allow developers to focus their algorithms on what they do best, while driving nuisance alarms down and relying on operators to find those threats that the machines cannot, rather than being forced to adopt the HBS strategy of requiring the algorithms to detect everything, with high false alarm rates. This approach may have the added benefit of simplifying the operators' ever more complex job. In the meantime, the AT automatic algorithms remain unused. An example of this strategy is a Canadian company, OptoSecurity, which is developing an add-on to existing AT systems to detect liquid explosives and conventional weapons. Other companies are working on algorithms specifically for laptop inspection. If successful, rather than having the operator only resolve automatic rejects, both the operator and the automatic AT will have parallel primary detection roles, simplifying the operators' job considerably. This tactic of using the strengths of both operators and automation may be expandable to other threats and, if successful, this ability for companies to offer such upgrades could change the marketing approach for security systems, especially in poorer countries that lack resources to upgrade hardware. However, it may pose a challenge for regulators aiming to maintain consistency across various combinations of hardware and software from different vendors.

More capable from a detection perspective is CT technology. TSA trialled compact baggage CT scanners from two companies, Analogic and Reveal Imaging, and Morpho Detection (which owns GE's CTX product line) is releasing a high-speed compact CT that might have checkpoint applications. Manchester Airport also trialled the Reveal system, but has yet to adopt the technology. However, if there is an incident, then given the superior detection capabilities of CT, it is likely that a major replacement strategy will occur on an accelerated basis, in spite of it being more costly, larger and slower.

For secondary search, or Level 2, there appears to be no better short-term solutions for the cumbersome secondary search process, which is about to get more burdensome with rejects from liquids inspection and could easily become the bottleneck if detecting a wider range of threats leads to more rejects. Regulators are relying instead on next generation trace detectors.

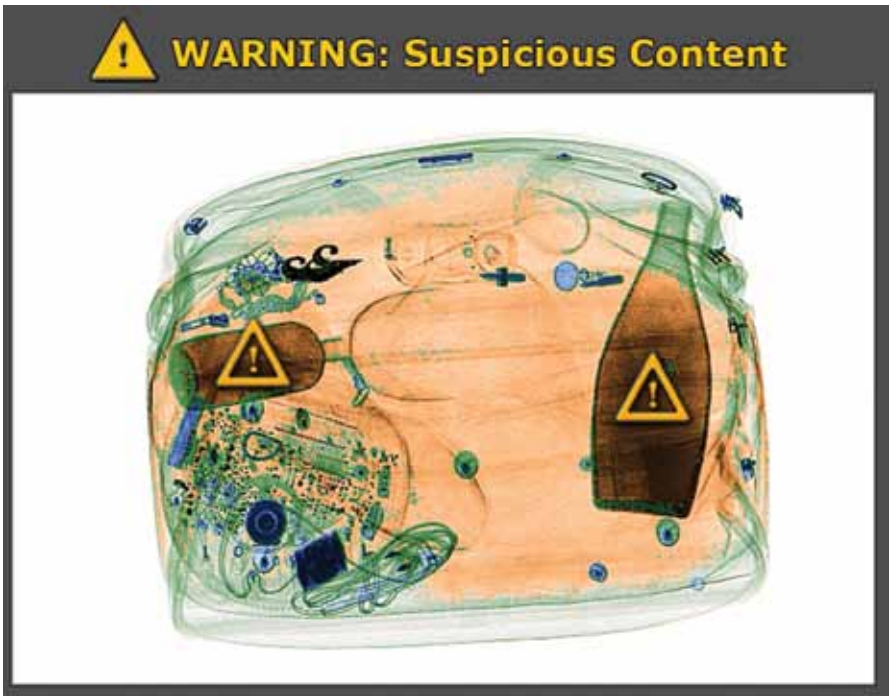
Alternatives to X-ray

Over the past 10 years, several manufacturers have integrated complementary technologies with X-ray and CT. One example is Rapsican's QXR1000, a combined X-ray/Quadruple Resonance (QR) system. QR is a radio frequency technique that detects plastic explosives regardless of shape and thickness but lacks the breadth of materials to be used

on its own. To date, it has not been deployed at airports, though it is in use for non-aviation applications.

Another example is the integration of trace with X-ray. Regulators are rightfully wary of trace systems' ability to detect concealed explosives inside baggage as the primary challenge is getting a good sample of explosive molecules into the trace analyser – trace has been shown to work best when there is access to the interior of the bag. Automatic sampling systems have been developed (by Traceguard, for example), but no standards exist, nor have systems yet been approved for use. Stand-alone trace is used for secondary search, but lacks the speed and automation for primary screening and is prone to human error.

In Russia, Thermal Neutron Activation (TNA) has been used to resolve operator rejects from X-ray. While TNA may work in this regard for some explosives by detecting the presence of nitrogen and chlorine, these elements are missing in many homemade explosives (such as TATP). Fast neutron inspection can overcome this limitation, but at the expense of increased size, cost, more safety concerns and slower inspection that will relegate any such application at best to secondary search only. A Russian company, RATEC is working on integrating TNA and potentially fast neutron activation with X-ray for cabin



XMS® Threat Detection Software (Credit: Optosecurity)

Kromek bottle scanner

baggage screening. A US company called Clear Path has a compact robot-mountable fast neutron system for inspecting unattended bags and such technology could potentially be adapted to secondary search. Both companies are taking advantage of 20 years of technology improvement since TNA was last considered for aviation applications.

"...divesting and repacking of personal items are the rate-limiting steps at the checkpoint..."

Processes

Divesting and repacking of personal items are the rate-limiting steps at the checkpoint. Worldwide, passengers have to remove various items (such as laptops, toiletries, camcorders, etc) from bags and place them in trays for separate screening. Though in place for several years, this extra divesting has substantially reduced checkpoint throughput and raised passenger frustration. From a pre-9/11 average of 275 passengers per hour per lane; after 9/11, lanes more typically processed 225 to 235 passengers per hour per lane, a 15 to 20% reduction in Europe and as low as 100 to 200 passengers per hour in the US due to enhanced divesting. To partly compensate, some commonsense steps have now been widely adopted, such as replacing every other metal detector with an X-ray system, which helps alleviate the longer divesting and repacking times. However, many airports have had to build out facilities and add more lanes to meet capacity.

When the liquids rules are finally relaxed, it is likely that bottles will need to be screened in trays, adding to the divesting burden as well as increasing the number of secondary search inspections. TSA recently relaxed its rule on removing laptops from certain types of briefcases, but until this is broadened to include most briefcase types, it is unlikely to raise the processing rate at the checkpoint and potentially may increase confusion and delays in the short term.

However, the additional views offered by AT X-rays should reduce the need for bags to be re-screened as there is less likelihood of objects being hidden in several views.

The Future

In spite of a desire for harmonisation between the US and Europe regarding regulations, it appears that both are approaching the problem differently. In Europe, discussion has focused on customising algorithms to focus the AT systems on what they do well, driving the false alarm rates down as low as possible and leaving the rest of the threat up to the operators. This would lead to a parallel initial inspection process, one automatic and the other human. The TSA, while currently lacking a certification standard similar to Hold Baggage Screening (the current AT qualification standards are less stringent), expects that in future, a harmonisation of hold and cabin baggage threat types will occur, although not likely for the next couple of years. Also, the approach to relaxing the "3-1-1" rule appears to differ between the US and Europe.

For the complex challenges of cabin baggage screening, a high speed, cost-reduced CT system would likely provide the best detection capability, but it remains to be seen whether the hurdles of cost, reliability and size can be overcome. Failing that, novel designs are being explored by several companies that might fall between AT and CT in terms of capabilities. TSA is evaluating 3DX-Ray's binocular-vision AT X-ray and Reveal Imaging is adapting its Array-CT laminography system to meet AT image quality and liquid screening standards. SureScan Corporation is testing a scanner for hold baggage that uses many X-ray views, produces a 3D image yet does not fully fall into the CT category. If it achieves TSA hold baggage certification, the approach might be applicable to cabin baggage (as well as cargo) screening, if X-ray tube size can be scaled and reliability ensured. It may also validate the introduction of spectroscopic Cadmium Zinc Telluride (CZT) to replace the photon-counting detectors that have been used on X-ray and CT systems to date. However, even CT is unlikely to provide a comprehensive solution for the wide breadth of materials, geometries and concealment methods that terrorists could use. To fill in the detection gaps (and to reduce the burden higher false alarms will have on secondary search), a suite of secondary technologies, e.g. QR, trace, possibly neutron techniques may have a role in

resolving rejects, especially from watch-list or selectee passengers and some of these should be considered for primary screening. It is unlikely that such a combination could be applied to every passenger; so screening passengers according to their potential threat, likely will – and should - replace today's "one size fits all" approach.

In summary, given that the vast majority of terrorist attempts against civil aviation have occurred via the checkpoint, the procedures and technologies that are in place or being planned are critically important. Unfortunately, too often we've seen reactions to a specific event rather than a carefully thought-out plan that would provide a true defence against such incursions. Regulators appear to be pinning their short to medium term hopes on automatic detection algorithms for AT systems in spite of their proven limitations on the 'easier' task of hold baggage screening. Regulators worldwide (possibly via ICAO) should develop a clear, realistic migratory path and timeline for new systems in terms of performance requirements, development and deployment in a manner similar to Europe's current HBS plan. This path should also have incentives that improve customer service for airports to adopt new technologies ahead of schedule, such as improved operations and relaxation of other security measures. All stakeholders would then have a clearer understanding of the long-range strategy and opportunities, allowing manufacturers to use a combination of private capital and government R&D funds to develop systems that meet the capabilities along that timeline. In parallel, airports can plan their revenue needs and infrastructure modifications to meet these requirements. At the very least, a substantially higher investment along with better technology combinations and processes is sorely needed to address the complex detection and operational challenges of cabin bag (and passenger) screening.

"...from a pre-9/11 average of 275 passengers per hour per lane; after 9/11, lanes more typically processed 225 to 235 passengers per hour per lane..."

Steve Wolff has 25 years experience developing & marketing advanced aviation security detection systems. He was a co-founder of InVision Technologies and for the past 7 years consults, helping companies with product development, government introductions, marketing and sales strategies.