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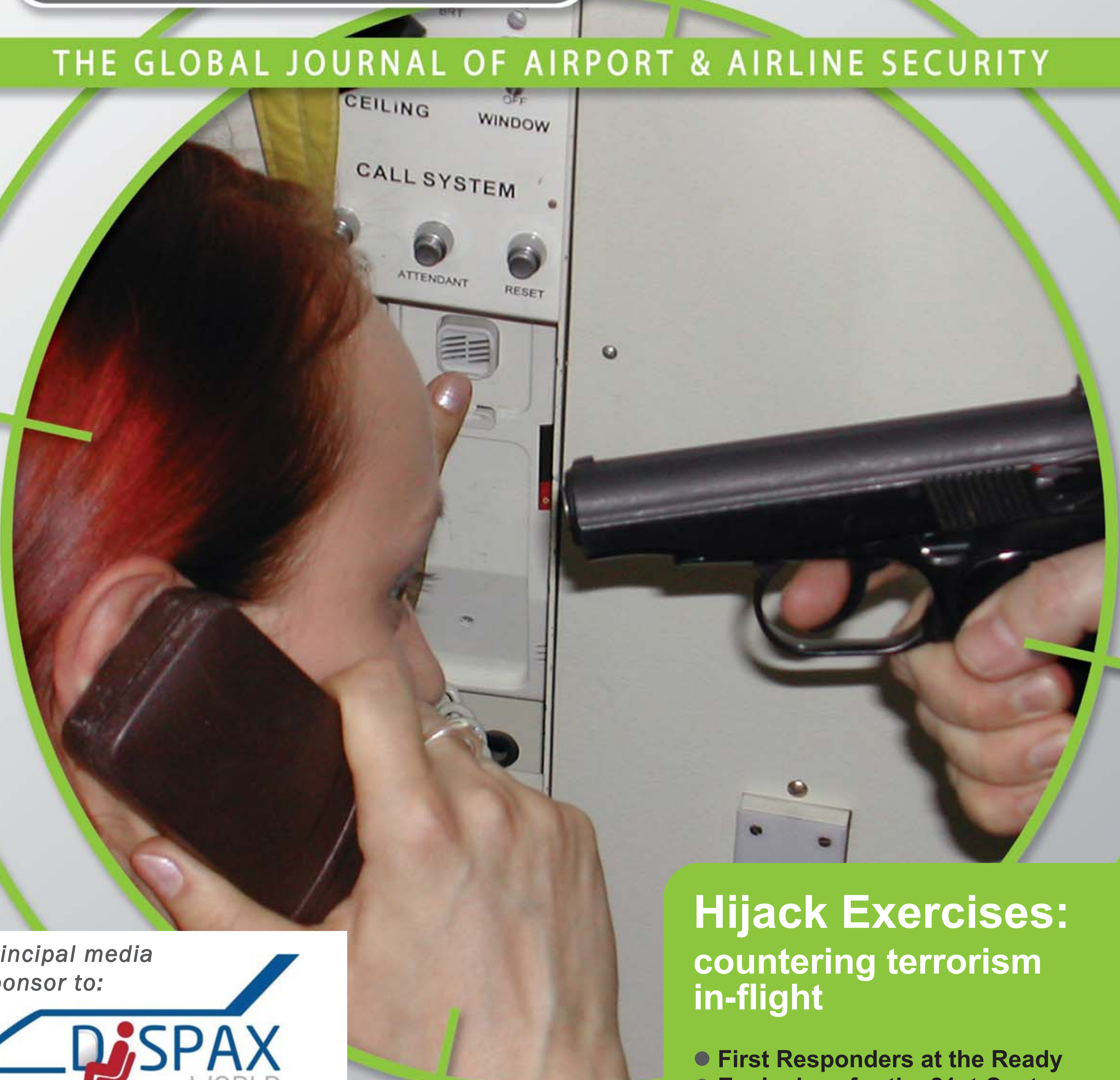

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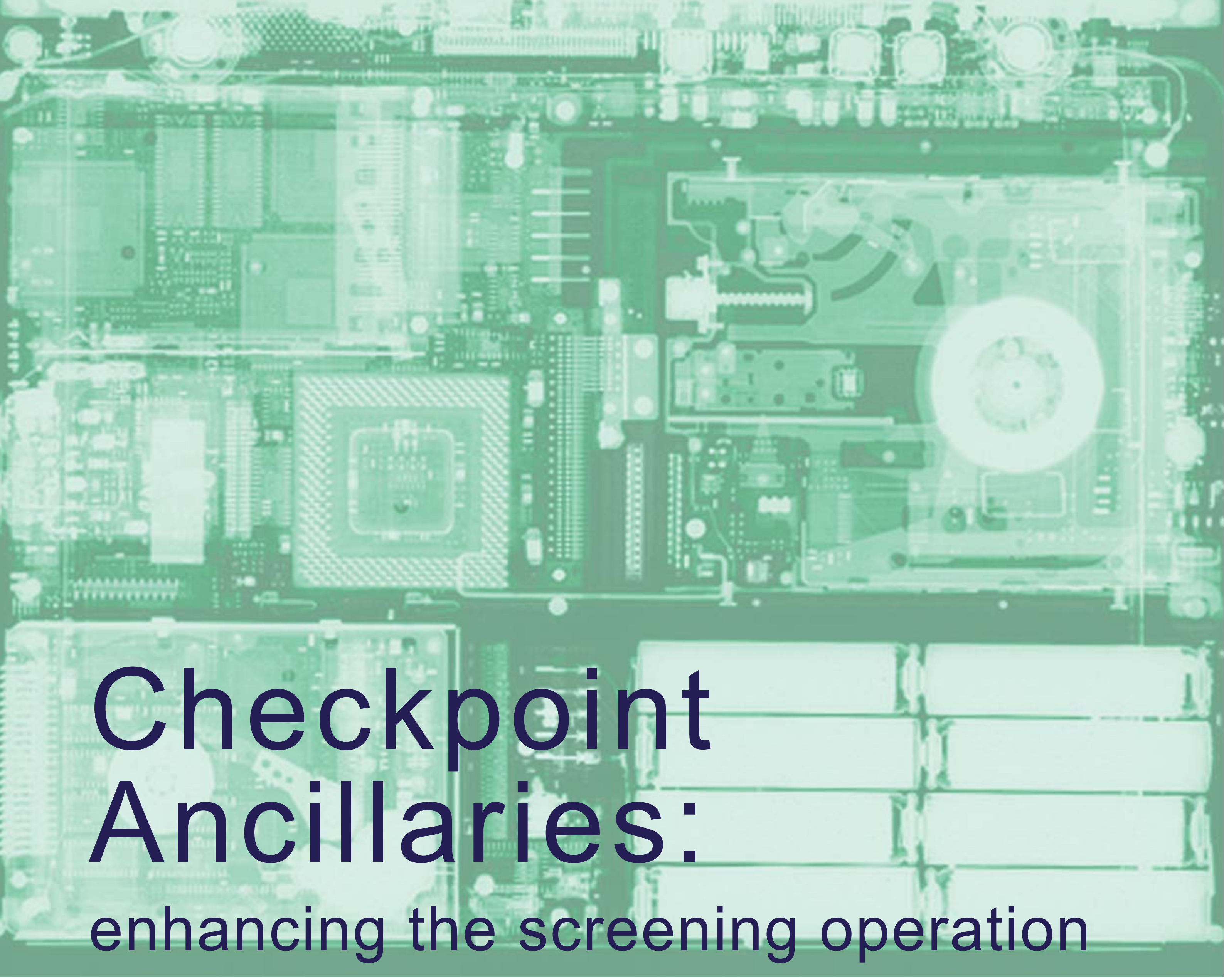

Checkpoint Ancillaries:

enhancing the screening operation

As terrorists grow ever more sophisticated in their attempts to smuggle weapons on board commercial aircraft, industry and regulators have adapted their tools and inspection processes – somewhat unevenly – to meet the expanding threat. ***Steve Wolff*** *examines several different areas and technologies, in the early stages of being trialled and deployed at several of the worlds' checkpoint operations, that are designed to supplement the 30-year-old screening process and address specific security loopholes.*

It's too early to assess which of the multitude of new approaches on the drafting board have broad enough benefits for worldwide roll-out to become as ubiquitous as metal detectors and X-ray scanners. At some point, however, rather than adding new boxes and procedures to an already confusing (from everyone's perspective) inspection process, new strategies, coupled with appropriate technologies will likely be needed to enhance security and improve the passengers' experience. Let's consider where the future might lead…

Currently, the industry is playing catch-up with an increasingly diverse set of threats and terrorist sophistication, so adding more stand-alone solutions seems to be the short-term focus. There are four major areas where new technology is being explored and applied to address loopholes:

- niche inspection applications,
- X-ray detection enhancements,
- checkpoint operations improvements, and
- system integration

Complementary / Niche Technologies

In terms of the largest impact on (and annoyance to) the travelling public, shoe removal requirements and liquids inspections are, most likely, top of the list, with laptop removal a close third. Several devices to mitigate the operational impact have been undergoing trials and initial deployments over the past year.

Shoe Scanning

Techniques for scanning shoes, without necessitating their removal, have been sought and explored ever since Richard Reid hid a combination of homemade TATP and PETN-based detonating cord in his sneakers and attempted to destroy American Airlines 63 in 2001. In response, two companies, GE Security and QR Sciences developed prototypes that used a radio-frequency technique called Quadrupole Resonance (QR), that was under development at the time for plastic landmine detection. After a series of initial TSA trials, the TSA determined that QR's performance was too limited to warrant broad deployment, even though the systems should be able to find one of the constituents used by Reid in small quantities.

The GE system has seen limited deployment as part of the CLEAR Preferred Passenger screening programme approved by the TSA, but is not used at the TSA checkpoint itself. The cost of QR is fairly high due to the need to compensate for radio interference.

GE's Shoe Scanner

"….the TSA determined that QR's performance was too limited to warrant broad deployment…"

Other companies, including CEIA and IDO Security have adapted metal detection techniques for shoe scanning, though such techniques would not have found the Richard Reid device, which was carefully designed to avoid any metallic objects that might otherwise trigger metal detectors. L3 Communications has developed a trace-based shoe scanner, currently under TSA evaluation, that has a potentially lower price tag and finds a broader set of materials than QR. But, trace is likely to have material sampling challenges that have been well established in other applications, especially where no direct contact is made with the IED exterior.

TSA continues to evaluate several different shoe scanners but has yet to reach a conclusion on their effectiveness or desirability. Until regulators provide a clearer indication of interest, other companies with potentially applicable technologies are waiting on the sidelines, even though airports urgently need a solution.

Liquids Scanning

Europe is part-way through a thorough assessment of various liquids scanning technologies, aimed at eliminating the so-called 311 rule, which has been so restrictive on – and unpopular with – passengers since the foiled August 2006 attempts to destroy multiple aircraft departing from the UK. Led by the Britain, the focus is to assess alternatives and lift the liquids ban by mid-2010, though most likely passengers will still need to divest liquids to a separate bag or tray rather than allowing bottles to remain in their original bags. To evaluate the technologies, the regulators have grouped the various systems into four categories in order of operational desirability:

Category A – open bottle inspection, which will be used as a baseline only

Category B – single bottle inspection, loosened lid – aimed at trace technology

Category C – multiple closed bottles, either organised and distributed in trays to avoid overlap or randomly loaded without regard to configuration or overlap

Category D – bottles randomly located inside the bag (i.e. as it was prior to the 311 regulations)

Currently, technical teams under the auspices of ECAC (European Civil Aviation Conference) are trialling several technologies in each category to understand likely false alarm and detection rates. Based on these initial results, the European regulators will define detection standards for evaluating systems in subsequent qualification tests and will use operational data combined

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with discrete event modelling (software that simulates checkpoint operations) to assess and refine alternate concepts of operations (CONOPS) for primary and secondary search of liquids. A series of airport trials will assess both the checkpoint simulations and the CONOPS and the regulators will use the qualification process to formally evaluate these and other systems. Most likely, the regulators will offer airports different options and incentives for each category of system deployed, recognising that any Category D systems are likely to be the most costly.

Medical Cast/ Bandage Inspection

TSA funded the development and recently deployed 35 CastScope systems at various airports as part of a limited deployment to counter a current security loophole that has not yet been exploited by terrorists; the potential for terrorists to smuggle concealed weapons inside medical casts, bandages and prosthetic limbs. This novel application of X-ray backscatter technology was strongly supported by several US veterans and disability groups who objected to the impact of current, highly invasive methods of screening that subjected disadvantaged passengers to additional humiliation at the checkpoint while offering minimal security value. CastScope offers a method for detecting a large – though by no means all – range of threats. Though also trialled in the UK, the US is the only country that has started deploying the systems to date.

Enhancing X-Ray Detection

This past year saw a change in how regulators in Europe and the US viewed the ongoing development of inspection algorithms. Historically, detection standards (such as the TSA's Certification Standards for hold baggage) have aimed at a broad spectrum of explosives and concealment methods. Regulators have since realised that attempting to use software algorithms in such a broad manner generates too high a false alarm rate, which becomes a burden on X-ray operators and passengers, especially at the checkpoint. The new approach put forward by several governments is to challenge equipment manufacturers to fine-tune their algorithms by detecting only what they do best and driving the nuisance alarm rate down. The goal is to achieve excellent automatic detection in a few areas and use human operators to inspect the balance of threats, ideally simplifying the ever more difficult job that the operators are currently being asked to do. There are three key areas that companies are currently exploring.

Liquids Inspection

The first, and likely most mature, is liquid inspection enhancements to X-ray. A system called the OptoScreener uses software algorithms and hardware add-ons to transform conventional X-ray systems into measuring instruments capable of liquids inspection. By carefully calibrating the X-ray signal and only looking at liquid containers in trays without

"…several airports, especially in the UK, are investigating and using tray return devices and even automatic diverters for rejected bags…"

other clutter, the system performs a 3D reconstruction of the container's X-ray image and then strips away the container to perform a more detailed density and atomic number analysis of the liquid itself. The approach is analogous to what Computed Tomography does, but in a more limited manner and with simpler and hence less expensive hardware. Such a system is targeted at the "C" Category of liquids inspection, defined by ECAC.

Laptop Inspection

A second application that is still under development is for electronics inspection. X-ray imaging works best for separating out objects of different contrast from each other, such as explosives against metal, or metallic objects against clothes, food and plastics. High false alarm rates are caused by attempts (both by software and operators) to differentiate similar materials from each other (such as explosives from certain types of food). An operational and security challenge has been the inspection of laptops and other electronics. In the US, laptops and camcorders must be removed from most briefcases and scanned separately, causing checkpoint delays, requiring more scanning time and raising the potential for loss or damage to passengers' valuable assets. If successful, new algorithms could allow close electronic scrutiny of laptops hopefully without such intensive measures.

Other Areas

Automatic inspection techniques for guns and knives are being studied in Canada to allow operators to focus on those (hopefully fewer) areas where software algorithms are less effective. This more pragmatic approach towards fusion of the best of human and machine inspection capabilities is likely to be more common in future.

Checkpoint Management and Cost Reduction Enhancements

Many manufacturers and airports are taking lessons learned from hold baggage system integration and adapting them to the checkpoint. Divesting and separation of an ever-increasing number of items from passengers and their bags, along with the increased use of trays places additional burdens on security operators, and causes more confusion for passengers. Several airports, especially in the UK, are investigating and using tray return devices and even automatic diverters for rejected bags. Several X-ray vendors offer baggage handling and tray return systems that work with their own products, such as Smiths' iLane and Analogic's COBRA while other airports (for example Manchester Airport) have sub-contracted baggage system integrator companies to develop their own.

These systems are in the early stages of deployment in Europe but are of lower priority in the US, according to a TSA source. In the UK, passenger confusion was significant at a checkpoint I visited a couple of months back, but as the systems become more robust and passengers become more familiar with them, it's likely that operations will improve and could result in a significant reduction in non-inspection manpower (and associated cost) at the checkpoint.

Systems Integration

Communications technologies that have been used in the computer industry for over 20 years have yet to be applied to the security checkpoint. Today's checkpoint screening method can be compared to early 20th Century manufacturing: each inspection step is completed with little knowledge from the prior step or data transfer to the next step in the security process. While companies like Smiths, L3 and Rapiscan offer Remote Display Stations (RDS) that take a first step towards sending information gathered during X-ray screening to the secondary search location, much more can – and should

CastScope's system uses X-ray backscatter technology to scan medical casts, bandages an prosthetic limbs

– be done to integrate and improve the checkpoint process.

Typically, RDS are manufacturer-specific: a Smiths RDS will only work behind Smiths' devices and the same is true for Rapiscan and L3.

One company has a system that is manufacturer-neutral, which is important as no single company provides all of the best bag and passenger screening technologies. The device, called SecuriFlo, combines off-the-shelf components with its own proprietary

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hardware and software to acquire, display and store the primary and secondary search information as well as passenger and bag details. The system handles the RDS function, but also collects, collates and stores bag and passenger photos to allow better coordination of the various key aspects of the checkpoint screening process. X-ray operators categorise the location and types of threat on-screen, allowing operators to be remotely located yet still communicate electronically with secondary search staff. Secondary search images, video and suspicious object categorisation are stored for each passenger, potentially enhancing the security process as well as being useful for auditing and training. The open communications architecture permits boarding pass scanner data, other passenger information (e.g. government issued ID) and new technologies to be added in future.

Applying integration and communications technology should allow airports to improve their customer experience and reduce operator costs (by multiplexing operators and systems). Remotely locating operators will allow more screening lanes in a given area; saving on build costs while fewer distractions will improve the work environment and likely result in improved operator detection performance.

The Future

Improving Secondary Search

In the ongoing effort to deploy better technology for primary search, a key area that needs to be considered is how to handle greater rejection rates from primary to secondary search. For hold baggage, a 15-20% automatic false alarm rate is considered good, especially for international flights. At the checkpoint, many of the same technologies need to find smaller quantities of more diverse threats and configurations in bags and on passengers, so the rejection rate is likely to be significantly higher.

Today in the US, after separating out computers, electronics, liquids, shoes and coats, the average person ends up with four, five or even more separate items for inspection; if a 25% or more nuisance alarm rate is likely, then on average, each traveller will have one item rejected, so basically everyone will end up at secondary search. Unless the industry improves or devotes more valuable resources to time-consuming secondary search or compromises on detection, resolving rejected passengers and bags will become the bottleneck, require more checkpoint space and become a greater customer-relations problem. Hence, secondary search improvements are urgently needed, requiring new technologies and improved processes.

Feeding forward data collected at primary search will improve secondary search efficiency and reengineering systems that for various reasons are ill-suited to primary search may help secondary search. For example, Russia has used a Thermal Neutron Activation device made by RATEC Ltd. to resolve rejected bags. Also QR may prove useful for rapidly screening suitcase linings and certain whole body imaging and trace systems may resolve rejected passengers. Good process simulation models can help identify and prioritise the best solutions.

Addressing Team-Based Threats

Improved data and checkpoint integration will present opportunities for improving passenger flow and information usage. To improve security, we need to evolve away from today's bag-by-bag or passenger-by-passenger inspection process towards a system that can counter team-based attacks, where various threat components are distributed across multiple passengers (and/or their bags) and assembled on-board the plane. Today's checkpoint would be hard-pressed to foil such attempts.

Through a radical departure from how screening is performed today, data collection and networking tools mean that, technically at least, flight-based screening is feasible. The underlying hardware is mature enough – with large capacity storage and high-speed computer networks readily available at low cost. With passenger and inspection data stored in a database, it should be relatively straightforward to sort the checkpoint data by flight number. One or more inspectors could prioritise the passengers, inspect for suspicious items across different travellers while they are in the departure lounge. Any concerns could then be resolved at the boarding gate.

Terrorists are becoming more sophisticated in their attempts on civil aviation targets. Just adding more scanners to the checkpoint won't be sufficient. We need leadership, vision and "outside-the-box" thinking to adapt our screening methods to the 21st Century threat while improving the traveller's experience.

The author is President of Wolff Consulting Services. With 25 years experience developing and marketing advanced aviation security products, he helps technology companies with product development and worldwide marketing strategies.