SMART SECURITY

Guidance Document

Passenger Screening

3rd edition

ACI

Purpose	The purpose of this document is to provide guidance and best practice examples for stakeholders intending to introduce Smart Security initiatives in an airport environment. The guide is not intended to endorse any particular technology or provider, but rather provide details of the key considerations as well as various implementation models which could be adopted. The intended audiences for this guide may include but is not limited to: Airports, Airlines, Technology Providers, Regulatory Bodies and Security Organizations.
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Document Record

Document History			
Version	**Status**	**Date**	**Summary of Changes**
1	Final	December 2015	1st Edition
2	Final	December 2016	Includes review and comments from security scanner manufacturers. Includes additional layouts and configurations.
3	Final	December 2017	Content restructuring and updates to processing figures. Removal of Appendix E (on scanner optimization) with relevant content incorporated into Chapter 2.
4	Final	September 2019	Branding changes and minor amendments to the text to reflect ACI leadership of the Smart Security programme

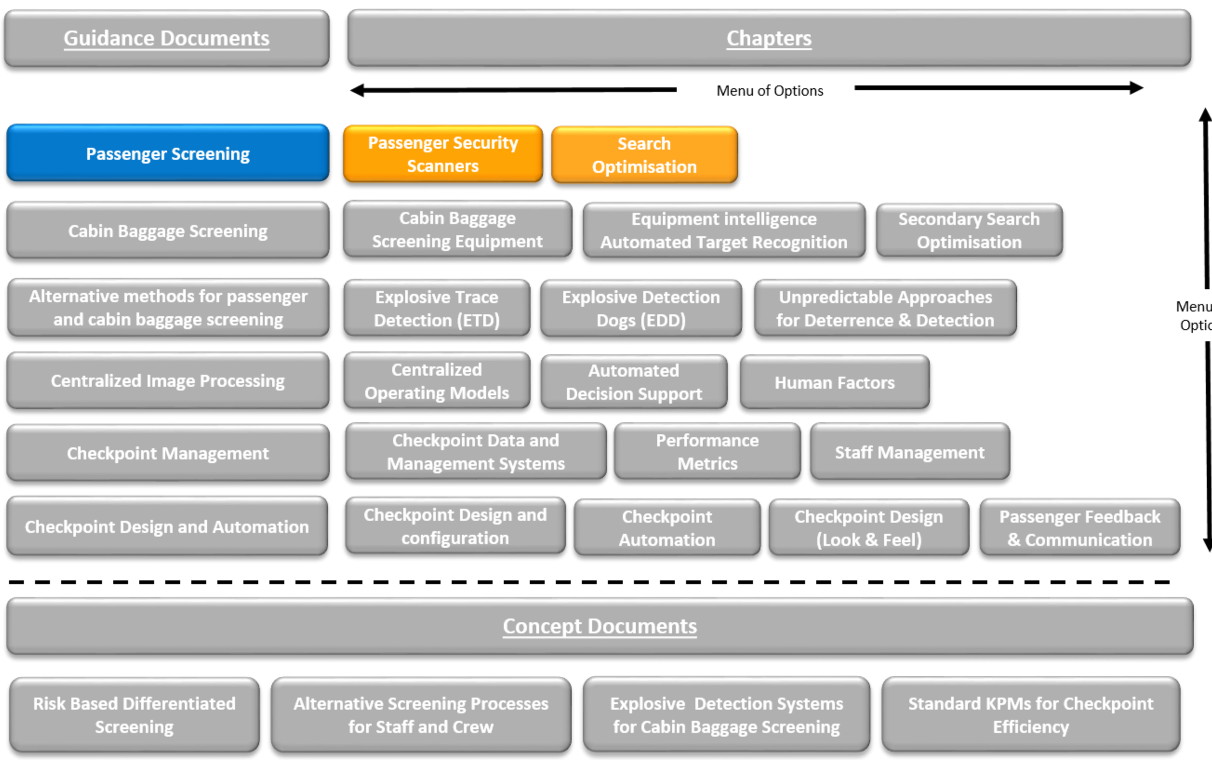
Contents

Executive Summary

This Smart Security Guidance Document for Passenger Screening contains advice and guidance on the deployment and use of passenger screening technologies, with a focus on advanced screening technologies such as passenger security scanners. It includes a summary of the benefits, operational models, as well as implementation considerations with case study examples where appropriate. However, is recognized that for many airports, walk through metal detectors (WTMDs) will continue to be a key part of the passenger screening process, therefore this document also provides considerations on how passenger security scanners and WTMDs can be used in combination to deliver security, operational and passenger experience outcomes.

This edition on passenger screening contains general information on passenger security scanners, WTMDs and methods for optimizing search procedures. As a 'living document', this information shall be constantly reviewed and updated as appropriate, with further updates exploring emerging technologies and ways to screen passengers without them having to remove shoes and belts.

This document is one of a number of Smart Security Guidance Document publications, which will become available to assist operators, regulatory authorities and key stakeholders.



Alternative technologies and approaches for passenger screening, such as the use of Explosive Trace Detection (ETD), are included in the "*Alternative Methods for Passenger and Cabin Baggage Screening*" Guidance Document.

Further information on these Guidance and Concept Document publications are available from the Smart Security team at smartsecurity@aci.aero.

Contributions

Through provision of trial reports and/or knowledge transfer sessions[1], the following organizations have kindly contributed to content development of this guidance document:

- Amsterdam Airport Schiphol
- The Canadian Air Transport Security Authority (CATSA)
- Department for Transport (DfT) – United Kingdom
- KLM Royal Dutch Airlines
- Gatwick Airport
- Heathrow Airport
- Melbourne Airport
- The National Coordinator for Security and Counterterrorism (NCTV) - Netherlands
- Qantas

ACI would also like to thank the following for their review of this guidance material publication. Not that such review does not per se imply the endorsement of individual or organizations listed.

- Smart Security Management Group (SSMG)
- ACI regional organizations and representatives
- Rohde & Schwarz
- Smiths Detection

[1] Knowledge Transfer Session is a broad term and may include sharing of: trial reports; operational feedback; business drivers; key lessons and may have been conducted on a formal or informal basis.

Chapter 1

Passenger

Security Scanners

1. Passenger Security Scanners

As the risk landscape has evolved over the last two decades, so has the aviation security community's focus on non-metallic threats and effective mitigation measures. In recent years and accelerated by the December 2009 "underwear" bomber plot[2], governments and industry stakeholders have partnered to drive the development and deployment of technologies to improve the passenger screening process.

Unlike traditional Walk Through Metal Detectors (WTMDs) which are threat specific (metallic), security scanners focus on detection of anomalies making them a threat neutral technology, more adaptable to evolving threats. As the detection technology and operational viability improves, adoption is expanding with many states now mandating use of modern security scanners as a key element of the passenger screening process.

1.1 Background

Trials and evaluations of passenger security scanners, including of millimeter wave and x-ray backscatter technologies commenced in the early 2000s. In 2001 the United Kingdom's Department for Transport commissioned a series of studies at Gatwick Airport to evaluate the use of passenger security scanners and in particular, the impact on passenger perception and the consequences of changing the existing 'pat down' process to one of body scanning. Beginning in 2006, Amsterdam Airport Schiphol and the Dutch National Coordinator for Security and Counterterrorism (NCTV) commenced their own trials and deployment of passenger security scanners. The United States Transportation Security Administration (TSA) followed shortly thereafter in 2007.

Initial roll-out of the technology was slow due to both health and privacy concerns. In particular there was public concern over the presentation of raw images, highlighting the need for national authorities to conduct thorough research, analysis, and operational refinement to properly address these concerns. The development of advanced detection algorithms that produce the result of the scan on an anonymized stick figure (refer illustration in Figure 1) went a long way in addressing privacy concerns. However, it was only after the 2009 "underwear" bomber incident that operational use of the technology really took off, supporting manufacturers' efforts to further enhance operational performance and hone detection algorithms a key element of the passenger screening process.

2 Reference to Umar Farouk Abdulmutallab on Flight Northwest 253

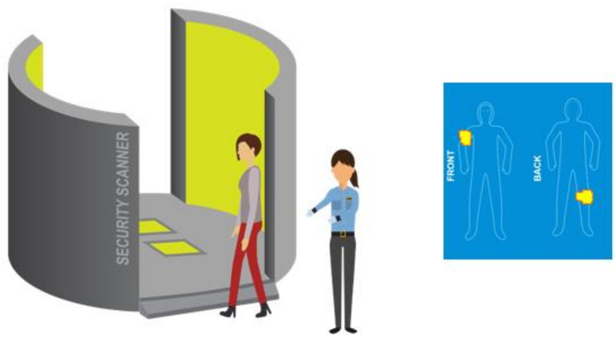


Figure 1 – Illustrative example of security scanner and anonymized stick figure image from a security

1.2 Passenger security scanners today

Currently, there are over 1000 passenger security scanners deployed at checkpoints across a range of states including but not limited to the United States of America, Canada, United Kingdom, the Netherlands, Italy, Australia, Denmark and Hungary. Many others are also considering the introduction of security scanners in an effort to support improved detection of explosive and other non-metallic threats at their airports.

Although initial deployment models included the passenger security scanner as a secondary screening technology in combination with the WTMD, increasingly airports are using the technology in the primary screening position. Alongside changes in the regulatory environment, this adjustment in deployment approach has been made possible through technology and process enhancements that have increased the throughput capacity of the equipment. Some airports have achieved processing rates upwards of 350 passengers per hour via a single machine. Space constrained airports are now also able to benefit from the technology, due to equipment with a smaller footprint coming to market.

Despite these improvements however, some remain concerned that security scanners are more expensive than WTMDs (and are therefore a less accessible solution for the wider airport community) and that their implementation can have a negative impact on operations. Whilst to an extent this may be true, lower throughputs and higher cost, may be offset by a number of factors including, reduction in additional measures, which may be reduced or eliminated due to the introduction of security scanners; and possible cost avoidance, with security scanners potentially reducing the need to purchase additional equipment to deal with specific threats.

In the longer term, advancements in technology are expected to further reduce processing times, improve reliability of automated decision support tools as well as potentially delivering truly walk through solutions.

1.3 Benefits

1.3.1 Security Effectiveness

Detection

As the regulatory community places increasing focuses on detection of non-metallic threats, the utility of the WTMD is being reconsidered. Moreover, many prohibited items that were traditionally composed of metal (such as knives) are now often made from ceramics or a combination of metal and plastics, meaning WTMDs may no longer be able to detect them in all cases.

Given that the passenger security scanner identifies anomalies, rather than specific threats, it provides better alignment between the current threat environment and mitigation measures. Moreover, anomaly detection is more adaptable to future threats.

Unpredictability and Deterrence

When used in combination with existing screening equipment, passenger security scanners bring a new element of unpredictability to the checkpoint. While potential infiltrators of the security system can be certain that non-metallic objects on the body will go undetected by the WTMD, this is not the case with the passenger security scanner. Therefore, many stakeholders are convinced by the deterrence value of adding security scanners to the passenger screening processes.

Even when deployed on a limited basis, for example in a secondary position on a few lanes, with passengers unable to influence their selection, overall checkpoint unpredictability is increased. In this regard, a number of regulatory authorities are currently assessing the best configuration for detection performance and deterrence. Whilst the results of these studies may be country specific, lessons will likely be learned that will support others in determining the most suitable deployment model for their specific regulatory environments.

Risk Based Screening

Moreover, where permitted by regulators, passenger security scanners may be able to support the implementation of differentiated screening (whereby not all passengers are screened in the same way). Initially, airports could use lanes equipped with security scanners to screen higher risk passengers or selectees. In the longer term, aided by other technological advancements in identity management, the dynamic adjustment capabilities of the equipment could be used to automatically adjust the sensitivity of the scanner in real time depending on the passenger. Application of differentiated screening has the potential to focus security resources more directly on those passengers requiring greater attention, but further studies and trials are required to achieve fully compliant implementation of such approaches.

1.3.2 Adoption

Throughput

Processing capabilities of passenger security scanners have increased considerably since initial deployments as a result of improved automated detection algorithms, process queuing (see section 1.5.1), and the familiarization among security officers and passengers with the technology. First generation security scanners have been able to achieve throughputs in the range of 120 to 240 [3] passengers per hour. Newer equipment has the potential to achieve sustainable throughputs of more than 350 passengers per hour. Airports should note however, that the ability to achieve these levels of throughput will be dependent on the flow through the rest of the checkpoint, thus alignment of passenger and baggage cycles will be critical to an efficient checkpoint.

In the longer term, CONOPS and regulatory changes that permit the use of zonal alarms or dynamic sensitivity adjustment could further support operational efficiency, potentially reducing the number of alarms and facilitating a faster process.

Officer observation & passenger search

Because the results of a WTMD scan are not displayed on screen, but rather are shown as zonal alarms via a lighting notification on the machine itself, security officers must pay particular attention to each passenger and to the region of alarm. This can be difficult to manage in a high throughput environment. Airports tend to deal with this in one of two ways:

1. Allocating additional resources to search tasks – increasing cost and/or diverting staff from other activities; or
2. Operating with a CONOPS that sees flow through the WTMD stopped every time a search is required, so officers do not lose track of who needs to be searched and where – resulting in significantly lower throughputs.

With a passenger security scanner operating automated detection algorithms, the search area is highlighted on a screen, allowing the officer to focus on the search rather than trying to remember the target area. In addition, this specificity of alarm notification provides opportunities for more targeted searches, which take less time to complete.

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[3] Based on inputs from various airports currently using scanners. They believe throughputs could be higher, but are currently impacted by the flow from the rest of the lane.

Use of security scanners also allow passengers to be “stacked” and queued more easily without the officer having to remember the location of the alarm for each individual passenger as the scan result indicating the alarm can be called up on the resolution station and analyzed. This ability makes newer passenger security scanners much more attractive to airports as it allows more flexibility in staffing model and layout.

1.3.3 Benefits

Passenger perceptions

Airports are finding enhanced customer satisfaction scores with the deployment of millimeter wave passenger security scanners, largely attributed to the fact that the technology significantly reduces the need for intrusive full body hand searches by allowing a faster and more targeted search of anomalies detected by the machine. Positive feedback in these airports has been made possible by deployment configurations that support acceptable throughput levels. Also, because of the more interactive nature of alarm resolution for security scanners, passengers are more involved in the process and have often identified the cause of the alarm before the screener.

Of note, one Smart Security partner airport has seen passengers with certain religious backgrounds specifically look for security lanes with passenger security scanners to reduce the chances of being subjected to a full body hand search, indicating a preference for the technology at that airport.

Whilst the above is positive, many passengers still have questions about the technology; security officers need to be prepared to answer these. Security officer training and appropriate passenger information support are useful in aiding this process.

Security officer perceptions

- **Security**: During initial implementation of passenger security scanners, airports have reported that security officers may often be reluctant to abandon full body searches in lieu of a targeted search. Over time, however, the security officers grow accustomed to the refined practice and become more confident in the process. Ensuring officers are appropriately briefed on the technology and its capabilities goes a long way to helping acceptance and the move to performing targeted searches.
- **Experience**: Implementation of passenger security scanners has the potential to lead to a reduction in the physical demands of security officers where targeted searches are permitted. It may also reduce the number of times a security officer needs to bend, stretch, and twist during the course of a shift (particularly in terms of having to excessively bend over when conducting a full body hand search). This is expected to lead to a healthier and safer working environment and an associated reduction in sickness and injury related

costs. In the majority of airports with passenger security scanners in operation, and with whom the Smart Security team have engaged, security officers' satisfaction levels have been positive due to the reasons mentioned above.

1.4 Operating Models

There tends to be three typical passenger security scanner deployment models:

- Passenger security scanner as Secondary
- Passenger security scanner in combination with WTMD as Primary
- Passenger security scanner as Primary (standalone)

Within these models, the number of machines per lane, operational procedures and resourcing will differ depending on the local threat environment, regulatory requirements, business drivers and operational constraints of the airport. These elements will be discussed in more details later in this document. Airports should deploy the passenger security scanner in a manner that most appropriately aligns with both the operational environment and budgetary constraints, in close discussion with their regulators.

As an example, a large international airport may choose to deploy passenger security scanners across its entire checkpoint to screen all passengers while other airports may choose to invest in the technology to handle only a percentage of total passengers in a random or targeted manner.

Initially, passenger security scanners were deployed as a secondary search technology as demonstrated in the diagram below.

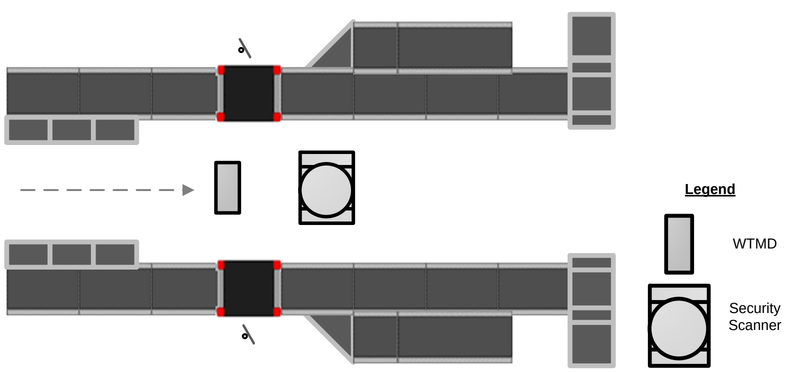

Figure 2 – Security scanner deployed as a secondary measure

More recently however, many airports have opted to deploy the technology in the primary screening position in combination with the WTMD, or as a stand-alone technology with the WTMD completely removed from the process. To implement primary screening using security scanners only, airports should discuss with their regulators as this configuration may require specific local regulatory approval.

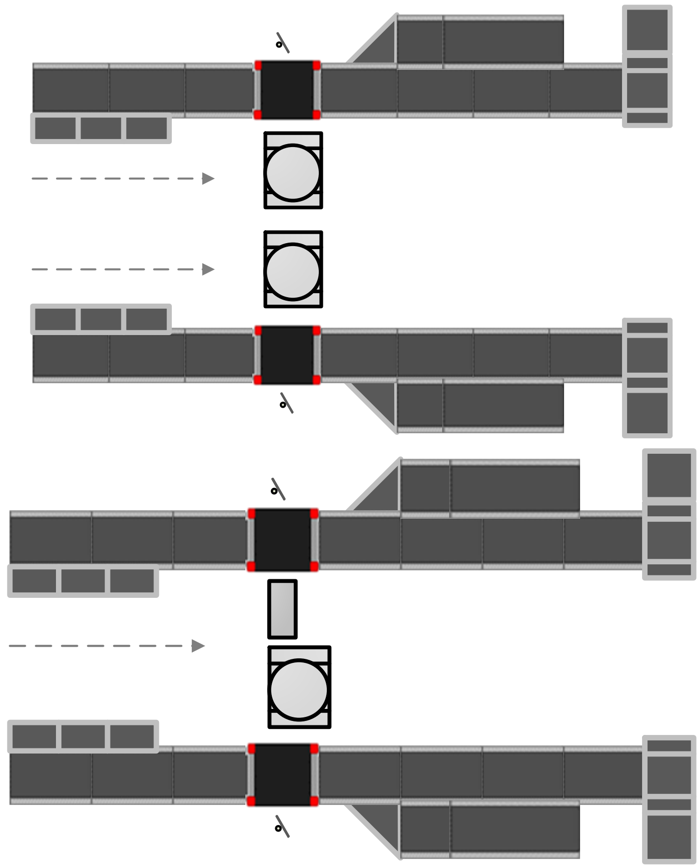

Figure 3 – Security scanners deployed as a primary measure and as primary combined with WTMD

These three models (Primary, Secondary, and Primary with WTMD) and their specific operational, security and passenger experience considerations are discussed in Appendices A through C. The following sections contain considerations applicable to all deployment models.

1.5 Equipment Considerations

General equipment considerations are discussed below and an equipment quick reference guide can be found in Appendix D.

1.5.1 System Requirements

Technology

Airports considering the deployment of passenger security scanners will need to evaluate, in the first instance, the type of technology they wish to acquire. Two primary types of passenger security scanners have emerged for the security market: millimeter wave technology using electromagnetic radiation and backscatter x-ray using advanced x-ray imaging. However, in the aviation environment, the millimeter wave technology is the one used in most instances for two main reasons:

1. Perceived health concerns: unlike backscatter, millimeter wave technology uses non-ionizing radiation; and
2. Privacy: it can produce anonymized stick figures thanks to the advanced detection algorithm (ATR) available on these machines. To date, backscatter x-ray equipment does not support this functionality.

Airports should consult with the relevant regulators and authorities, as in some countries the use of non-ionizing radiation and ATR is mandatory.

Automated Decision Support

The introduction of automated detection algorithms (such as ATR) on passenger security scanners using millimeter wave technology has allowed the system to automatically detect anomalies and highlight them on an anonymized stick figure, without the need for operators to inspect raw images of passengers.

Security officers still have to conduct a hand search to investigate an alarm. However, as they are often permitted to conduct a targeted search, based on the areas highlighted by the algorithm, the targeted hand search should reduce the search time and improve security by focusing the officer's effort.

Airports should ensure that any equipment they purchase contains ATR functionality and can be upgraded with additional/revised algorithms in the future.

Algorithm selection

In most instances, governments have required automated detection algorithms on passenger security scanners. Depending on the type of technology acquired, airports and responsible authorities are challenged to identify a detection algorithm most appropriate to their operational environment, effectively balancing detection sensitivity and related un-necessary alarm rates against passenger throughput. Airports should find out whether their regulator requires use of a specific algorithm or if they are free to choose from a list of approved algorithms.

Scan Results Queuing

Many airports are looking closely at reducing downtime between passengers when using security scanners. Most security scanners today offer some form of queuing within their system which enables simultaneous processing of scan results. When using a queue of results, a passenger is scanned and then moves out of the machine to await the result and any alarm resolution required. While the machine is working to resolve the scan, a second passenger can enter the machine and a new scan process can commence.

This functionality of multiple steps performed as a queue helps to reduce downtime between passengers, allowing airports to better utilize their asset. It is important for an airport to minimize downtime between passengers, as the equipment's current alarm rates are overall still relatively high. Airports should discuss these options with manufacturers during product procurement to ensure that the passenger security scanner and the algorithms utilized encompass a queuing functionality.

1.5.2 Alarm Resolution stations

Passenger security scanners today come with a variety of options for the location of screens for alarm resolution. Whilst only one screen is required for basic functionality, in order to reach higher throughputs and maximize the technical capability of the machine in allowing simultaneous processing of multiple passengers' scan results, a minimum of one alarm resolution screen and one screen to initiate the scan is needed. Preferably, both of these screens would be configured for alarm resolution use.

Airports can choose to have the resolution screen attached to the machine, or located away from the machine at a dedicated resolution station. Where airports are required to utilize additional equipment during alarm resolution, such as shoe scanners and ETD, the latter may be a better option with the resolution screen co-located with other screening equipment.

In addition, different functionalities on the alarm resolution station may be available and possible to choose from. As an example, automated notifications on the resolution screen can be set up to notify the security officer when they need to perform a full hand search (i.e. if the number of alarms allowed by the regulatory authority for performing targeted search has been reached and a full hand search is required). This can help security officers monitor, without having to constantly count, whether the number of alarms have exceeded the threshold to perform a full pat down.

1.5.3 Achievable Throughputs

Manufacturers should be able to advise airports on the system capacity of their security scanners. However, it is rare that airports achieve maximum system throughputs in live operations. As noted previously, early generation scanners are able to achieve sustainable throughputs up to around

240 passengers per hour, with newer equipment achieving more than 350. However, ability to achieve these throughputs is heavily dependent on things such as:

- CONOPS;
- Number of staff allocated to alarm resolution;
- Alignment of cycles within the checkpoint (e.g. with baggage systems);
- Passenger demographics, language and familiarity with the equipment; and
- Time of the year (vacation periods, winter etc.).

1.5.4 Integration with other passenger screening equipment

With some newer systems there are opportunities to combine scan results with those of the WTMD. For example, where the scanner and WTMD are co-located, one after the other, the results from both machines may be aggregated and presented to the search officer on a single screen. This may be a useful functionality in states where regulators require the use of both the WTMD and security scanner for the majority of passengers.

1.5.5 Maintenance

Airports acquiring passenger security scanners will need to plan for maintenance periods (possibly routine and thorough maintenance when this applies) as well as any calibration that may be required to ensure the equipment's reliability and safety. The required maintenance and calibration will need to be factored in the operations and monitored closely. In addition, airports should be aware that regulatory bodies may impose requirements for equipment testing and calibration that go above and beyond what is detailed by the manufacturer.

1.5.6 Testing

Apart from the passenger security scanner itself, airports considering purchasing passenger security scanners will also need to consider creating or acquiring test items (complementary to security scanners) and the additional costs involved that can be run through the machine to analyze detection effectiveness, within the framework of an agreed methodology with the manufacturer, airport and regulatory authority. Dedicated test pieces may be mandated by regulators, or airports may be free to use test pieces provided by manufacturers. Airports should ensure they understand the requirements ahead of purchase.

1.5.7 Cost

Airports should ensure they factor in all elements related to cost when procuring security scanners. This includes the outright cost, as well as any CAPEX (due to infrastructure changes) and ongoing OPEX (such as additional staff).

Where given flexibility in deployment option by regulatory authorities, airports are encouraged to conduct trials prior to deployment, to ascertain the best short- and long-term plan for rolling out the technology in the context of their unique operation.

1.5.8 Size and design

A number of manufacturers now have security scanners on the market offering airports an increasing amount of choice in selecting a scanner that best suits their operations. Whilst these machines all seek to do the same thing and are tested against the same standards, they come in a variety of shapes, have varied spatial footprints and operate with different CONOPs and processing capabilities.

Importantly, airports should consider the demographic of their passengers when making this choice. Some machines require passengers to turn around, while others require passengers to lift their hands above their heads. Some cultural or social factors may mean passengers are less willing to do this. In addition, where airports are challenged to communicate with passengers of diverse backgrounds and varying languages, the simplest solution may be the best.

These latest generation machines are smaller and lighter than their predecessors, however they still take up more space than a traditional WTMD and airports required to screen a large portion of passengers via security scanner are likely to need more than one machine per pair of lanes in order to limit the impact on their operations.

For more information on checkpoint configuration and design, please refer to the Guidance Document on Checkpoint Design and Automation.

1.5.9 Data Capture & Reporting

Airports should assess how passenger security scanners can be networked with existing equipment. In order to avoid manual collection of operational data, airports are advised to work with manufacturers early on to ensure that required data (i.e. throughput and alarm ratios) can be automatically collected from the system and centrally collated. It should be noted that references to data in this context do not include the storage of passenger images.

For more information on checkpoint data and management systems, please refer to the Guidance Document on Checkpoint Management.

1.5.10 Electrical/Power Requirements

Passenger security scanners may require more power than traditional WTMDs. Airports should ensure that sufficient power outlets and back-up power outlets are provided at the checkpoint. Depending on the layout an airport wishes to utilize, this may require movement of existing power outlets, which should be factored into planning.

1.5.11 Environment

Passenger security scanners may require a rather controlled operating environment when deployed, to ensure optimal operation. When deploying passenger security scanners, airports will need to take into consideration the Heating, Ventilating and Air Conditioning (HVAC) system, temperature, humidity and excessive electromagnetic interference to ensure best operational environment.

1.6 Regulatory Considerations

Given legacy health, and privacy concerns associated with use of the passenger security scanner in the passenger screening process and evolving regulatory requirements, regulatory approval is an important component of an effective deployment. Airports should consider discussing the following topics with the appropriate authorities prior to passenger security scanner implementation:

1.6.1 Deploying as a standalone primary measure

To date, most airports have implemented passenger security scanners in combination with traditional WTMDs in order to provide a wider security capability. However, moving forward, some airports may wish to deploy passenger security scanners as the sole primary screening measure. This will need to be authorized by the appropriate regulatory authority and where necessary alternative screening procedures (e.g. full pat down, or full pat down plus ETD on passenger, etc.) put in place to cater for opt-out situations.

1.6.2 Scanner screening rates

At present airports have significant flexibility in how they deploy security scanners. However, as threats evolve, regulatory bodies may increasingly mandate how scanners are deployed. Airports should therefore make sure they understand:

- if a percentage screening rate will be mandated,
- whether a security scanner must be accessible to all lanes (or pair of lanes);
- whether any percentage-based requirement will be measured by lane or by concourse; and
- whether any timing requirements will be mandated for measurement (e.g. percentage per hour, per day).

Depending on the answers to the above questions, airports may need to think about their checkpoint design and possibly configure their random alarms in order to achieve mandated percentage-based requirements.

1.6.3 Selection

If the passenger security scanner is not used as a primary measure for 100 percent of all passengers, then consideration needs to be made for how passengers are selected for the scanner. Several selection mechanisms exist, such as automated random based selection or officer-based selection, which in turn can be random or random and continuous.

While designing the selection process, an airport should ensure that the queuing, selection mechanism and processes are designed such that passengers do not have the opportunity to self-select their lanes. These decisions will have an impact on the overall percentage of passengers screened and the robustness of the process.

1.6.4 Decision support algorithms

As noted previously, airports are encouraged to work closely with regulatory authorities in selecting appropriate decision support algorithms that effectively balance detection and throughput. At present, there are a variety of algorithms certified for use with passenger security scanners. Airports will need to understand which of these algorithms can be used and how. Airports should note, that some states mandate or have preferred algorithms, whilst others allow airports to choose from a list that have passed testing.

1.6.5 Resolution Protocols for Genuine Alarms

Operators and regulators are continuously working with manufacturers to refine detection algorithms. However, the number of un-necessary alarms[4] leading to a secondary search remains quite high. As a large number of lengthy alarm resolution processes can negatively impact operations, airports are encouraged to consult with national regulatory authorities regarding:

- use of zonal alarms and targeted search resolution methodology;
- the number of zonal alarms that can be triggered before a full search is required (as opposed to targeted);
- any additional screening equipment that must be used as part of alarm resolution (e.g. ETD); and
- the point at which supervisors and law enforcement should be engaged.

1.6.6 Alternative Procedures

Passengers with reduced mobility, or with certain medical conditions, may wish to opt out of screening via the passenger security scanner, or may be physically unable to undergo a security

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[4] An un-necessary alarm is a term used throughout this document to refer to an alarm that should be avoided. Detection sensitivity of the equipment currently correctly detects ‘anomalies’ but these are not anomalies that pose a potential security threat (E.g. wrinkles on clothes that alarm would be an un-necessary alarm)

scan. Airports will need to discuss with their regulators the workaround, together with any special procedures they will need to put in place to facilitate this. It is likely that in these cases, the regulatory authorities will require an additional explosive detection measure to be applied to these passengers to eliminate predictable gaps created in the system and to ensure that security effectiveness is maintained.

Airports should also discuss with regulators whether passengers can opt in with regards to security scanners.

1.6.7 Random alarm requirements

Given the non-metallic threat detection capabilities of security scanners, airports should discuss with regulars the possibility of reducing (or removing) random requirements for additional and invasive hand searches on passengers. Any decision to remove or reduce these requirements will likely depend on the deployment option implemented by the airport.

However, at this stage the introduction of security scanners is unlikely to impact other random requirements related to explosive detection such as ETD, EDD or shoe screening.

1.6.8 Scan Results Storage

Current scan results from automated decision algorithms do not allow for visual identification of a passenger. Nor are there any tags or similar which would link the result to a passenger's boarding card or digital identity. If regulators or airports require the ability to link a passenger to the scan results, the results would need to be coupled with a complementary identity management system.

Additionally, as with x-ray baggage screening, it is possible that airports and other stakeholders, such as the police, will seek some sort of storage capability in order to better follow up after any incidents. Given privacy concerns, airports will need to discuss with regulatory authorities any requirements around storage and even possible transmission of the meta-data[5] of scan results, in terms of both data protection policies and in system security and integrity. It should be noted that the equipment is not enabled, nor is it allowed by most states, to store the raw image of the passenger.

1.6.9 Training Requirements

Airports are encouraged to discuss training requirements with regulatory authorities, focusing in particular on how training will address situations where potential threats are found on a passenger.

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[5] Meta-data is information about data, i.e. the processed information detailing the suspicious areas in an anonymized stick figure is the meta-data from the scanner's original data, the raw image of the passenger.

Where targeted search is permitted, airports should understand if and how regulators will require officers to maintain proficiency in full body search. In some cases, a drop-in performance of full body search has been noted following the introduction of target search procedures and is something airports will need to carefully monitor and include in any regular staff competency testing.

1.6.10 Health & Safety

Airports are encouraged to work with authorities to ensure that passenger security scanner technology, and its installation, meet health and safety requirements.

1.7 Infrastructure and Logistics

Airports should give thought to the following logistical and operational considerations prior to passenger security scanner deployment:

1.7.1 Lane configurations

Airports should consider some key variables (many of which were identified in the previous section) when determining staffing and lane configurations:

- Model: Whether scanners will be a primary or secondary device and whether it will operate in combination with a WTMD or other lane technologies and processes. In designing their checkpoint model, airports should plan, where possible, so that the greatest number of passengers are subjected to screening by the most advanced equipment.
- Selection: Percentage of passengers (if not 100% of them) that need to be screened via a passenger security scanner. And where passenger security scanners are not the sole primary measure, airports will need to consider, in consultation with regulatory authorities, whether selection is manual (officer based) or automatic (technology based) and whether it occurs in the lane, or upstream (where for example dedicated lanes are used).
- Throughput: Anticipated, required or desired throughput.
- Equipment: Whether there will be one scanner per lane or pair of lanes, or whether some lanes in the checkpoint will operate without scanners. As noted above, this may be dictated by regulatory bodies.
- Space and layout: How equipment will be laid out and the space between the lanes is important. This is discussed in more detail later under section 1.7.4

A number of additional operational considerations are discussed below.

1.7.2 Resourcing levels

Resourcing levels will largely depend on the operating model deployed and the throughputs an airport is aiming to achieve. As such, the airport will decide whether security officer numbers can be maintained or need to increase/decrease.

Airports that have implemented passenger security scanners have tested a variety of staffing models and some have been able to introduce passenger security scanners into the screening process as a secondary measure with a two or three officer model. However, for airports implementing security scanners as a primary measure, or whose regulator mandates a significant number of passengers be screened by security scanner, it is expected that staffing levels will increase, particularly if airports wish to maintain or increase throughputs.

These staffing models, and associated layout considerations are detailed in Appendices A through C.

1.7.3 Utilization

As passenger security scanners have either two entrances or an open area to enter, they provide significant flexibility in lane and staffing configuration. For example, for space or staff constrained airports, it is possible to enter and exit from the same point with no impact to how the machine operates. However, airports should discuss these arrangements with the manufacturer when purchasing equipment to ensure that the resolution screens can be located as necessary.

Alternatively, depending on where security officers are located, resolution of alarms could occur at either end/side of the scanner, perhaps avoiding male and female officers from having to switch positions to accommodate same gender searches.

This is further discussed further in the appendices.

1.7.4 Space

Although the size of the passenger security scanner equipment and the necessity to maintain wheelchair access through the checkpoint are important considerations in determining space requirements, it is not the only consideration. The need for space is also largely impacted by the number of search officers an airport wishes to deploy (regardless of whether a WTMD or passenger security scanner is used) and in the specific case of passenger security scanners, whether resolution screens are located directly next to the machine, or slightly removed at dedicated resolution stations.

Airports operating conventional sized lanes (with generally 4m or less between lanes) have experimented with up to four search officers, finding that the fourth officer is most often used for passenger control activities given there is insufficient room for him/her to conduct search activities. Space requirements are discussed in greater detail in Appendices A-C.

In addition, space is required to allow access for maintenance and consideration should be given to evacuation routes in the even there is a need to quickly remove passengers and staff from the checkpoint.

1.7.5 Passenger Refusal and Alternative Screening

As indicated in the regulatory considerations, there may be times where a passenger is permitted (by law) to opt out or may be physically be unable to use the security scanner. The airport will need understand how alternative screening procedures will impact checkpoint operations.

Where a WTMD is used in conjunction with a passenger security scanner, airports may be able to revert to traditional screening measures (WTMD screening and additional full hand search or additional explosive detection) for these passengers. However, passenger security scanners implemented in isolation may require an alternative other than traditional screening measures, possibly of passengers being redirected to an entirely different lane if the specific airport requires such a set up. In this instance, airports should consider the easiest route to move passengers, considering how this will impact the flow of the existing lane and where possible have processes in place to proactively identify these passengers prior to the checkpoint. In this regard, some airports operate family and special assistance lanes, which can be designed and staffed to manage passengers who are unable, or where the procedure would not apply, to use primary checkpoint equipment.

1.7.6 Communication with passengers

This consideration is not unique to the deployment of passenger security scanners, and in fact, can often occur in a traditional lane when any unexpected or unfamiliar requests are asked of a passenger (e.g. ETD, hand search etc.). However, as many passengers are still unfamiliar with passenger security scanners, or have heard negative feedback on earlier models, there may be an increased number of questions put to security officers. Passengers may also require additional advice on how to use the security scanner and may not speak the same language as the screener.

This is an area of critical importance as lengthy discussion and delays at the passenger security scanner have the potential to negatively impact the flow of the checkpoint. In instances where quick communication with the passenger is not effective, airports should consider how to manage these situations to ensure checkpoint operations continue and whether supervisory staff should become involved.

Communication Campaign: A proactive communication campaign (for example via the airport's website) and the use of different modes of communications may be required to address any of the concerns commonly experienced with the deployment of passenger security scanners, health and privacy considerations in particular. This not only puts the passenger's mind at rest but can also ensure a smooth flow at the checkpoint without passengers pausing to ask questions. There are many examples of successful passenger communication including, airport websites, in-airport signage, in queue videos, brochures, apps etc.

Airports should also consider the fact that passengers may use social media such as Twitter to publicize instances where they are provided incorrect information (e.g. passenger security scanner contains radioactive material). Airports are therefore encouraged to have a process in place to handle passenger feedback such as this. Passenger communication and feedback is discussed in detail in the Guidance Document – Checkpoint Design and Automation.

Communication at checkpoint: In addition to a proactive communication campaign, officer communication at the checkpoint can be critical to alleviating concerns about potential passenger security scanner privacy issues and can help the passenger better understand the process. Many airports now engage with the passenger during the alarm resolution process, showing them the resolution screen and the location where alarms have been generated. Not only does this help to manage passenger privacy concerns, it also supports ongoing passenger education of the technology.

Airports also should have a plan in place to manage situations where passengers do not understand the instructions of the screener. Airports should assess their passenger demographics and where possible, have staff rostered who speak the most common languages. Translation cards may be useful for less common languages.

1.7.7 Alignment with other systems

Where new technology is trialed or implemented as part of a wider system, airports are encouraged to align the operating cycles of each component in the system to avoid the creation of bottlenecks. For example, if passengers are able to move more quickly through the screening process as a result of the passenger security scanner but they must then wait for their bags, the benefits of the operational efficiency gained from the passenger security scanner are lost due to inefficiency elsewhere. Similarly, an airport operating a high throughput baggage system will need to carefully consider how best to deploy passenger security scanners so as to ensure that passenger and baggage throughputs align.

1.8 Personnel

When planning organizational and personnel related issues during the deployment of passenger security scanners, consideration should be given to the following:

1.8.1 Training (Initial and Refresher)

As with the deployment of any new technology, both initial and refresher training will be required. A dedicated training program will be critical and need to be put in place, across a number of weeks/months, depending on the size of the workforce and to take place well ahead of the deployment.

For instance, initial tests of the equipment can be carried out by the security officers so that they become familiar with the use of security scanner and they grow accustomed to what elements may provide alarms and how to best resolve them.

In addition to technical elements, use of passenger security scanners creates the possibility for targeted search, which officers will need to be trained in. Airport should also consider how to ensure their staff remain proficient in full search procedures.

Security officers will also need to be trained in how to manage passenger enquiries and where airports are introducing passenger security scanners alongside other innovations, additional process training over and above machine operations training may be required. When introducing scanners, airports should expect a transition period for security officers to get used to the equipment and the new processes.

1.8.2 Communication and involvement

Training should not only include the what, but also the why. Passenger security scanners offer different detection capabilities to WTMDs and it is not uncommon for officers to express concern regarding effectiveness of scanners when first deployed as in many cases the new versions of the technology are unfamiliar to them.

It is important for acceptance and appropriate utilization to provide officers with a better understanding of the threat context and how passenger security scanners, along with other equipment and processes at the checkpoint, will allow them to better perform their duties.

Airports that have successfully integrated passenger security scanners as part of their operation have found that early engagement with officers before the start of any trials or implementation is essential. When comparing similar set ups, airports that engage best with security officers generally achieved higher throughput in the usage of security scanners. This will need to be followed by continuous engagement all along the implementation process. Enabling security officers to contribute to the development of CONOPS, surrounding processes, rotation plans and passenger communication strategies can result in earlier acceptance of the technology and a smaller period of disruption for the airport, avoiding any pushback from staff which may result in non-optimal operations.

1.8.3 Performance Management

Airports will need to consider how to evaluate and manage security officer performance in operating the passenger security scanner, in combination with other elements of the screening process. In particular, testing should focus on assessing officer use of the machine, not just the machine itself. In this regard, scan result interpretation as well as correct search and alarm resolution procedures should be a key focus. Some regulators have undertaken assessments that offer validated and standardized assessment procedures for the operational evaluation of a security officer's performance in the passenger screening task. These can provide a sound foundation for supporting an evidential competency-based performance management system underpinned on accrued historical operational data.

1.8.4 Working Environment

The deployment of passenger security scanners will most likely involve discussions around working environment and possibly shift rotations, as in many deployments it means adding or modifying a staff position in the lane.

1.8.5 Occupational Health

Security officers operating passenger security scanners will need to be upright for the entire period they are operating the equipment. Airports will need to evaluate how this impacts occupational health and how best to mitigate any related risk.

Whilst this will not be a new issue for airports, who are already managing the same risk in relation to WTMDs, careful consideration should be given to shift rotation where the two technologies are used together at the checkpoint. With the addition of the passenger security scanner, and in some cases a new screening position, officers may now be required to spend an additional rotation period in an upright screening role.

Security officers may also raise concerns around the safety risk posed by working in close proximity to the technology. Airports should obtain safety related information from manufacturers and be prepared to present it in a logical manner to officers, for example in comparison to a WTMD or x-ray as well as to other everyday activities such as mobile phone use etc. This kind of information can also be useful in managing passenger enquiries.

1.9 Evolution

Airports and governments are continuing to work with manufacturers to build smaller and faster machines, refine detection algorithms and improve the queuing of the scan results and security scanner steps functionality. Such work on the detection algorithm could include development of ATR to include shape recognition or use of material discrimination in combination with the use of algorithms.

Meanwhile, some airports are leveraging passenger security scanners to build a dynamic screening platform in support of a more risk-based passenger screening model. Currently, the focus is on improving mechanisms for randomly switching the detection algorithms used on the passenger security scanner. The success of these trials could set the stage for the switching of algorithms between passengers based on their behavioral indicators.

In the long-term, it is hoped that individual passengers will be screened according to their risk profile. Depending on checkpoint configurations and local regulations pertaining to passenger security scanner use, there is the opportunity to have the passenger security scanner deployed as a primary inspection device on a dedicated enhanced security lane, supporting a process where passengers are differentiated based on risk and by lane (e.g. TSA Pre✓®). Alternatively, there is the future possibility of dynamically switching the algorithms on the passenger security scanner according to the risk profile of the passenger, allowing for a lane-neutral passenger differentiation process. Such trials have already been performed in lab environments, indicating successful proof of concept.

1.10 Related Opportunities

Within the Smart Security context, passenger security scanners are one component of a larger integrated approach to passenger screening. Implemented as a single component, they enhance passenger experience and security effectiveness, while maintaining acceptable throughput. In addition, they have the possibility to greatly enhance the efficiency and risk-based nature of the entire screening process if properly integrated with other aviation security components referenced in other Smart Security Guidance Documents including Centralized Image Processing (CIP), cabin Baggage Screening, Checkpoint Management and Risk-Based Passenger Screening.

Chapter 2

Search Optimization

2. Search Optimization

This chapter aims to analyze some of the factors that impact search optimization in the passenger screening environment. Including:

- **Passenger Preparation –** specific to passenger screening equipment
- **Equipment Utilization –** including staffing, layout and demand handling
- **Belts and Shoes Screening –** integration with the passenger process

By better preparing passengers, reducing the number of un-necessary alarms and facilitating improved asset utilization at the checkpoint, airports can ensure security officers remain focused on core screening activities and the greatest threats; passenger experience is improved; and that checkpoints operate more efficiently.

Elements discussed in the following section should be considered by airports and represent minimal investments that can be made to maximize throughput opportunities.

2.1 Passenger Preparation

Passenger preparation is not unique to the passenger process, but rather is relevant to the checkpoint as a whole. Full details on passenger messaging and compliance are discussed in the Guidance Document – Checkpoint Design and Automation, however, passenger preparation has a major influence on the use of WTMD and even more so on security scanners. A number of key points are discussed below.

2.1.1 Divest Messaging

Regardless of the passenger screening technology used in the checkpoint, better prepared passengers will result in an improved flow and fewer alarms.

By educating passengers as to the cause of frequent alarms and reminding them, prior to entering the passenger security scanner or WTMD, to remove any items which may cause an alarm, the resolution time can be minimized or even completely eliminated.

This is an important, but often overlooked element of the process by both passengers and security officers. Whilst passengers are now very familiar with the need to remove metal objects prior to screening via WTMD, they are less aware that items of paper in their pocket (such as a train ticket, receipt, handkerchief or boarding pass, etc.), jewelry or heavily ruffled clothes that could all generate unnecessary alarms when passenger security scanners are utilized.

In addition, in contrast to western-style clothing customs, the Asian and Middle Eastern traditional dresses[6] and the prevalence of garments with high levels of folded fabric have shown high levels of unnecessary alarms. Manufacturers are working on the performance of the algorithms under those circumstances.

Compared to WTMDs, passenger security scanners offer some alleviation with regards to alarm resolution, with States often permitting targeted search. However, once the number of alarms reaches a threshold (as defined by the regulator) then a full search will be required, which greatly increases the alarm resolution time.

Care and attention should therefore be taken to minimize alarms through passenger compliance. This can be achieved through education prior to screening (e.g., posters, mobile app, etc.) and reinforced by security officers verbally reminding passengers, often the divest officer[7] at the cabin baggage divestment point.

Unique Alternatives to Divestment:

After a period of analysis one airport found that long necklaces would alarm at a sensitive chest area that could not be resolved by targeted search and as such would require the passenger to divest his/her necklace and come through the security scanner a second time, taking up a significant amount of time. They decided to request upfront at the divest area that passengers wearing long necklaces turn them to the back to allow quick targeted search to resolve the alarm at the security scanner.

2.1.2 Process Familiarization

Whilst passengers are seemingly comfortable with the process for passing through a WTMD, the introduction of passenger security scanners presents an additional challenge for airports. The more familiar passengers are with the use of passenger security scanners, the less anxious and hesitant they will be, which may otherwise cause delay in entering and exiting the scanner.

Furthermore, the more familiar passengers are with the screening procedure, which may for example require them to stand, place their arms in specific positions or even turn around, the quicker and more efficiently they will autonomously carry out this activity without prompts from a

[6] Such as traditional clothing such as abaya, the gutra & agal or hijab

[7] Security officer allocated to the divest position, where passengers comply with the divestment requirements

security officer. While these small changes may only reduce the downtime by a few seconds per passenger, this can have a dramatic effect on the number of passengers that can be processed per hour.

2.1.3 Health and Privacy Concerns

While passenger security scanners have been reported as safe by several leading authorities and now use automated detection algorithms reporting alarms on an anonymized stick figure, it should not be taken for granted that all passengers will be comfortable with the technology. In particular, infrequent travelers, or those who have not regularly used security scanners, may still have concerns with perceived privacy and health implications. Discussions regarding health and privacy concerns can be important to the passenger and their experience, however, this can at the same time negatively impact checkpoint flow.

All operators of passenger security scanners are therefore encouraged to consider a continual familiarization effort. At an individual passenger level, much of this will be driven by widespread use of passenger security scanners at airports around the world. However, until a critical mass of locations adopts scanners, even if a particular airport has had scanners in place for some time, there are likely to be many passengers who have not encountered them before or are wary of their use. Appropriate approaches to allow the passenger to 'experience' the passenger security scanner even before entering the passenger security scanner should be explored. These can be made available through different mediums and languages and can be fact sheets, FAQs, flyers, videos, etc.

Passengers with special needs (e.g. reduced mobility) may require alternative screening approaches. Familiarization with the health effects of the scanner and its physical limitations relative to their specific case can all help to reduce delay in handling passengers.

2.1.4 Analysis and use of passenger compliance data

As airports gain operational experience from deployed scanners, alarm data that is accrued can offer guidance on the impact of processes and algorithm settings and enable airports to ensure that the checkpoint screening system is configured correctly to ensure optimum flow and security effectiveness.

> One airport trialing different security scanners observed that when allocating an extra resource specifically for passenger preparation, throughputs increased by up to 21% (15% on average across the different security scanners), showing the importance of passenger preparation.

While the example above may not be practical for all airports, as it requires a dedicated resource, airports are encourage to test various staffing configurations and messaging options in order to maximize operations at their checkpoint

Analysis of compliance data can also aid airports to develop a compliance messaging strategy. In particular, common causes of unnecessary alarms should be identified and compliance messaging focused on these areas. In addition, security officers should be trained to observe passengers in advance so that they can quickly assess what will need to be divested or what can remain based on results of earlier analysis.

Airports may find that compliance messaging needs to be varied across checkpoints, times of the day and even between flights. This is discussed further in the Guidance Document – Checkpoint Design and Automation.

One airport that has performed such assessment found that the most common un-necessary alarms were occurring on the arm area. As a result of the accrued operational alarm data, they were able to assess the impact of different passenger messaging options. In particular, they were able to assess the effect of leaving a watch on versus taking it off had on overall passenger processing time. Ultimately making the decision to advise passengers to leave their watches on.

Trials at another airport resulted in an alternative process for important items (passport, bank notes, boarding pass etc.). In this instance the airport identified that passengers were concerned about leaving these items in the tray and now allows them to carry them in their hand as they pass through the security scanner. With current security scanner CONOPS, any alarms can be resolved more quickly and the airport in question is able to better manage the concerns regarding these items.

2.2 Equipment Utilization

2.2.1 Demand Handling

For the passenger security scanner and/or the WTMD to fulfill its screening potential and to achieve the greatest possible throughput there should be a continuous demand at the equipment. This means there should be at least one passenger waiting to enter the scanner or WTMD at any given moment.

This requires a suitably structured space, possible additional facilitation elements (such as sound or visual aid to help passenger to proceed) and the appropriate male/female ratio of security officers to resolve alarms (note also that the regulatory requirements differ across countries on whether a passenger can be searched by a security officer of the same gender or by either gender).

Use of alarm resolution stations, discussed in the previous chapter, is likely to be critical to effective utilization.

2.2.2 Alignment of cycles

WTMDs and passenger security scanners have different processing times. Regardless of which equipment is used and in what combination; key to an efficient checkpoint is alignment of the operating cycles with the complete passenger screening process at the checkpoint.

A checkpoint screening system wide understanding is therefore required to ensure that the processes and flow are optimized. For a passenger security scanner deployed as a primary device, the loading and divesting procedures prior to the scanner should take slightly less time per passenger than the average scanner processing time per passenger to ensure that a passenger is always ready and waiting at the scanner.

With the current rules regarding the divestment of liquids and laptops from passenger's belongings, the average loading and divestment time at many locations is much longer than the average scanner processing time and so the target throughputs through the scanner may not be achieved. This is not due to limitations of the equipment processing time or through poor passenger compliance (etc.), but simply due to a low demand as a result of a lack of constant flow of passengers. This is further compounded when the scanner is deployed as a secondary screening device and its utilization is driven by the number of alarms through the WTMD. That is why several locations have only achieved a throughput level closer to 120 passengers per hour on their scanners.

To ensure that correct assessments are made as to the reason for throughput limitations, airports should seek to assess quantitatively and diagnostically the transaction times and passenger flow for each element in the complete checkpoint process. This will ensure that the reason for bottlenecks is understood and that any remedial actions identified can be appropriately implemented.

In addition, many airports are investing in newer cabin baggage screening technology capable of running advanced algorithms. Some of this technology (such as CT) operates at a slower belt speed than traditional x-ray systems, whilst at the same time may enable a reduction in images per passenger. This is just one example, however airports should consider both current and future cabin baggage screening technology they may seek to deploy when undertaking any modeling or assessment of cycles.

Hypothetically, consider a security scanner processing passengers at a rate of 170 passengers per hour, meaning, on average, each passenger takes around 21 seconds. If the average loading and divestment time per passenger is longer than 21 seconds, this means the scanner will have an idle time before a 'new' passenger arrives and will be underutilized. In this particular example, a desirable average divestment time of 15 seconds or less may be more appropriate to allow time for the passenger to move from the roller bed to the passenger security scanner and be ready to be processed as soon as the scanner becomes available.

2.2.3 Layout

Overall checkpoint layout can also have an impact on optimized use of the security scanner or WTMD:

- If passengers are too widely distributed at the checkpoint this may introduce delays in entering the scanner and may impact preceding processes;
- If a security scanner used in the primary position is located too close to divest areas this may disrupt the passenger preparation and queueing process at the roller bed; or
- if used as a secondary device, it may impact the flow of passengers through the WTMD. For example, in some situations, the restriction on space can mean passengers waiting for the security scanner block access to the WTMD. In this scenario, some airports have evaluated "stacking", whereby passengers are queued to enter the passenger security scanner in a small area to the side of the WTMD (illustrated below as the Holding Area) allowing security officers supporting primary screening to continue processing passengers through the WTMD unimpeded.

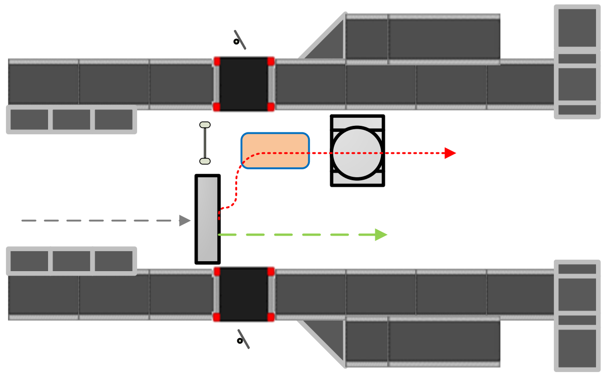

Figure 4 - Checkpoint Layout with a Holding Area[8]

It is recommended that in addition to general spatial lane requirements, airports introducing passenger security scanners consider the space officers will require to appropriately manage and queue passengers prior to screening at the security scanner.

2.2.4 Resourcing

Passenger gender split

Inadequate rostering and rotation of security officers for alarm resolution activities can generate bottlenecks throughout the lane, either due to the fact that the passenger process is stopped while alarm resolution is performed, or because an officer is pulled from another role (e.g. bag search) in order to resolve the passenger alarm.

Importantly, airports should understand the male and female split of their passengers and how they vary by time of day and season, among other demographics. Security officers should be appropriately rostered so that hand search can be conducted by the appropriate gender without generating delays. It is worth noting that some states allow flexibility, particularly when it comes to targeted search, for example allowing either gender to conduct targeted search in certain zones.

To address this issue several airports utilizing security scanners, deploy two security officers in off peak periods (one male, one female) and three during peak periods with two officers of the highest percentage gender anticipated during that period of time. Airports should keep the demographics of their passengers under constant review and not become complacent in ensuring that the correct split of security officers are deployed at critical times.

[8] As there are several different manufacturers of security scanners and they vary in shape, the rectangle pictogram including a dotted circle has been adopted throughout this document to represent any security scanner.

2.2.5 Passenger flow

Airports should make all efforts to minimize down-time in the processing of passengers. For example, it is not an effective process to stop the flow of passengers every time a search is conducted. With modern passenger security scanners the technology can be used to commence a scan whilst the alarm resolution of the previous passenger is being conducted. Airports should seek to identify optimum ways to manage passenger flow during such alarm resolution periods. For example, if one security officer is already performing alarm resolution, other passengers may still go through the security scanners and even be searched following an alarm if the security officer gender allows so.

2.2.6 Security Scanner Optimization

As explained in Sections 1.5.1.and 1.5.2, the throughput of the security scanner can be increased in the first instance by using a queuing of results functionality. In this way, a passenger can enter the scanner and start the scanning process while the previous passenger is still in the results resolution stage.

If the resolution of the result of the previous passenger requires extra time (e.g. hand search of certain alarmed area), it is possible that the scanning of the following passenger is completed before a previous alarm is resolved. For this case and in general for further optimization, an additional strategy is explored below.

2.2.7 Multiple Remote Resolution Stations

Remote resolution station systems are a relatively new concept, though functionally they work in the same manner as the results queuing model explained in section 1.5.1 and 1.5.2 and above.

In a standard configuration, the equipment remains as a “single piece”, i.e. all in the same place and embodiment. With the introduction of remote resolution stations there is an additional equipment piece introduced, and the need for additional infrastructure and space.

In addition to maximizing the equipment utilization and therefore improving throughput, these resolution station models may provide airports with an opportunity to improve the passenger experience, or at least the perceived experience. To do this, they create the opportunity to make better use of available floor space and further optimize passenger flow. In addition, they allow the possibility to have a resolution station networked to a close-by small cabin that would allow privacy for targeted or full search of passengers if need be. Similar to the cabin baggage secondary search screen, these models may also create a situation more suited for the control of passengers awaiting manual search.

An example of multiple results queuing configuration with remote resolution stations can be seen here.

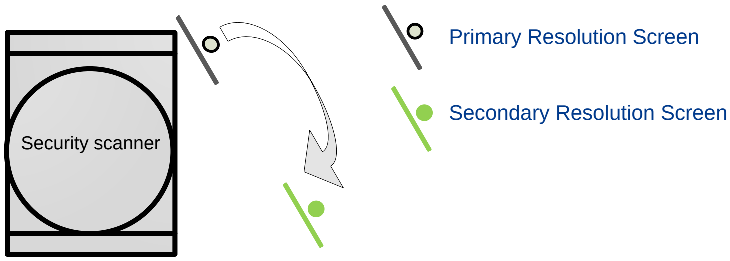

Figure 5 – Remote resolution station

2.3 Belts, Shoes and Jackets Screening

The ideal passenger process would see passengers able to leave shoes, belts, and jackets on when moving through the security process and to this end, manufacturers and research institutions continue to look at the range of technology solutions that may enable this. However, at present, leaving these items on either results in a sub-standard security outcome, or disproportionately impacts efficiency – for example the resolution of the resulting alarm outweighs the benefit the passenger receives from not having to remove the items in the first place.

Therefore, at most checkpoints around the world, passengers are asked to remove jackets before proceeding through the passenger screening process and shoes are dealt with in a variety of ways including x-ray, ETD and Hand Held Metal Detectors (HHMDs). Likewise, belts and jewelry are often removed from passengers because they would alarm the WTMD and slow down passenger flow.

Because regulatory requirements differ, it is hard to make blanket recommendations for the way to deal with these items. It is likely that in the short-term passengers will continue to have to remove large bulky jackets and coats for screening. However, there may be some alleviation for belts, jewelry and shoes as discussed below.

2.3.1 Belts and jewelry screening

Passenger security scanners may offer respite in some jurisdictions for the screening of belts and jewelry. Although recent algorithms are improving, a belt or jewelry may still trigger an alarm on a passenger security scanner. However with targeted search often permitted, airports may determine that the time taken to remove these items is longer than the alarm resolution process post a passenger security scanner alarm, meaning that an operational decision to allow these items to remain on is made based on overall processing and transaction time. There may, nevertheless, still be a need to x-ray some belts or jewelry where a specific concern exists.

2.3.2 Shoes screening

The full capability of passenger security scanners with respect to screening passengers wearing shoes should be clarified between the airport and potential equipment vendors. In addition, confirmation of any specific requirements in relation to shoes and passenger security scanners should be sought from the regulatory authority.

Depending on the regulatory requirements it may make sense for airports to proactively engage with passengers wearing shoes that will likely alarm the WTMD and suggest they be removed and x-rayed. Other airports and regulatory bodies may choose to ETD or use a shoe scanner to screen a proportion of shoes, in which case, encouraging passengers to leave shoes on, may make sense.

New metallic and explosive detection shoe screening equipment

To enhance passenger experience and allow passengers to leave shoes on, new equipment for shoe screening, detecting both metallic mass and explosive threats located in the shoe is already being tested in some airports and is in the process of certification and regulatory inclusion. They are similar in terms of equipment size, layout, footprint and processes to the previous metallic threat detection shoe scanner. Passengers need to keep their shoes on and then step in, one feet foot at a time, for the analysis.

So far this equipment has been tested located after the WTMD as an alarm resolution for WTMD when WTMD zonal alarm indicates the shoe area. These trials have already proven the following benefits:

- Passenger experience: passenger satisfaction resulting from keeping the shoes on is quite high. The alarm resolution process was perceived as quick by passengers and they appreciated the fact they could keep their shoes on in the alarm resolution process.
- Security officers' experience: improved security officer satisfaction as the number of shoe removals are reduced.
- Operational efficiency: easy usage by both passengers and officers as well as a significant passenger processing time reduction as passengers do not systematically need to remove their shoes at divest.
- Security effectiveness: increased security by detecting the metallic and as well the dielectric components that could be hidden in the shoes.

As trials continue in different airports, there will be better understanding of the different possible operational deployments and benefits of such new generations of shoe screening equipment.

Whatever the decision, process, and equipment, it is important that passengers have clarity on the required action expected from them as they reach the checkpoint. Otherwise airports should anticipate delays as a result of additional alarms, or enter into discussions with security officers over the efficacy of the requirements.

2.3.3 Risk-based differentiation and the impact on divestment

In the absence of a single technological solution that can screen all items a passenger may be wearing or carrying, some states are using risk-based differentiation as a means to allow lower risk travelers to divest at a minimum and keep certain items on such as shoes and belts, etc. For example, TSA Pre✓® in place in the US supports a risk informed assessment to identify those low risk passengers and consequently adapt the screening proportionally, and managed in a potentially expedited manner, with less divestment.

Other risk informed processes can result in adapting the sensitivity of the WTMD to allow passengers to keep their shoes and belts on while compensating with the use of trace detection techniques and other unpredictable approaches. This option could be considered as a more risk-based approach to passenger screening where there is evidence to support security and process optimization.

2.4 Evolution

In the future, by incorporating shoes screening and other technologies into the passenger security scanner, it is envisaged it will be possible to reduce the amount of divestment required by passengers. For example, it is expected that a passenger will be able to keep their shoes, belts, and watches on, provided that the technology has advanced to a level that meets the respective aviation security regulatory requirements.

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Appendices

3. Appendix A – Passenger security scanner as a Secondary Screening Measure

3.1 Concept

Many airports over the last few years have begun co-locating passenger security scanners with WTMDs in their checkpoints in an effort to speed up alarm resolution and enhance passenger perception of alarm resolution while limiting any potential negative impact to checkpoint flow. This appendix discusses such co-location, with the passenger security scanner being used as a secondary screening measure to resolve alarms generated by the WTMD.

3.2 Benefits

Airports having deployed passenger security scanners as a secondary screening measure have highlighted the following broad benefits:

- **Faster WTMD Alarm Resolution**: In checkpoints where a passenger security scanner is not present, alarms on the WTMD are resolved by full hand search or handheld metal detector and targeted hand search combination; in some cases ETD is also required. Alarm resolution of this nature, can often take a significant amount of time. Through passenger security scanner use, airports are often permitted to conduct targeted search, significantly decreasing the alarm resolution processing time per passenger (Smart Security Feb 2014).
- **Better Passenger Flow**: In many locations, a hand search must be conducted by a security officer of the same gender as the passenger. When a same-gender officer is unavailable, flow through the WTMD is often halted (or partially halted) until an officer becomes available and the alarm can be resolved. With passenger security scanners, officers are no longer required to contain passengers who have alarmed the WTMD (while waiting for a same-gender officer to assist) but, rather, can direct them straight to the passenger security scanner. This enhances flexibility and overall passenger flow.
- **Greater Staffing Flexibility**: Given the WTMD is a first filter while the passenger security scanner is used for alarm resolution (and security officers no longer need to hold passengers at the WTMD after an alarm), in most regulatory environments, one rather than two security officers are required to manage the WTMD. In the future, this officer could be re-deployed entirely if, for example, an automated swing gate or other technology is implemented to either allow a passenger to proceed or divert them to the passenger security scanner.

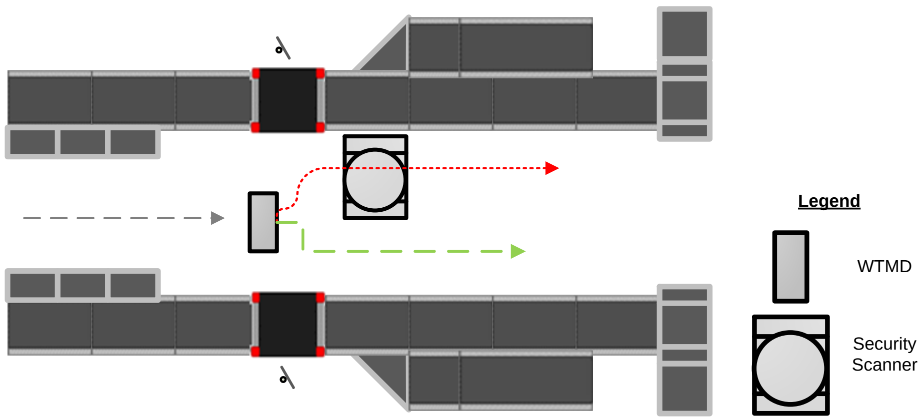
3.3 Layout

The layouts provided in this section are based on a configuration of one WTMD and one Passenger security scanner per two lanes.

3.3.1 Layout 1 passenger security scanner directly positioned after the WTMD

The following layout includes the passenger security scanner directly positioned after the WTMD and may be suited to airports with very little space between lanes.

Layout 1



Considerations

Although this model may not be ideal nor very practical from an operational viewpoint, it may be the only option some airports have given space constraints. Airport operators are encouraged to consider the following points if implementing this layout:

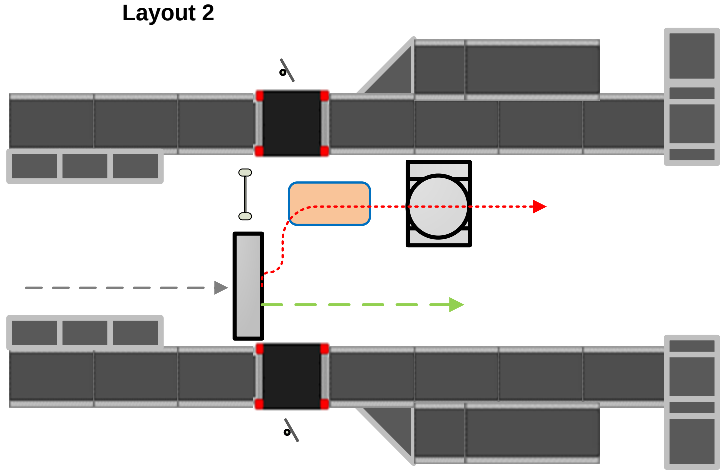
- **Staffing**: If operating with only two security officers of different gender (based on national requirements), the officers may have to swap positions (between scanner and WTMD) frequently in order to accommodate passenger searches. To avoid this, airports may need to add an additional officer, so that two officers (a male and a female) are always stationed at the back of the scanner to conduct alarm resolution (deployment of staffing is further detailed in paragraph 4.4.1).
- **Passenger Control**: If space is limited, the officer positioned at the WTMD may be challenged to control passengers, ensuring that alarmed passengers proceed through the passenger security scanner and that cleared passengers continue through the checkpoint. Airports may find that, in trying to keep control of the passengers, security officers may slow or halt flow, thereby diminishing some of the operational efficiency benefits gained

from using the passenger security scanner. Given this, airports are encouraged to work through appropriate passenger paths and flow.

3.3.2 Layout 2 passenger security scanner positioned after WTMD with an Hold Area

Similar to Layout 1 above, Layout 2 includes the passenger security scanner positioned after the WTMD. In this model, however, there is more space available and, therefore, both the WTMD and passenger security scanner are off-center, and there is a larger holding area allowing for improved flow and staffing.

Layout 2

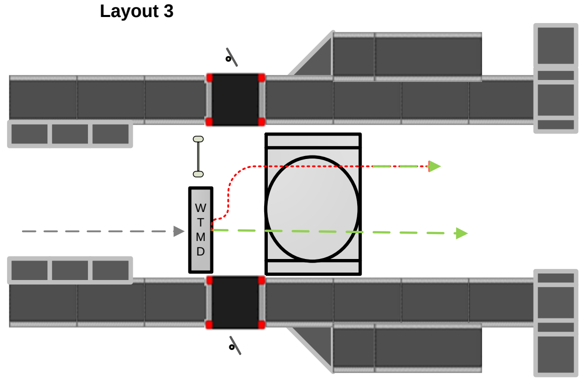


Given the larger holding area in this model and the fact that the passenger security scanner is off-center, officers are required to hold fewer people at the WTMD and can stack 2 or more passengers in the queue for the passenger security scanner. This ensures a more constant flow of passengers through the WTMD than that seen in Layout 1 above. Additionally, this allows airports to operate with a two-officer staffing model, as opposed to the three officer staffing model most likely required in Layout 1.

3.3.3 Layout 3 passenger security scanner positioned after WTMD across the entire width between 2 lanes

Depending of the equipment used, another layout of a security scanner positioned after the WTMD can be possible. With this layout, passengers who do not alarm still physically walk through the security scanner (when security scanner is not in the process of scanning) but without being scanned as the space is large enough to accommodate both passengers who did and did not alarm. This however may require officers to pay more attention to ensure that those they require screening to not inadvertently pass through the scanner without being scanner. Also as in layout 1, flow may be halted once officers are occupied resolving alarms.

Layout 3



3.4 Resourcing

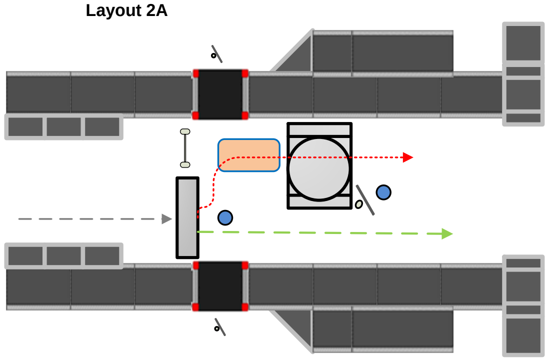
There are two primary resourcing models for the layouts illustrated above: a two-officer model and a three-officer model. Given the preference for layout 2 or layout 3, where space permits, this has been used as the basis for the following examples. Note that these are examples only and many other configurations can be possible for a given airport:

3.4.1 Two Officer Model

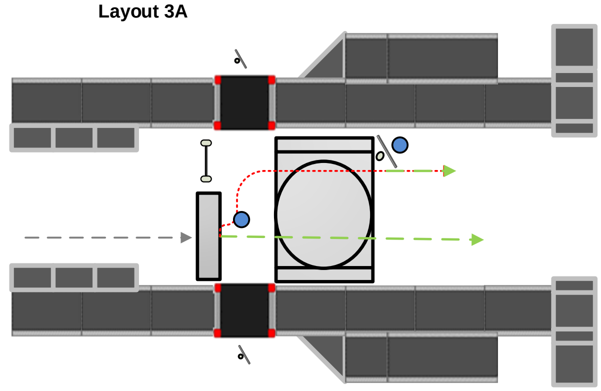
Layout 2(A) and 3(A)

Layout 2A and 3A include one officer positioned at the WTMD and one officer positioned at the back of the security scanner. Passengers enter via the front of the security scanner and leave via the back of the scanner.

Layout 2A



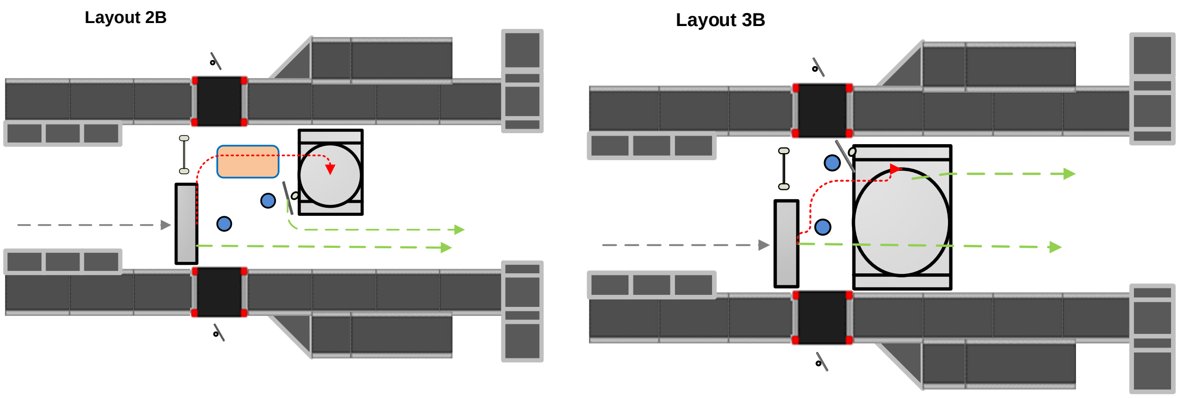
Layout 3A



Another alternative to layout 2A sees the WTMD officer positioned further back towards their colleague at the scanner. In this way they can still monitor the WTMD but also easily swap with the other security officers to perform security scanner alarm resolution if the passenger gender requires it. This configuration however is possible with only some security scanners.

Layout 2(B) and 3(B)

In contrast to Layout 2A and 3A, Layout 2B and 3B have the security officer positioned at the front of the security scanner, also with a security officer positioned at the WTMD. In this model, in layout 2B there is only one entry and exit to the security scanner and passengers enter and leave via the front of the scanner.



Both of the above configurations require two security officers to manage the process. However, passenger flow and security officers' movement (and swapping of positions depending on gender) vary between the two.

Differences

The key differences between these layouts include:

- Location of the passenger security scanner resolution screen;
- Location of the second security officer (back or front of the passenger security scanner);
- Location of the passenger security scanner alarm resolution process (back or front of the passenger security scanner/co-located with the officer); and
- Passenger path through the scanner (leaving from front or back of the scanner).

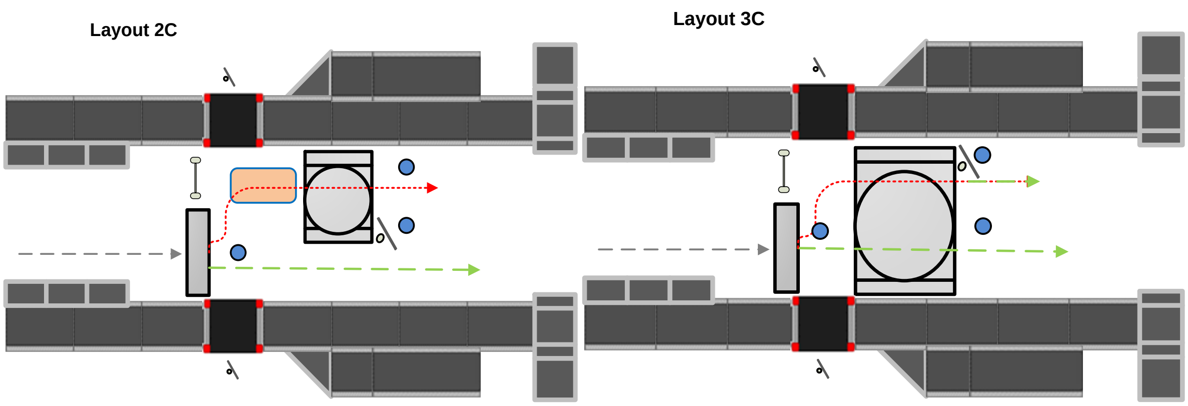
Considerations

Layout 2A and 3A require that security officers have to move further to swap positions for search activities and in addition, communicating the need to swap may be more difficult as they are not in close contact to enable easy verbal communication.

Conducting alarm resolution in the passenger security scanner at the front of the machine (as seen in Layout 2B and 3B) allows the two officers to swap positions more easily, thereby resulting in fewer/shorter stoppages and overall higher throughput through the checkpoint. However, it does reduce the space available for queuing.

3.4.2 Three-Officer Model

The three-officer model operates with the same layout as 2A and 2B, and 3A and 3B. However, here (Layout 2C and 3C) an additional officer is added at the back of the passenger security scanner, thereby providing even greater flexibility and opportunity to maximize functionality.



Benefits

- Generally higher throughputs compared to the two-officer model.
- Possibility to maximize throughput on the passenger security scanner.

Having two security officers of different gender at the back of the passenger security scanner eliminates the need for security officers to swap positions between the WTMD and the passenger security scanner each time alarm resolution is required. Importantly, the officer at the WTMD can focus solely on guiding passengers through the WTMD and ensuring that those who alarm, queue for the passenger security scanner.

In this model, use of the passenger security scanner can be maximized (discussed in Chapter 2-Search Optimization) and in doing this (and aligning with appropriate cabin baggage screening processes), some airports, based on their regulatory requirements and specific CONOPS, have seen throughputs over 550 passengers per hour through the combined passenger security scanner/WTMD process (Smart Security Feb 2014).

Considerations

Many airports operating with WTMDs only, do so with two security officers resolving alarms on passengers. This model requires airports to add an additional staff resource to help enhance throughput. Airports will therefore need to consider whether the additional throughput that the extra officer facilitates, is worth the additional cost.

With an additional security officer, and thus the capability to conduct two passenger security scanner alarm resolution processes in parallel, the layout may require additional space as compared to the 'two-officer' models. This is not related to any change in equipment footprint or layout, but simply to an increase in size of the passenger search area after the passenger security scanner.

4. Appendix B – Passenger security scanner as Primary (in combination with WTMD)

4.1 Concept

This Appendix discusses co-location of the passenger security scanner with the WTMD. However, unlike the configuration described in Appendix A, here the passenger security scanner is used as a primary method of screening in combination with the WTMD. In this scenario, passengers can be selected for either the passenger security scanner or the WTMD and are unable to predict by which technology they will be screened prior to reaching the checkpoint. For WTMD alarms, standard alarm resolution protocols can apply or airports can opt to resolve alarms through the passenger security scanner. For the passenger security scanner alarms, alarm resolution is performed with standard protocol (either targeted or full hand search) and there is no use of WTMD.

4.2 Benefits

- Unpredictability: A key security benefit from this model is the fact that all passengers have an equal and unpredictable chance of being selected for screening via the passenger security scanner, which enhances detection capability for non-metallic threats.
- Management of Persons with Reduced Mobility (PRMs): When the security scanner does not allow for PRMs to go through the lane, this model makes it easier to manage passengers with reduced mobility or other conditions as they can simply be processed through the same lane via the WTMD, without being redirected to an alternative search location (if consideration is given to ensure that there is enough space for a wheelchair to pass through)
- Reduction in full hand search: Whilst some passengers may still be subject to a full hand search if they alarm the WTMD, those selected for the passenger security scanner could undergo a targeted search regime and have an improved passenger experience.
- Minimal throughput disruption: In this model, passenger security scanners can be implemented with little to no impact on the overall throughput and as such it can help in their gradual deployment.

4.3 Layout

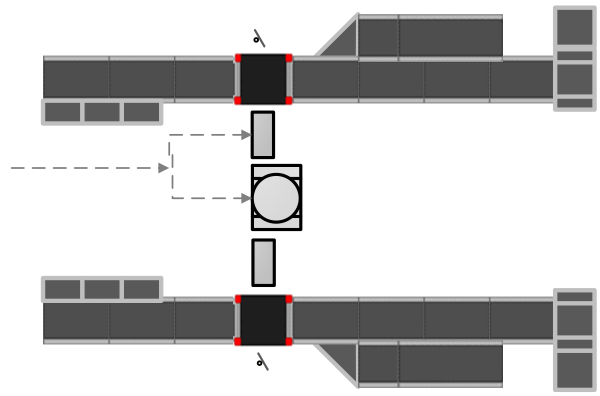
There are two layouts most commonly used by airports for this model:

4.3.1 Layout 1

In layout 1, two WTMDs are co-located with one passenger security scanner for primary screening. In many locations with this configuration, the second WTMD is not operational but is available as back-up if the primary WTMD is not working. At other times, the second WTMD is only used during peak periods.

Of note, utilization of an additional WTMD (for a total of 2 operating at the same time) may reduce the overall percentage of passengers screened via the passenger security scanner. Regulators may have an issue with this, so airports should discuss this ahead of any implementation.

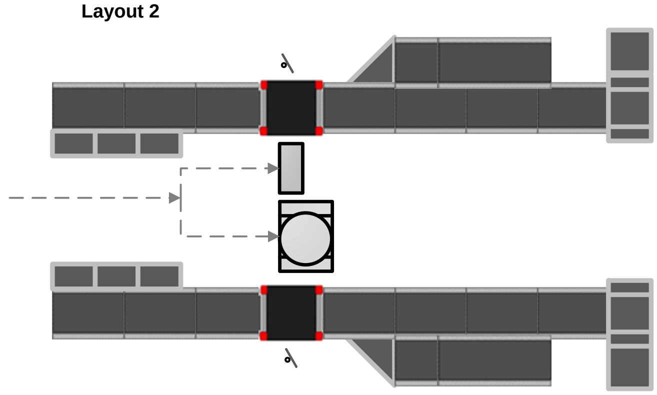
Layout 1



4.3.2 Layout 2

In general, there tends to be a minimum requirement of one passenger security scanner and one WTMD per two lanes for airports co-locating passenger security scanners with WTMDs for primary passenger screening purposes. Airports deploying one WTMD with one passenger security scanner may wish to stagger the layout, especially where space constraints exist.

Layout 2



4.4 Selection

Given that passengers can be selected for either the passenger security scanner or the WTMD, airports will need to decide on a selection method, choosing between manual or automated selection.

4.4.1 Manual Selection

Many airports deploying layouts one or two use manual selection to direct passengers through the passenger security scanner, applying a random and continuous approach. This generally means as soon as the passenger security scanner is free, an officer will direct the next passenger in line to enter the scanner and following passengers will be directed to the WTMD. In this way, a passenger cannot predict which screening method will be applied to them.

This selection method is beneficial in that there is no build-up of passengers waiting for the passenger security scanner, meaning it can be implemented with limited available space. In addition, from an operational perspective, because of the random and continuous selection model, airports should not see a significant decrease in throughput from implementing this model (as compared to WTMD only operations).

However, this selection method requires careful staff management to make sure that security officers are alert at all times to identify if passengers within the queue are swapping places to avoid being selected for the passenger security scanner for instance.

From a regulatory standpoint, there is no way for an airport to guarantee a consistent percentage of passengers screened via the passenger security scanner, especially when flexing between 1 and 2 WTMDs. This is a critical point if the regulatory authority has mandated a specific percentage requirement. Airports will therefore need to ensure that capacity through the scanner is sufficient to consistently achieve or exceed the proportions mandated.

Another variation of manual selection mechanism that has been observed is to direct all passengers towards the passenger security scanner using the WTMD as an overflow for the passenger security scanner. In this case, the alternate path using the WTMD as primary is only used either randomly or to relieve the queue when it is getting too big, to increase total throughput.

4.4.2 Automated Selection

Selecting passengers in an automated way would require airports to use a swing gate or selection pad to randomly allocate passengers to either the passenger security scanner or WTMD. Through automated selection, airports could guarantee the percentage of passengers directed to the passenger security scanner per hour and reduce any concerns that officers may discriminate between passengers. However, this approach may also lead to a build-up of passengers awaiting the passenger security scanner and could result in a misalignment between passenger and baggage screening. This misalignment and queuing could result in a reduction in overall throughput.

4.5 Resourcing

Airports have deployed a variety of staffing models associated with this configuration, with up to four security officers manning the technology. Airports will need to identify appropriate staffing models.

In order to maintain control of passengers, and ensure a continued flow, it is likely that a minimum of three officers would be required – one officer selecting passengers and two officers for alarm resolution. Where airports have a mechanism to automate this selection, this process could be managed with as few as two officers.

One CONOPS observed at a Smart Security participating airport is a three security officers operation; one male or female located in front of the passenger security scanner while an opposite gender operates at the back of the scanner swapping position from back to front and vice versa depending on the alarm resolution required. A third officer (male or female) is positioned on the WTMD.

In this configuration, the security officer operating the WTMD never leaves his/her position as in doing so they risk losing control of passengers. Alarms on the WTMD therefore are resolved either by the passenger going through the WTMD again (and clearing on the second pass after they have divested correctly) or by the officer calling in another security officer from the lane to help in the alarm resolution. This CONOPS has been designed around the staffing requirement, however other airports may choose to operate with additional officers allocated depending on the nature and number of alarms to be resolved.

Airports are advised to consider security officer staffing based on their specific layout, noting that staffing requirements may even differ between lanes, especially where lane spacing and size is not uniform (a common occurrence where airport checkpoints have expanded into areas beyond initial allocations).

4.6 Considerations

When looking to deploy the models outlined above, airports are encouraged to consider the following:

4.6.1 Plan B

In instances where airports choose to deploy one WTMD with one passenger security scanner per two lanes, they should consider alternate screening procedures for situations when the WTMD or the passenger security scanner may not be working (other than simply putting all passengers through the single passenger security scanner or the single WTMD, which could negatively impact throughput and overall compliance with any mandated percentage targets).

4.6.2 Space

Although airports are often initially concerned with the spacing required to operate this model, multiple layout options should be investigated further. Staggering, for example, could reduce the width required to deploy a WTMD and passenger security scanner in combination between two lanes.

Where the security scanner is not wide enough to allow a wheelchair to go through, airports that do not wish to create additional and separate lanes for PRMs will need to make sure that enough space is planned for PRMs ensuring that a wheelchair can go through the lane.

4.6.3 Alarm Resolution

Given this model places the passenger security scanner in the primary position and it is no longer dedicated to WTMD alarm resolution, airports will need to consider how standard WTMD alarms are resolved and the impact of different models on staffing.

4.6.4 Number of machines

As indicated by the illustrations above, operators may use more than one WTMD or passenger security scanner in this configuration. The number and combination of machines used may be dictated by the regulatory authority. Where this is not the case, airports are encouraged to consider space and staffing considerations when making a layout decision.

4.6.5 Persons with Reduced Mobility (PRMs)

Although this model makes it easier to manage PRMs, as seen in the benefits section, it is important to note that PRMs should be dealt with separately to ensure that they are not replacing a selected passenger and/or that there would be no way for the passengers following a PRM to assess which passenger screening process they will be asked to go through.

4.6 Evolution

In the near term, it could be envisaged that not all lanes have the same capability. Some airports may choose to do their passenger selection upstream and direct passengers to specific lanes, meaning not all lanes would need passenger security scanners. This would lead to the same results as developed above. However, it should be noted that for this to occur, regulations in some states may need to be amended to move away from a per lane measure, to a checkpoint measure when it comes to percentage rates for screening.

5. Appendix C – Passenger security scanner as Primary (without WTMD)

5.1 Concept

This appendix discusses placement of the passenger security scanner in the primary screening position without the WTMD. In this configuration, 100% of passengers are screened by the passenger security scanner with no passengers going through a WTMD.

It should be noted that very few airports have implemented this model to date. However, if regulatory authorities require airports to screen 100% of passengers via passenger security scanner (or airports choose this model for other reasons), the information below should be considered as basic discussions for implementation.

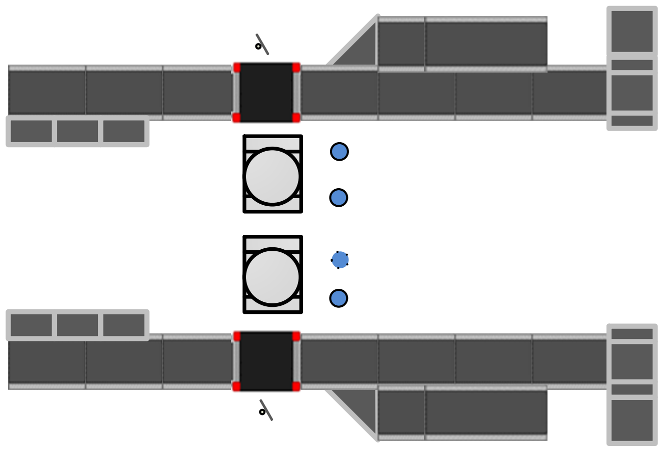
5.2 Benefits

The following benefits may be seen through the deployment of this model:

- Improved passenger experience: With the elimination of the WTMD, passengers may no longer be required to undergo full hand-search for alarm resolution purposes. Rather, the passenger security scanners allow the possibility of targeted search, which can improve the passenger experience.
- Further optimization and greater cost competitiveness: Eliminating the WTMD from the equation allows airports to focus on training and CONOPS development strictly related to the passenger security scanner. Moreover, airports can work with manufacturers, in collaboration with regulatory authority, to adjust the automated detection algorithms to enhance the balance between detection and throughput. The use of passenger security scanners in isolation means that algorithms can be updated as new threats emerge. This is not the case with WTMD devices.
  Heightened Security Effectiveness: Given the importance of mitigating non-metallic threats, sending 100% of passengers through the passenger security scanner enhances security effectiveness in this regard.

5.3 Layout

It is anticipated that the following layout would be most commonly deployed by airports wishing to operate with passenger security scanners only, however depending on overall lane throughputs, some airports may only require one scanner per pair of lanes, others may require a third scanner:



Note that where airports are space constrained, equipment could be staggered so as to reduce the width required, whilst still facilitating a normal passenger flow.

5.4 Considerations

Airports are encouraged to consider the following points when implementing this model:

5.4.1 Opt-Out Protocols

Airports will be required to identify alternate screening procedures for passengers who opt-out of screening through the passenger security scanner, or who cannot physically enter the scanner. This is more challenging in an environment where passenger security scanners are the sole primary means of passenger screening. Opt-out solutions can include, but not limited to, full body hand search and/or other explosive detection mechanisms.

Airports will need to consider whether alternative procedures occur within the lane (and how this impacts the flow), or whether a dedicated screening area is established for passengers opting out (noting that a process will need to be in place to move passengers and their cabin baggage to this area).

5.4.2 Redundancy

Airports will need to consider how to handle passengers when a passenger security scanner is not working such that flow is not dramatically impacted. This will be particularly important where airports are operating near to capacity, and the option to open an alternative lane does not exist.

It is recommended that airports discuss redundancy measures with their regulatory authority prior to implementation and ensure that alternative equipment (if needed) is in place and staff are trained in its use.

5.4.3 Number of Machines

Depending on the type of passenger security scanner acquired and its associated processing rates, airports will need to consider whether one passenger security scanner per two lanes is sufficient or whether one machine per lane is required.

Even though currently, when deployment is optimized, airports have been able to consistently achieve throughputs of 210 to 240 passengers per machine per hour, it is likely that for now at most airports, at least one passenger security scanner per security lane will be required to maintain current throughputs (Smart Security Sep 2014). Some airports, with higher lane capacities, may even require three based on current technology.

Airports will need to develop a business case for this deployment model and consider whether the associated OPEX costs (primarily equipment and staff) are offset by the potential security and passenger experience benefits.

5.4.4 Alarm rates

Passenger security scanners can have high alarm rates leading to high numbers of secondary search and hand search (targeted or full) but not necessarily leading to the detection of prohibited items. This high alarm rate must be offset by efficient alarm resolution through secondary search and improved detection algorithms or combinations of detection algorithms. Using only passenger security scanners in the checkpoint makes throughput even more dependent on these areas and eliminates the provision that the WTMD can provide in situations where rapid processing is required.

5.4.5 Staffing

Airports will need to determine suitable staffing models to appropriately manage passenger flow and throughput. Airports wishing to maximize throughput through the scanner, will likely need a minimum of three security officers per two passenger security scanners, but will probably more commonly utilize four security officers as indicated in the layout above.

5.4.6 Space

This model may require a larger footprint and up to four security officers for secondary searches. In combination, this will require more space than many airports have today. Space should not just be limited to the machine itself. Considerations should also be given to the space required for alarm resolution screens and search areas.

Airports should consider how the machines could be staggered when space between lanes is a limiting factor.

6. Appendix D – Quick Reference Guide – Passenger Security Scanner Equipment

Quick Reference Guide – Passenger Security Scanner Equipment (Section 1.5)			
Area		**Key Considerations**	**Stakeholders to consult / Criteria to be sourced from**
System Requirements	Technology	• Evaluate type of technology required: - Millimeter wave - Backscatter	• Equipment vendors • National regulator
	Decision Support	• The ability to integrate automated and operator assist detection algorithms	• Equipment vendors • National regulator
	Algorithm	• Identify a detection algorithm most appropriate to operational environment, balancing detection sensitivity and un-necessary alarm rates against throughput	• Airport business case • Equipment vendors
	Integration	• If useful, can the results from multiple passenger screening technologies (i.e. scanner and WTMD) be integrated	• Airport business case • Equipment vendors
Scanner results queuing		• Functionality of successive processes performed simultaneously to reduce down time between passengers	• Airport business case • Equipment vendors
Alarm Resolution Stations		• Number of stations required NB: minimum of 2 for higher throughput • Resolution display screen attached to the machine, or	• Airport business case • Equipment vendors

	located away from the machine	
Maintenance	• Plan for heavy and light maintenance periods as well calibration requirements	• Equipment vendors
Testing	• Determine testing requirements - both officer and equipment	• Equipment vendors • National regulator
Cost	• Airports should develop a business case to identify links between initial purchase price and ongoing costs across a number of years, compared to traditional models.	• Airport business case • Equipment vendors
Size	• Discuss space requirements with manufacturers and ensure appropriate spacing between lanes for equipment maintenance and servicing.	• Equipment vendors
Data Capture and Reporting	• Discuss requirements with manufacturers to assess whether equipment could be networked and how data is collected and stored	• Airport business case • Equipment vendors
Electrical/Power Requirements	• Determine power requirements and factor into planning	• Equipment vendors
Environment	• Take into consideration HVAC system to ensure best operational environment	• Equipment vendors

Quick Reference Guide – Passenger Security Scanner Equipment (Section 1.5)