Smart Security, a joint initiative of the International Air Transport Association (IATA) and Airports Council International (ACI), envisions a future where passengers proceed through security checkpoints with minimal inconvenience, where security resources are allocated based on risk, and where airport facilities are optimized, thus contributing toward an improved journey from curb to airside.
The present

Today’s passenger and cabin baggage security screening works, but at great cost to the aviation industry, to authorities, and to passengers.

Given the predicted growth in air travel, continuously evolving threats, and passengers becoming increasingly dissatisfied with queues and intrusive measures, today’s model is no longer sustainable.

The future

To address this issue, ACI and IATA have joined forces to define a future where passengers proceed through security with minimal inconvenience, where security resources are allocated based on risk, and where airport facilities are optimized.

This will be achieved through the introduction and integration of risk-based security concepts, advanced screening technologies, and process innovations.

The benefits

Security effectiveness is paramount if Smart Security is to be successful. By implementing new technologies and processes, the project strives to increase the detection capabilities of the checkpoint and the effectiveness of human resources. All stakeholders benefit from an improved ability to counter threats, including governments, industry stakeholders and the traveling public. And landside risk is reduced through the reduction of queues on the landside of the security checkpoint.

There are many additional benefits for all, including:

Better passenger experience. Passengers benefit through faster, more convenient, and less intrusive security screening. Airlines and airports may have higher customer satisfaction from passengers due to fewer departure delays.

Improved operational efficiency. Airports and screening authorities can reduce costs or benefit from better deployment of their resources. Airports may also benefit from increased revenue opportunities through reduced wait times. Both airlines and airports may be able to offer reduced connection times through efficient transfer screening.

The journey

IATA and ACI are working in close cooperation with industry and government partners. A roadmap for the long-term future of passenger screening has been defined and received support at the ICAO High Level Conference on Aviation Security in Montreal on 12-14 September 2012, and was subsequently supported by the ICAO Council.

Testing and evaluation

The Smart Security program aims to validate and demonstrate the operational viability of these innovative concepts through laboratory tests, operational trials, computer simulations, and other research methods. Smart Security solutions must also demonstrate security effectiveness through testing and evaluation to ensure regulatory requirements are met.

Since 2012, Smart Security solutions have been tested and evaluated in partnership with forward-thinking governments, airports, airlines, and solution providers. Several of the trial concepts are now permanently installed and fully operational. Research, testing, and evaluation will assist the industry to remain in line with new developments.

Guidance materials

The knowledge gained and lessons learned from various trial and research activities in many locations are summarized into guidance material, with the objective of giving other airports and screening authorities a head start in adopting innovative security screening solutions.
Passenger Screening

Concept

Passenger screening refers to the security procedures that inspect individuals for prohibited items prior to allowing them entry into a security-restricted area to board their flight. Passenger screening should provide effective security while making the experience as pleasant as possible for the traveler.

Traditionally, passenger screening processes focused mostly on the detection of metallic threats using walk-through metal detectors (WTMDs) supplemented by manual pat-downs.

Today, security scanners can address the threat of explosives and other non-metallic threats in a single process while better respecting the privacy of passengers thanks to the anonymized format of images and advanced detection capabilities, reducing the need of full body pat-downs.

Solutions

Different deployment models can be considered:

• **Security scanner as secondary measure:** Passenger security scanners can be used to screen those who set off the WTMD alarm or are selected for additional screening. This configuration is expected to be the most common in the near future as a way for airports to speed up alarm resolution and enhance passenger perception of alarm resolution while limiting any potential negative impact to checkpoint flow.

• **Security scanner as primary measure:** In this model, passenger security scanners replace the WTMD as the primary screening device. Regulatory changes and the improved efficiency of passenger security scanners should gradually increase the attractiveness of this model.

• **Enhanced lane:** The majority of lanes use WTMD as the primary measure, with a small number of lanes operating security scanners as the primary measure. The lanes with security scanners are used for processing passengers selected for enhanced screening.

Results and benefits

With over 1,000 passenger security scanners deployed at checkpoints worldwide, the following benefits have been highlighted:

• Advanced detection algorithms better support detection and decision making.
• Varying the algorithms and sensitivity settings of the equipment increases detection, deterrence and unpredictability.
• Operational flexibility is maximized as security scanners can be deployed as both primary or secondary measures, in isolation or alongside other equipment.
• Positive passenger and security officer feedback.
• The level of future proofing is improved with the ability to add new algorithms as threats evolve.

Integrated approach

Further benefits from using security scanners will be realized if attention is given to the following components:

• **Cabin baggage screening:** The speed of cabin baggage screening should be coordinated to avoid creating flow disruptions and bottlenecks.

• **Alternative measures:** Advanced algorithms or variations in the deployment of passenger screening solutions should be considered to maintain the unpredictability of the screening process, which is a key deterrent.
Concept

Conventional stand-alone, single-view X-ray equipment has been the standard for a long time, but is highly dependent on the screener’s training and experience for detection. This results in:

- Extra passenger divestment requirements (laptops and liquids, aerosols and gels, or LAGs).
- A higher number of complex images to be viewed.
- Challenges detecting prohibited items from a single-view image.
- A high proportion of bags sent to an unassisted secondary search.
- Greater reliance on the screener’s abilities.
- Additional burden on loader position to correctly position bags to achieve the best possible image.

Advanced screening technologies will allow for effective threat detection while reducing the burden for passengers with items to divest. Decision support and, to some extent, decision automation will allow officers to focus on those images that require their attention the most, and help them to make decisions.

Solutions

Assisted secondary search: By implementing a secondary screening workstation in the cabin bag search area, the security officer allocated to the secondary search is able to review the X-ray image of the bag while performing a hand search. This can accelerate the bag search by allowing a targeted search where regulation allows it and foster better communication between the X-ray operator and the secondary search officer.

Dual/multi-view X-ray: Dual/multi-view X-rays assist operators by providing images of multiple angles of the same bag. Capabilities are now expanding and enabling the deployment of advanced equipment intelligence.

Computed Tomography (CT): CT screening equipment is becoming mature enough for large-scale implementation. CT capacities include the ability to produce 360 degree images from the bag, and to produce slices from the bag to provide the screener with an unobstructed view of content. This enables more items to be left in passengers’ bags.

Equipment intelligence: Automated Target Recognition (ATR) algorithms can examine cabin baggage for threats (e.g., bulk or liquid explosives). They can also look for specific items to support the X-ray operator, for example providing virtual separation of a laptop from a bag. Advanced screening equipment is a key enabler of equipment intelligence deployment.

Results and benefits

Dual/multi-view, CT and other emerging X-ray technologies, depending on the features deployed and the equipment intelligence evolution, may deliver the following benefits:

- Better threat detection capabilities.
- Fewer secondary bag searches.
- The ability to use automated explosive detection systems (EDS) and to vary the algorithms used.
- Reduced divestment requirements.
- Improved efficiency due to the reduced number of images per passenger.
- Future proofing for additional threats.
- Reduced burden on loader position.

Integrated approach

Dynamic lane: Innovative screening equipment could be vital in a risk-based environment. By allowing different types of algorithms to be used depending on the risk level associated with an individual passenger, the screening equipment will be able to screen both high-risk and low-risk passengers in the same lane.

Centralized Image Processing (CIP): Advanced screening technologies and equipment intelligence, combined with a CIP environment (see page 7), would further enhance operational efficiency.

Checkpoint Environment: To get the maximum benefits from these new technologies, innovative lane configuration and advance automation may have to be considered.
Alternative Detection Methods and Unpredictability

Concept

Alternative screening methods can enhance deterrence and the overall effectiveness of the security checkpoint, while at the same time support operational efficiency and an improved passenger experience through a layered approach.

Alternative detection methods include:

- Explosive trace detection (ETD).
- Explosive detection dogs (EDD).
- Unpredictable approaches.

Solutions

Explosive trace detection: Residue left from the manufacturing, handling or transporting of explosives is hard to remove. ETD equipment can detect trace amounts of explosives on a person, their clothes or their belongings.

The detection capabilities of ETD are well recognized and a variety of solutions are available. The portability of these, together with the unobtrusiveness of the process, makes ETD an efficient and passenger-friendly way to resolve alarms and/or introduce unpredictability across the checkpoint.

Explosive detection dogs: Dogs are already deployed wide range of transport settings and can be used to identify passengers who may be carrying, or have recently been in contact with, explosive materials.

With the ability to easily move about the terminal while assessing a large number of passengers in a short space of time, dogs offer greater operational flexibility than fixed screening equipment.

The main limitation with using explosive detection dogs is the length of time that they can maintain effective detection capabilities.

Passengers generally respond well to dogs and their use is seen as fairly unobtrusive compared with other checkpoint measures.

Unpredictable approaches: The role of unpredictability is important as checkpoints become increasingly constrained and new threats emerge.

Unpredictability can be applied to primary screening equipment through the use of algorithms and standard operating procedures for manual processes. It can also be applied to the selection methods and application of alternative measures such as ETD.

Unpredictability in the checkpoint improves security effectiveness, ensuring individuals cannot learn security methodologies or use coerced or deceived individuals as a tool for improper intent.

Benefits

Depending on the deployment method used, benefits may include:

- Enhanced detection of threats.
- Improved checkpoint deterrence value.
- Flexibility in resource and space allocation.
- Flexibility to adapt screening percentages to the prevailing threat level.
- Reduced need for more invasive procedures such as full pat-downs.

Integrated approach

Alternative screening measures will likely have the most value when implemented in an unpredictable way, and in coordination with other primary screening approaches.

The combination of measures applied should ensure that the checkpoint remains as predictable as possible from a passenger’s perspective, but unpredictable to those with ill intent.
Concept

Due to the growing number of passengers, additional security requirements, and increasing capacity constraints, airports are considering innovative ways to keep passengers moving through the checkpoint and to optimize their resource utilization. Improvements in the checkpoint environment are an important element of Smart Security as they could contribute to:

- Improving the passenger experience through a faster flow and clearer communication.
- Increasing operational efficiency through greater automation and resource optimization.
- Strengthening security by enabling the introduction of new screening technologies and methodologies.

Coupled with advanced checkpoint environment solutions, dynamic IT infrastructure (also known as a Checkpoint Management System, or CMS) could help better coordinate and share information, monitor performance, and enable the technical integration of all checkpoint elements.

Solutions

- **Automation**: Automatic document scanning, tray handling systems, and flow control gates can optimize staff utilization and therefore reduce operating costs.

- **Configuration**: Innovative lane layouts, such as parallel divestment stations or tray loading solutions, can improve throughput and operational efficiency, as well as deliver an improved passenger and staff experience.

- **Risk-based**: Integrating lanes with supporting technologies, such as radio frequency identification (RFID) trays and biometrics can enable seamless differentiated screening without the need for dedicated lanes for each passenger type.

- **Checkpoint design**: The checkpoint environment can be improved by making it more appealing to passengers and staff, resulting in a better security screening experience.

- **Passenger feedback**: Solutions to collect and analyze passenger feedback will enable a constantly improving checkpoint environment.

Results and benefits

Trials and implementations at a number of airports have produced the following results:

- **Innovative divest solutions**: The utilization of checkpoint equipment has significantly improved by allowing multiple passengers to prepare at once.

- **Automated reject lanes**: Screeners are enabled to maintain control of cleared and uncleared bags in both a conventional and CIP set up thanks to automated reject lanes.

- **Environmental improvements**: A calm and quiet checkpoint environment reduces passenger and staff stress and improves passenger and staff satisfaction scores through ergonomic features and less industrial-looking lanes.

- **CMS – Performance review and assessment**: Management decisions are supported by easier staff performance monitoring, assessment of equipment deployment or modification of processes.

- **CMS – Resource planning and supply**: Efficient resource planning and staff allocation at the checkpoint are allowed thanks to historical and live data feed.

Integrated approach

It is crucial to consider the overall checkpoint automation and design when planning to install CIP, passenger security scanners, identity management or risk-based differentiated screening.
**Centralized Image Processing**

**Concept**

In the traditional checkpoint process, every open security lane requires an X-ray operator at the same location to scan and assess the contents of hand luggage and other items as they pass through the machine. Often, however, the machine is not working to its full capacity, resulting in sub-optimal lane throughput.

CIP allows all X-ray machines to be networked to provide airports with an enhanced ability to ensure the X-ray machine and the X-ray operators viewing the images are working to their full capacity. This makes cabin baggage screening more efficient and cost effective.

In practice, the X-ray image is collected, queued, and presented by an image processing system to the next available officer who can be stationed away from the lane in a centralized location or even still within the checkpoint. Depending on the X-ray operator’s decision, the tray will either be allowed back to the passenger for reconciliation, or diverted to a bag search point.

**Solutions**

Several variables should be considered when determining the deployment model to utilize. These represent what may be operational today and what may be possible in the future. Different deployment models can be considered:

- **Resourcing:** X-ray operator numbers can be flexed up or down to achieve higher throughputs or resource optimization.

- **Image stream:** In general, airports will have operators assess images from passenger checkpoints but, in the future, there could be a more integrated approach with operators viewing images from other operations (e.g., staff, crew checkpoints).

- **Location:** X-ray operators can work from one or more dedicated CIP rooms (either onsite at the airport or offsite as part of a larger operation) or, can remain located within the checkpoint.

**Results and benefits**

A significant number of airports have trialed and are deploying CIP in accordance with their operational and regulatory requirements. Depending on the model deployed and the business needs, CIP can deliver:

- Increased lane and checkpoint capacity.
- Improved resource utilization.
- Reduced operating costs.
- Delayed capital expenditure related to expanding/building new security areas.
- Improved working conditions for security officers.
- Greater flexibility in security officer resourcing and rotations.
- Integrated data collection for better checkpoint management.
- Enhanced passenger experience through shorter queue time and quicker access to the checkpoint.
- Increased security effectiveness.

With the introduction of CIP, one airport has increased its passenger throughput from 180 passengers per hour on a conventional lane to over 400 passengers per hour on a CIP lane.

**Integrated approach**

The full implementation of CIP is not possible without an image management system to gather, sort, display, and transmit the images between the lane and the CIP location. The benefits of CIP can be maximized in conjunction with innovative lane design, automated reject lane, and RFID trays (or similar). The upcoming integration of the ATR algorithm will definitely extend the opportunity and benefits offered by CIP in an integrated environment.

Decision automation algorithms, such as autoclear algorithms, could also enhance the efficiency of CIP. These would automatically clear such non-threat images as a tray with keys and a coat. Autoreject algorithms would automatically reject an image if a threat is perceived, without presenting the images to the X-ray operator, thus reducing the number of images to be reviewed.
**Risk-based Differentiation**

**Concept**

The approach to aviation security must evolve to counter emerging threats.

Risk-based security is the concept of applying different measures depending on the assessed level of risk. In the context of the passenger screening checkpoint, this may mean varying the way that passengers are screened based on a number of factors.

Risk-based security initiatives will transition aviation security from a somewhat predictable model to a more flexible and targeted concept that will enable screening resources to adapt to changing threats. Retaining elements of unpredictability will enhance this approach to maximize the security outcome.

**Solutions**

**Risk-based threat detection**: As the primary threat to aviation has shifted from metallic items, such as guns and knives, to non-metallic items, such as solid and liquid explosives, advanced detection technologies should be integrated within the checkpoint.

**Risk-based passenger differentiation**: To balance the effective use of resources, different security measures can be applied to passengers at the checkpoint. While some passengers will benefit from an expedited screening experience, others will be selected for enhanced screening.

Risk assessment may be achieved through behavior analysis and questioning techniques, ticket purchase characteristics or the flight routing. Per passenger pre-screening analysis may also help to categorize passengers according to risk, either through the use of passenger data, or through membership in a known traveler program. A combination of the most appropriate methods for the risk and regulatory environments can greatly contribute to the sustainability of the entire security system.

**Benefits**

Advanced technology that allows risk-based threat detection is already benefiting the industry by providing the ability to detect those items that are of greatest threat today while future proofing against the threats of tomorrow.

Data-driven risk-based differentiation models have already been implemented in some States while other stakeholders are still considering the best differentiation models for their existing and future needs.

Risk-based security practices do not need to be based only on the use of passenger data. Nevertheless, the use of data has the potential to offer a more objective approach to screening, enabling resources to be targeted appropriately depending on what is known about the passenger.

Today, all key aviation stakeholders recognize the need for a more risk-based approach to aviation security, as the current system will not be sustainable in the long term.

**Integrated approach**

The development of risk-based differentiation in aviation security contributes to the efficiency of security measures deployed at airports by ensuring that screening measures are tailored to the risk profile of each passenger. This is done by switching the detection algorithm of the security scanner (and/or on the X-ray machine) or by guiding the passenger toward additional verifications. As such, dynamic lanes or dedicated lanes would facilitate greater operational flexibility. This approach could offset random selection.

By defining the risk in advance, airports are allocating human and financial resources as required.
Guidance documents

The knowledge gained and lessons learned from the Smart Security trials and research activities are summarized into a comprehensive set of guidance documents that provide a wealth of information and best practice examples for stakeholders intending to introduce Smart Security concepts in an airport environment.

The guidance documents below cover the full range of Smart Security solutions, and touch upon technology, process, human factors, risk-based screening concepts, regulatory perspectives, and implementation considerations.

Facilitating Knowledge Transfer

“Smart Security has demonstrated that many solutions exist today to make security checkpoints more effective, efficient, and passenger-friendly. Our customers want to see these innovations adopted by governments and industry as speedily as possible. IATA and ACI stand ready to assist.”

Alexandre de Juniac
Director General and CEO, IATA

Workshops and showcase events

Smart Security is not a “one-size-fits-all” solution; components can be combined in a wide variety of configurations. But the set of variables that need to be considered to define an optimal configuration given a specific regulatory, business, operational and cultural context can be quite challenging.

To help stakeholders understand how they could achieve maximum benefits from implementing Smart Security solutions in their own, specific environment, IATA and ACI facilitate workshops around the globe.

Where possible targeted recommendations for airports to achieve measurable improvements in security effectiveness, operational efficiency, and passenger experience are provided. This enables the development of a business case for checkpoint optimization.

ACI and IATA also host showcase events, in close cooperation with airports that already have achieved Smart Security implementations, to facilitate hands-on knowledge transfer to the wider aviation security community.

“The Smart Security program has made tremendous progress through trials and pilots, and is now able to offer advice and guidance that will benefit all airports. Through the delivery of regional workshops, comprehensive guidance materials, and information sharing sessions, the program’s innovations are now being brought into the mainstream, while work continues on new areas of research.”

Angela Gittens
Director General, ACI World
While there is a lot that can be done today at security checkpoints to improve security effectiveness, operational efficiency, and the passenger experience, the Smart Security program continues to look for innovative solutions that will define next-generation passenger screening.

Continuing the research, testing, and evaluation of individual components to assess their feasibility and benefits, as well as testing several components in combination with one another, will all help to achieve this goal.

**Pilot programs**

Smart Security has partnered with forward thinking airports such as Amsterdam Airport Schiphol, Hamad International Airport, Dublin Airport, London Heathrow Airport, and Melbourne Airport, to conduct pilot implementations where several Smart Security solutions are combined in an operational environment to demonstrate the benefits and document the lessons learned.

The following solutions, some of which are now permanently installed and operational in airports, have been or are being tested:

- Innovative use and integration of advanced and new security technology and passenger processing systems.
- Use of biometrics and data for passenger differentiation.
- Adaptable risk-based screening capabilities.
- Dynamic lane screening.
- Efficient resource allocation.
- Seamless integration of security processes into the passenger journey from curb to boarding.
- Process efficiencies.

In the next few years, work will continue at airports to test and implement new solutions.

**Future research**

For each of the Smart Security components, additional work and research continue to be carried out or have been identified to be completed in the following areas.

**Passenger screening**

Although the core performance of security scanners is improving, further enhancements are needed. In addition, future research should focus on integration with other components. For example, the use of biometrics for identity management and verification can enable risk-based differentiated screening to be applied on a per passenger basis. This may be coupled with variable algorithms on a security scanner to apply different levels of screening.

Another potential area for integration is the inclusion of explosive trace detection or other detection methods into security scanners to enhance detection capability, improve security effectiveness and reduce passenger touchpoints.

Further research in passenger screening should continue to focus on finding and developing solutions and technologies that will reduce the need for divesting such items as belts and shoes.

**Cabin baggage screening**

Future research should focus on improving the intelligence of the screening equipment while keeping the false alarm rate as low as possible.

By efficiently assisting the X-ray operator’s decision in all aspects of cabin baggage screening, advanced equipment will allow a further increase in security while improving the passenger experience with reduced divestment and fewer bags sent to secondary search. Further work will also need to be carried out in hardware and software decoupling to allow for independent upgrades and easier certification, as well as checkpoint solutions tailored to an airport’s needs.
Alternative detection methods

With ETD already used in some States as a primary screening measure for crew, future work is needed to determine whether the same principle could be applied to passengers as part of a risk-based screening approach.

As explosive detection advances to the extent that stand off screening and dynamic adjustment may be possible, further research will be required to evaluate how this technology interacts with other checkpoint elements for optimal checkpoint design.

Operational unpredictability will also be assessed. Covert unpredictability combined with dynamic lanes will make the checkpoint more robust.

Unpredictability, new screening equipment, and alternative detection methods offer the opportunity to move the current prescriptive regulations to a more flexible, outcomes-based approach. Rather than checkpoint methodology, security outcomes should be the focus.

Checkpoint environment

Future research should focus on evaluating the optimum working environment, which will allow officers to focus on their core security duties and reduce the need for extensive manual handling.

Improvements in the checkpoint environment will always be a work in progress as designs adapt to new threats and the associated detection technologies. These changes in screening technology and the introduction of additional elements, such as biometrics and video analytics into the passenger journey, will further facilitate the development of enhanced automated solutions.

Future trials may even move away from the conventional screening approach, exploring innovative checkpoint configurations. This could include physically separating passenger and cabin baggage screening processes and reuniting passengers with their belongings at the end of the process.

In addition, research on predictive modeling and optimal staff allocation must be conducted to assess any possible benefits relating to checkpoint reactivity and adaptability.

Centralized image processing

Research has been carried out on human factor elements. This included assessment and information provision concerning how time on task, image inspection times, time between images affected security officer performance. It demonstrated that CIP, compared with traditional screening, does not have adverse effects and could even enhance security depending on how it is implemented.

This work and future studies will contribute to understanding the feasibility and benefits of more extensive networking, both on an airport and country-wide level, including networking operations centrally across several airports.

Taking the networking concept even further, some stakeholders are now considering whether image assessment for cabin and hold baggage can be combined. Further work is needed in this area to develop the concept.

Risk-based differentiation

Risk-based passenger screening exists today. But to facilitate wider adoption, States will likely seek further collaboration and agreement on issues, such as mutual recognition and equivalence, standards for risk assessment, interaction with existing security arrangements, and flexibility to counter emerging threats.

The ability to measure the effectiveness of risk-based procedures, the potential impact of false positives on the traveling public, and data protection and privacy are also key elements to be considered.

Further work will take place on identity management and the ability to track and trace passengers and their belongings through the checkpoint, providing States with a full end-to-end risk-based passenger differentiation model.
This is just the beginning.
Work with us to deliver the future.

smartsecurity@iata.org
www.iata.org/smart-security

smartsecurity@aci.aero
www.aci.aero/smart-security