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Smart Solutions to Airport Security in Post-COVID-19 Era

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Abstract: *It is self-evident that air transport is one of the most affected industries from the COVID-19 pandemic. Border closures and travel restrictions were put in place to safeguard the traveling public, which result in a considerable drop in air traffic worldwide. Now, with the easing of restrictions, countries are gradually reopening their borders. Airports and airlines are readjusting their regulations and procedures to match with the "new normal". Meanwhile, they are facing a tough challenge: rebuilding passenger confidence in air travel. Security checkpoint is the most conspicuous and iconic touch-point in almost all airports. However, passengers report a lowest satisfaction rate with security check which is even regarded as the most frustrating part of their journey. To reflect this, it is necessary to focus on solutions that relieve pressure for airport security, specifically, relieve pressure from security screeners as well as passengers. There is no one-size-fit-all solution to the problem. The series of solutions should be emphasized on smart security that is sustainable and scalable.*

Keywords: *airport security screening, post-COVID-19 era, smart security*

1. Introduction

COVID-19 presents the most significant stress test the air transport industry has ever faced. 2020 saw a 66% decline in global revenue passenger kilometers (RPKs) as the pandemic took hold, much more dramatic than the 9-11 terrorist attacks and the global financial crisis (as show in fig. 1.). Technology will be fundamental for airlines and airports to adapt to fast-changing regulations, safety scenarios, and help convince passengers to return to the skies. However, passengers are also demanding faster, automated journeys, and more sustainable approaches to air travel. According to the "SITA 2020 Passenger IT Insights", the satisfaction rate is significantly higher when passengers use technology at various stages of their journey. Passengers report a lowest satisfaction rate with security check which is even regarded as the most frustrating part of their journey (as show in fig. 2.) [1]. To reflect this, it is absolutely necessary to focus on solutions that relieve pressure for airport security, specifically, relieve pressure from security screeners as well as passengers at checkpoints.

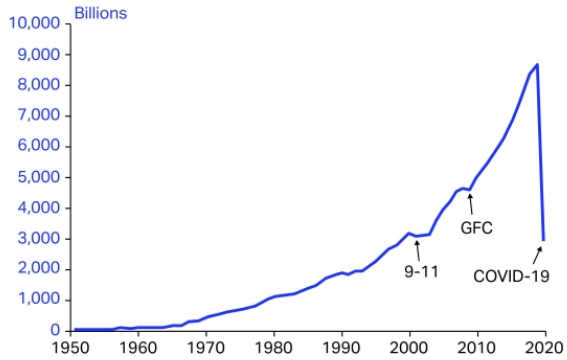

Figure 1: Global revenue passenger kilometers (Source: IATA Economics, using data from IATA and ICAO)

Airport security checkpoint is the most conspicuous and iconic touch-point in almost all airports. Given the evolving threat stream facing the aviation sector, coupled with the increased passenger

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volumes with the need of social distancing, the current state of play of most airport security checkpoints is not sustainable for post-COVID-19 era. Long queuing time for identity validation, high false alarm rates and the time-consuming alarm resolution processes of traditional technologies can obstruct the passenger flow and reduce checkpoint throughput [2]. To resolve alarms, security screeners and passengers must endure invasive physical inspection or frisk searches that increase the risk of cross-contamination. Fortunately, some airports, airlines, vendors and authorities are committed to identify the game changers.

2. Smart security screening systems

Some promising developments on security screening system include Central Image Processing (CIP) and automated checkpoint configuration, which can greatly improve passenger experience, aviation security and operational efficiency.

2.1. Central Image Processing (CIP)

Central Image Processing is also known as Remote Screening. CIP is a checkpoint X-ray carry-on baggage screening system in the context of network. It allows for the real-time management and transmission of X-ray images to locations that are away from the X-ray machine itself. The X-ray image processing and interpretation can occur in a remote location to the checkpoint screening area, where the security operators can review images from multiple checkpoint screening lanes in a quiet and separate environment.

Drawing inspiration from Checked Baggage Screening and Air traffic Control, where operators manage multiple locations from remote places in an efficient way, CIP potentially offers on solution to ease the bottleneck of passenger flow at the checkpoint and without compromise in security effectiveness.

In the longer term, it may be possible to realize the function that larger airports help small airports review and clear X-ray images in the context of CIP. Some promising results have been achieved in this concept in New Zealand. Some other trials have also been made, such as the sharing of X-ray images captured by security checkpoint on the outgoing trip with immigration and customs on the incoming trip. These solutions would do much to streamline security screening and enhance aviation security [3]. CIP for remote carry-on baggage screening can significantly reduce interpersonal contacts between passengers and screeners, increase X-ray image processing capacity, especially when combined with automated checkpoint configuration.

Figure 2: Passenger satisfaction rate (Source: SITA 2020 Passenger IT Insights)

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2.2. Automated Checkpoint Configuration

Checkpoint automation allows airports to improve security screener performance and enhance passenger experience. The automated checkpoint configuration includes but is not limited to: automated entry, automated reclaim belt, and automated tray return systems.

In recent years, automated entry gates (e-gates) are becoming more common in airports worldwide. Implemented prior to the checkpoint, it ensures that only passengers and staff enter the area. Some e-gates can be linked to the flight information database which can prevent a passenger from entering the checkpoint area if there is no enough time for them to take their flight. In these cases, passengers can be referred back to the airline counters for rebooking, rather than going through the security procedure only to miss their flight. Meanwhile, airline can offload the passenger's checked baggage to ensure an on-time departure.

Unlike traditional systems where the conveyor belt stops just beyond the X-ray machine exit, some airports have extended the automated belt all the way to the tray collection point at the back of the lane. With trays continuously moving in the fully powered system, passengers are prevented from repacking at the X-ray exit. They can repack as they move along the automated belt all the way to the end of the lane. This allows more passengers to collect their belongings simultaneously.

In recent years, Automated Tray Return Systems (ATRs) have been tested or implemented in some airports. By reducing manual operation of tray management, ATRs can ease the burden from the security screeners who could be more focused on core security activities. In these systems, specially designed conveyor belts automatically draw the trays into X-ray machines and return them from the back of the lane to the front of the queue for passenger collection. All items of baggage that set off an alarm to indicate a potential threat are redirected to a designated area automatically so that trays behind them can move uninterruptedly through the screening process [4].

3. Smart technology—advances in artificial intelligence

Passengers' demands and concerns are changing with the COVID-19 pandemic. As the "IATA COVID-19 Passenger Survey" says, once it is declared safe to travel as the pandemic has subsided, 84% of passengers would feel safer having contactless departure and arrival procedures. 65% of passengers would feel somewhat or extremely concerned by presenting their passports, boarding passes, phones or laptops to airport officials. 70% of passengers are willing to share their biometric identifiers at passport control [5]. According to the "SITA 2020 Passenger IT Insights", digital identity was the one that passengers thought would add most value to their journeys in the future with 34% stating this (as show in Table 1.) [1]. In an effort to serve the purpose of removing travel restrictions, the safe restart of air business and rebuilding passenger confidence in air travel, Airport Council International (ACI) and International Air Transport Association (IATA) launched a project called "New Experience in Travel and Technologies" (NEXTT). It aims to build the future airports which take advantage of technology to reassure the passengers in air travel. One ID is one of the building blocks of NEXTT.

Table 1: Percentage of passengers ranking the technologies that will add most value in the future (source: SITA 2020 passenger IT insights)

Technology with the Most Value to Passengers in the Future									
Digital identity	Artificial intelligence	5G wireless technology	Digital tags	Interactive way-finding	Autonomous vehicles and robots	Wearable technology	Wearable technology for staff	Augmented reality	Drones
34%	17%	13%	8%	7%	7%	5%	5%	2%	2%

3.1. One ID—Smart ID Validation and Passenger Flow Management

One ID is an IATA-led project, supported by ACI, that envisions a streamlined, friction-free process. It allows passengers to assert their identity at every touch-point in the end-to-end passenger process, both online and in person (as show in fig. 3.). It also maintains the privacy of personal data and enables great improvements to operational efficiency and security. It aims to achieve a truly interoperable system coordination between multiple stakeholders, form check in (airlines), to border control (government), to security check (airports), to shopping (retailers), etc. [6].

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One ID relies on advance off-site passenger's ID validation, that is, passengers can complete identity verification and face image collection in areas outside the airport (such as at office, home, or even at subway or bus station, etc.). To achieve this, a collaborative approach to sharing identity and journey-related information between stakeholders is a must. Biometric recognition is an enabler for identity management. All passenger touch-points should be enabled with biometric recognition for a total seamless experience.

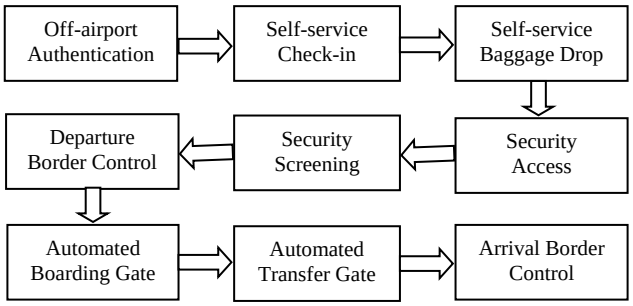

Figure 3: A flow diagram of One ID

With One ID, passengers will no longer need to juggle between different documents. They will be easily recognized by all service providers with a single identification. This will eliminate repetitive processes that result in less queuing (as show in Table 2.). Achieving this would replace the exchange of documents with facial recognition, minimize physical interaction between people, and help to protect passengers as well as employees from cross-contamination [7].

Table 2: One ID time cost benefit (source: IATA NEXTT cost benefit analysis)

Direct impact			Indirect impact
Reduction in check-in time	Reduction in passport control time	Reduction in boarding processing time	Reduction in security screening time
10%	80%	40%	4%

By reducing time spent on manual ID checks, One ID will improve staff productivity. It will provide real-time visibility of where passengers are in the airport process, control the rate and flow of passengers throughout the airport, enhance management of queues to reduce bottlenecks and disruptions, allocate resources and personnel strategically to match demand and other considerations. It will also identify passengers who require further screening or quarantine, confirm whether passengers should be able to cross checkpoints, permit and restrict access to designated airport areas [8].

One ID will make significant improvements in aviation and border security. It will cut off the routes of illegal immigration and other cross-border criminal activities by reducing the possible occurrence of imposters [9].

3.2. Computed Tomography (CT)—Smart Baggage Screening

In response to the evolving threat to aviation and passengers' expect of seamless, contactless, secure travel experience, the security screening of some airports is focused on developing the state-of-the-art technology, which will be used to revolutionize the way airport security operates.

An increasing number of airports began deploying CT technology for carry-on baggage screening. This technology also relies on X-ray but instead of providing the screener with 2D views of carry-on baggage, it provides a 3D image and unobstructed view of the carry-on baggage and its content. An X-ray camera which spins around the conveyor shoots hundreds of images and generates a 3D image of the item being screened. A security screener can rotate the X-ray image on-screen 360 degrees for a thorough visual analysis. In this case, liquid and bulk explosives which are the greatest threat to air travel can be detected more easily [10].

Sophisticated equipment intelligence, such as Explosive Detection System (EDS) algorithms, has been incorporated in the systems. This makes it possible to automatically identify potential explosives within carry-on baggage. With this advanced EDS algorithms, passengers may be allowed to keep their laptops and liquids inside their carry-on baggage. In order to meet the evolving list of threats, EDS algorithms must be continuously upgraded to allow airports to enhance screening capabilities. Research on other equipment intelligence algorithms is being made. In the future, CT scanners are capable of

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automatically recognizing and detecting some non-explosive prohibited items such as guns and knives.

This state-of-the-art technology not only provides an enhanced security threat detection capability at the checkpoint, but also reduces the need for manual searches of baggage, thus reducing a touch-point during post-COVID-19 era.

3.3. Enhanced Advanced Imaging Technology (eAIT)—Smart Personal Screening

The eAIT is the next-generation millimeter-wave passenger security scanner. It was initially deployed as a secondary screening technology in combination with the Walk-through Metal Detector. However, this technology has been used in the primary screening position by increasingly airports in recent years. Easing passenger experience, this technology enhances the detection capabilities of explosive and other non-metallic threats [4]. In first-generation AIT technology, passengers have to enter a confining chamber and strike a pose to be screened. This will make them feel uncomfortable and inconvenient. Fully electronic eAIT technology has no moving parts. Instead, the system consists of two flat panels that provide an open space for easy screening. Each flat panel of the eAIT is integrated with over 3,000 transmitters and 3,000 receivers. Each transmitter is sequenced one at a time as the 3,000 coherent receivers pull signals from the noise and bounced off the screened person's skin to yield a 3D map of all reflection points and reveal any anomalies. When the Automatic Threat Resolution (ATR) process detects an anomaly, it is then mapped to an avatar and presented to the security screener for resolution [2].

To the passengers, the most noticeable benefit of the eAIT system is the relaxed stance. Passengers can keep their arms down and close them to their sides instead of holding them over their heads, The actual scan takes less than a second [4]. Airports are finding higher passenger satisfaction scores with this technology, largely attributed to the fact that it significantly reduces the false alarm rates and thus reduces the need for intrusive manual searches by allowing a faster and more targeted search of anomalies detected by the scanner.

4. Smart risk assessment system

Complex algorithms and machine learning might be increasingly provided in airport security checkpoint in the future. However any technology has its limitations, no matter how intelligent the technologies are, it is necessary to differentiate passengers and take enhanced security measures for high-risk passengers. Therefore, to truly realize the streamlined, friction-free and one-stop security screening process, it is necessary to establish the passenger risk assessment system. Future security officers will be more focused on resolving critical alarm, analyzing behavior and managing security risks according to risk-based approach.

4.1. Risk-based Screening (RBS)

Risk-based screening is a risk assessment system that uses individual passenger data to inform the type of security screening procedure a passenger should go through at the airport [11]. The data sets may include registered traveler data, Advance Passenger Information, Passenger Name Records, Departure Control System data, and third-party information (e.g. data obtained from passport or visa application process). Through analyzing the data, if a passenger meets certain pre-defined high-risk criteria, he would be subject to an enhanced security screening. Similarly, if the individual passenger data matched with low-risk criteria, the passenger would have access to an expedited screening process. In most cases, the risk assessment would be performed by the government authorities. The airport security departments are entitled to obtain the risk scoring from government authorities in a way that respects data privacy rules.

The analysis of individual passenger data is entirely occurs behind-the-scenes. Passengers risk scores are generated in an efficient and automated way. Passengers are only aware of their potential risk score when arriving at the checkpoint queue or lane. If the risk scoring is incorporated in the boarding pass barcode, the passenger is automatically guided to a dedicated security screening lane according to the risk score [12].

RBS makes it possible to transform the traditional security screening that checks every passenger in the same "one size fits all" way into an intelligence-driven and risk-based model. It allows airports to

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utilize screening resources in a more efficient manner [13].

4.2. Behavior Detection Program

Apart from data-driven risk assessment system, the real-time risk assessment approach using behavior detection also plays an important role in smart security. In some airports there is a dedicated team of officers called Behavior Detection Officers (BDOs) who are specifically trained to identify anomalous behavior and signs of the fear of being discovered—individuals exhibiting involuntary physiological reactions to stress, fear and deception. Equipped with wireless headsets, BDOs communicate with each other about possible concerns.

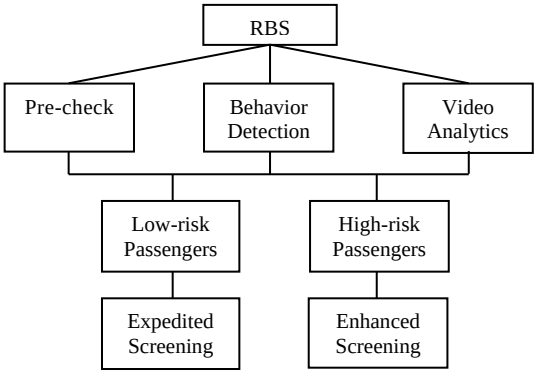

Figure 4: A diagram of risk-based screening

The good news is that video technology can be of great assistance for tracking of suspicious persons or objects and alerting staff of sudden behavioral changes or access violations. Smart video analytics software can turn standard CCTV systems into intelligent and effective detection and alert systems. The technology is already capable of recognizing people's faces, vehicles, animals and baggage automatically. Smart video analytics can not only recognize different behaviors, but also create an alarm on a user-defined rule [14].

Combining in-site behavior analysis of BDOs and real-time data delivered by video analytics, we can further identify high-risk passengers from ordinary passengers. This serves as an important additional layer of security in the airport environment, requires no actual contact with passengers (as show in fig 4.).

5. Conclusion

As a saying goes, "a breakdown is a prelude to a breakthrough" [15]. It is self-evident that air transport is one of the most affected industries from the COVID-19 pandemic. However, in order to emerge from the crisis, we must focus on the breakthrough. Airport security checkpoint is usually the point of frustration during passengers' departure procedures. This is a great opportunity for aviation security to come up with some solutions to match with the "new normal" in the post-COVID-19 era. There is no one-size-fit-all solution to the problem. The series of solutions should be emphasized on smart security that is sustainable and scalable. This would involve smart screening systems and technologies, smart risk assessment system, smart ID validation and passenger flow management, etc.

Ultimately, rethinking the airport security checkpoint might just mean "eliminating" them, while make sure that smart security which is out of view of passengers is still in place. Passengers will be more ready to accept invisible procedures and processes occurring behind-the-scenes, with little or no impact on their security perception. The world is moving towards "check-on-the-move" principles by screening passengers using biometrics and AI technologies, with visible and invisible checkpoints to carry out seamless, contactless, paperless passport control and security screening processes.

References

[1] https://www.sita.aero/globalassets/docs/surveys--reports/passenger-it-insights-2020.pdf
[2] Luke Olsen, "New security technology and the future of airport security checkpoint design," Airport business, 2019(33),5: 16-19

ISSN 2616-5902 Vol. 4, Issue 6: 100-106, DOI: 10.25236/AJBM.2022.040617

[3] Nathalie Herbelles, "Reimagining security screening to relieve checkpoint pressures," https://www.internationalairportreview.com/article/81746/security-screening-checkpoint/, 2019-3-4

[4] Austin Gould, "Advancing the checkpoint environment," http://www.internationalairportreview.com/article/101688/advancing-the-checkpoint-environment/, 2019-11-24

[5] https://www.iata.org/en/publications/store/covid-passenger-survey/

[6] Wipro, "Securing One ID: ACI and IATA's next big bet for seamless movement of passengers at airports," https://www.internationalairportreview.com/article/110147/securing-one-id-aci-iata-seamless-passengers-airports/, 2020-1-22

[7] Amandine Thomas, "How COVID-19 has enhanced the need for One ID," https://www.internationalairportreview.com/article/122613/iata-one-id-project-accelerated-covid19/, 2020-8-19

[8] https://www.sita.aero/globalassets/docs/brochures/sita-passenger-flow-management-brochure.pdf

[9] https://www.iata.org/en/programs/passenger/one-id/

[10] "TSA installs new 3D checkpoint scanners at Albany and Boise Airports", https://www.internationalairportreview.com/news/136543/tsa-checkpoint-scanners-albany-boise-airports/, 2020-9-22

[11] Cameron Mann, "Ensuring quality screening and passenger experience alongside astronomical growth," https://www.internationalairportreview.com/article/33547/security-screening-smiths detection/, 2017-3-27

[12] Laura Albert, "Risk-based policies for airport security checkpoint screening," Transportation Science, 2010-8

[13] Robert W. POOLE, Jr., "Toward Risk-Based Aviation Security Policy," International Transport Forum, Joint Transport Research Center, Discussion Paper No. 2008-23

[14] Alexander Laukenmann, "Pioneering AI in the aviation industry," https://www.internationalairportreview.com/article/114036/frankfurt-airport-pioneering-ai-aviation/, 2020-6-4

[15] Murali Varadarajan, "Contactless: The new norm in aviation ," https://www.internationalairportreview.com/article/126969/contactless-new-norm-aviation/, 2020-9-14