TURKS AND CAICOS ISLANDS AIRPORTS AUTHORITY

STRATEGIC MASTER PLAN FOR THE TCIAA

B.5. Technology Master Plan

October 2024

ALG

ALG

Disclaimer

QUALIFICATIONS, ASSUMPTIONS AND LIMITING CONDITIONS

This report is for the exclusive use of the ALG client named herein. This report is not intended for general circulation or publication, nor is it to be reproduced, quoted or distributed for any purpose without the prior written permission of ALG. There are no third-party beneficiaries with respect to this report, and ALG does not accept any liability to any third party.

Information furnished by others, upon which all or portions of this report are based, is believed to be reliable but has not been independently verified, unless otherwise expressly indicated. Public information and industry and statistical data are from sources we deem to be reliable; however, we make no representation as to the accuracy or completeness of such information.

The findings contained in this report may contain predictions based on current data and historical trends. Any such predictions are subject to inherent risks and uncertainties. ALG accepts no responsibility for actual results or future events. The opinions expressed in this report are valid only for the purpose stated herein and as of the date of this report. No obligation is assumed to revise this report to reflect changes, events or conditions, which occur subsequent to the date hereof.

All decisions in connection with the implementation or use of advice or recommendations contained in this report are the sole responsibility of the client. This report does not represent investment advice nor does it provide an opinion regarding the fairness of any transaction to any and all parties.

ALG

Objectives

- The objective of this report is to define a comprehensive technological development strategy for the entire TCIAA network, focusing on continuous improvement and innovation. To achieve this, the following actions have been outlined:

  1. **Scope and Pillars of the Technology Development System:** Defining the key areas for the technological advancement of the TCIAA network, supported by strategic pillars

  2. **Actions in the Technological Development Plan:** Developing several actions focusing on the digitalization of passenger experience, airport internal management, and collaborative tools for airport operations (A-CDM). These actions aim to enhance operational efficiency, improve the passenger experience, and implement collaborative platforms to ensure seamless and efficient airport management

  3. **Technology Development Action Plan:** Outlining a detailed action plan with specific performance indicators and timelines to monitor progress and ensure successful implementation

Content

TCIAA airports have limited modern technology infrastructure and lack digitalization, relying on traditional and manual airport operations

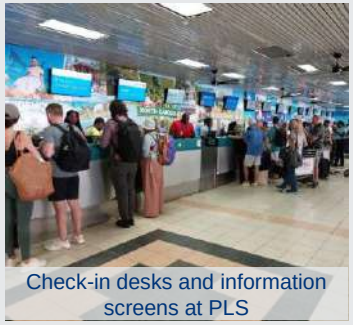
Current technology infrastructure

Terminal building

- **Overall passenger processes** at the TCIAA airports are **not automated, autonomous and lack digitalization**. Thus, passengers always rely on staff to proceed through the airport
- **Check-in, security, and boarding areas have limited technology,** except at PLS, which features basic systems such as check-in and boarding information screens
- This level of digitalization suffices for the current level of operations. As traffic increases, **GDT and XSC, and primarily PLS**, will **require a digital upgrade**, which could be developed alongside the planned terminal expansions

Airport operations

- Since most of processes are still **manual with minimal automation**, the current technology used for airports operations encompasses traditional and basic systems
- This **obstructs scalability of the airports**, **risking** their **efficient and safe operability**
- Although the existing technology developments are sufficient for current and future operations for the rest of the TCIAA network, **PLS must constantly update its systems, particularly those** that will allow it to efficiently handle higher traffic levels



Check-in desks and information screens at PLS

GDT boarding gates w/o information screens

Interior of PLS control tower; infrastructure is outdated

GDT control tower with generally outdated equipment

NCA control tower, with simple technology

Given the expected increase in traffic and TCI's status as a luxury tourist destination, airport operations and passenger experience should evolve by embracing digital and technological innovation

Source: TCIAA, ALG Analysis

The Technological Development Plan is based on the management of the organization and the risks and impacts linked to the airport network

Technological Development Plan concept

Technological Development Plan (TDP)

ACTIONS

- Technology Needs Assessment and Systems Building
- Digitalization of Passenger Experience
- Digitalization of Airport Internal Management
- Implementation of Collaborative Tools for Airport Operations (A-CDM)

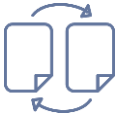
OBJECTIVES

These 6 pillars constitute the foundation of the technological development plan, ensuring that airport operations are efficient, safe, secure, and user-friendly. By focusing on these key areas, the plan aims to enhance overall airport performance, streamline processes, and improve passenger satisfaction

Accessibility

Predictability

Security



Non-duplicity

Operational Efficiency

Passenger satisfaction

Source: ALG Analysis

The TDP enhances pax experience, optimizes internal management, and implements collaborative tools within the airport network

Technological Development Plan scope

Actions

Technology Needs Assessment and Systems Building

Objective

1. **Identify technological requirements** needed to implement new systems and tools within the TCIAA Network for successful deployment, including the digitalization of data gathering
2. **Conduct a gap analysis** to assess the differences between current technology and what is required to meet strategic objectives, to later define the **implementation plan** (systems building)

Digitalization of Passenger Experience

Objective

1. **Improve overall passenger experience** by integrating advanced technologies to reduce waiting times and streamline processes
2. **Use digital travel credentials** and **mobile applications** to ensure accurate passenger information, provide real-time updates, and enable luggage tracking

Digitalization of Airport Internal Management

Objective

1. **Enhance operational efficiency** through automation of routine tasks and use of advanced analytics for critical decision-making
2. **Facilitate better communication** among airport staff with integrated digital tools, ensuring **compliance with regulatory standards** and reducing process silos

Implementation of Collaborative Tools for Airport Operations (A-CDM)

Objective

1. **Improve coordination among stakeholders using A-CDM tools** to provide real-time situational awareness and increase predictability in airport operations
2. Efficiently allocate resources based on **real-time data, minimize operational delays**, and **foster transparency** through **collaborative decision-making**

This approach is aligned with the international standards and best practices for technological innovation and operational efficiency

TCIAA

Technological Development Plan (TDP)

Source: ALG Analysis

The pillars of the TDP provide a comprehensive perspective aimed at optimizing airport operations through advanced technology

Technological Development Plan transversal objectives

Accessibility

Ensure systems are **easy to use and access** for all passengers, enhancing their overall experience

Predictability

Enable **accurate forecasting** and **anticipation** of airport operations to optimize resource allocation and reduce disruptions

Security

Enhance security measures through integrated digital tools for seamless data exchange and real-time monitoring

Non-duplicity

Eliminate redundancy and ensure information consistency across all airport operations through integrated management systems

Operational Efficiency

Increase efficiency by automating routine tasks and optimizing resource management, **supporting critical decision-making processes**

Passenger satisfaction

Streamline passenger processes and reduce waiting times to **enhance the overall travel experience**

Source: ALG Analysis

Content

The first step within the digitalization process should be adopting new systems aligned with the network's goals

Technology needs assessment and Systems building

1 Analysis of current technology

- Gather **qualitative and quantitative data** about current technologies and systems, including **conducting surveys or interviews with relevant stakeholders** to understand their expectations
- **Review existing documentation and performance metrics** to evaluate the effectiveness and efficiency of current technologies
- **Identify strengths, weaknesses, and limitations of existing systems**, evaluating how well current ones meet the network goals and user needs

2 Identification of future needs

- **Analyze market trends, emerging technologies, and best practices relevant to the network**, ensuring alignment with network's strategic goals and future requirements
- Assess the **technical, financial, and operational feasibility** of adopting new technologies, ensuring that any future technology complies with industry regulations, safety, and security standards
- Gather input from stakeholders on **desired features and functionalities** for anticipated future systems

3 Gap analysis

- **Compare current technology within the TCIAA with the identified future needs**
- **Identify gaps between current technology capabilities and future requirements** evaluating its functionality, performance, security and scalability

4 Implementation planning – Systems building

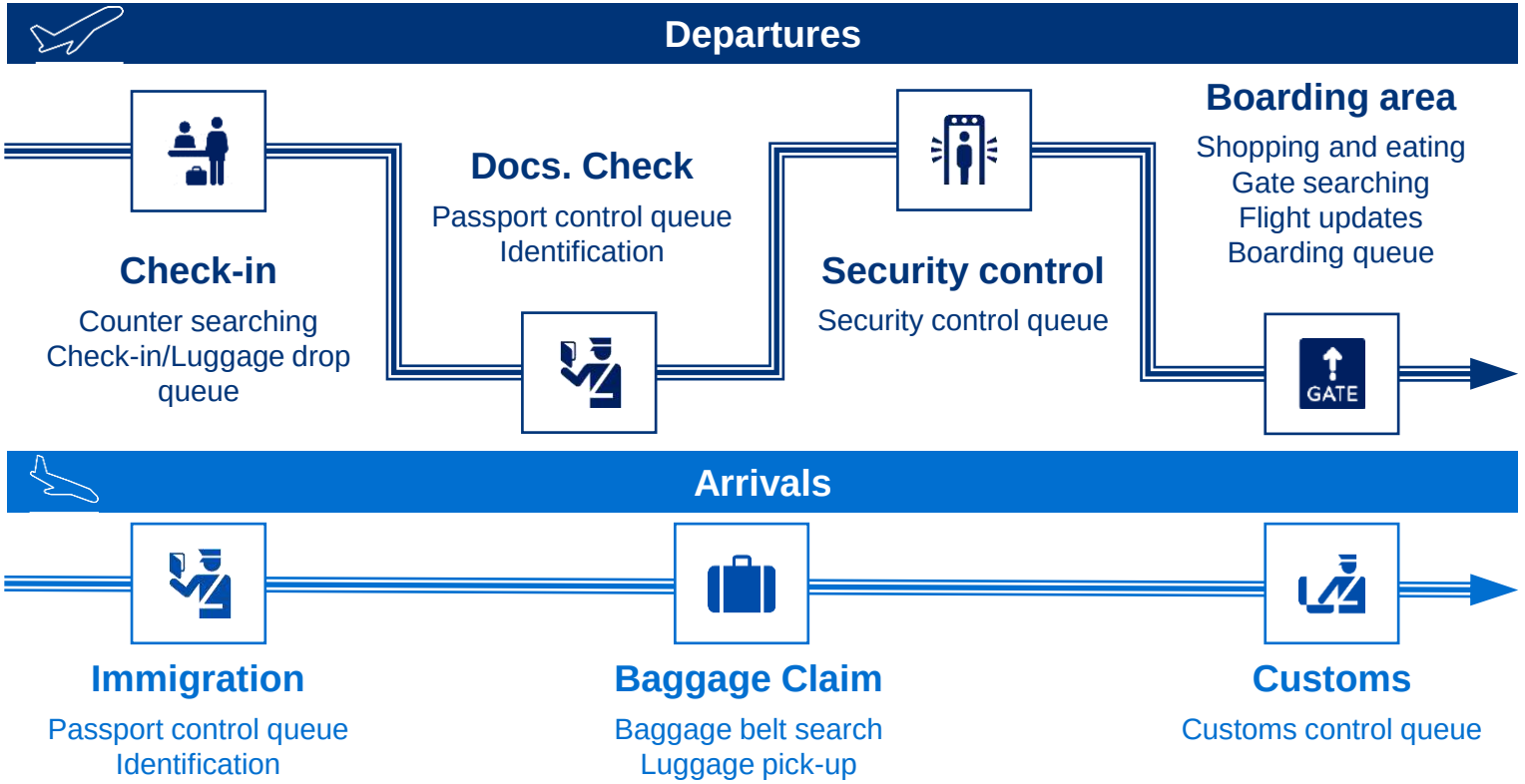
- **Prioritize** which technologies or system functionalities are most critical for the network
- Assess the **potential risks** involved in bridging the gap, including costs, integration complexity and disruptions, while stablishing mitigation strategies
- Evaluate the **financial implications of adopting future technologies**, considering upfront costs, maintenance, and the potential return on investment
- **Implementation plan – Systems building for the TCIAA network**, including the digitalization of data gathering

Source: ALG Analysis

Content

The technology deployment will entail rethinking airport layouts and integrating “On-the-Move” pax processing, with little stoppings points

International passenger terminal flow



Airports struggle with the fluctuating passenger demand associated with peak and off-peak holiday seasons

The enormous potential of technology could disrupt traditional airport operating models and transform the customer experience, while also enhancing efficiency, thus requiring lower investment in infrastructure

This technological development will enhance the passenger experience, essential for airports serving luxury tourist destinations; additionally, greater efficiency will reduce or delay the need for extensive infrastructure

Source: TCIAA, ALG Analysis

These are the latest tools introduced in international airports to disrupt traditional operating models and transform the customer experience

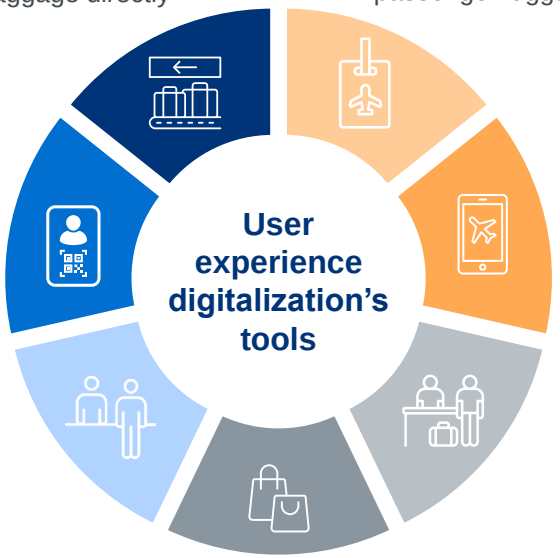
Tools for the Digitalization of Passenger Experience

Self-Bag Drop system

A self-service system that allows passengers to check their baggage directly

E-luggage tags

Electronic baggage tags allows to track the passenger luggage via smartphone



Digital Travel Credential (DTC)

A virtual credential derived from a state-issued passport or national ID

Airport App

Integrated travel apps to manage every aspect of the journey at airport terminals

Virtual queues

It allows booking a time to pass through security checks or virtual queuing for boarding

Remote check-in

Luggage is sent to the airport from home or hotel before departure through luggage pickup and checking services

Autonomous shopping

A shopping experience more autonomous for passengers, reducing waiting time and queues for travelers

All these tools embrace digital innovation to take a step forward to a enhance passenger experience, which follows that passengers spent time in airports by choice, not because of queues, check-in and controls

Source: ALG Analysis

Tools for the Digitalization of Passenger Experience (1/6)

Self-Bag Drop system

Description and objectives

- **Self Bag Drop (SBD)** is a self-service system that allows **passengers to check their baggage directly**. It involves scanning the boarding pass and passport, and checking-in luggage after attaching the baggage tag
- Since one machine can be configured for multiple airlines, these systems **enable more open space**, **reducing queuing** and ensuring a safe, secure, and hassle-free journey
- Besides, they **require fewer airline staff, allowing personnel to be allocated at other 'concerning areas'** across the airport
- With some processes **taking ~60s**, it helps **increasing the time that passengers spend in duty-free shops and food and beverage outlets**. Moreover, as more machines support more languages, airports can overcome communication barriers, providing a stress-free passenger experience

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	N/A	N/A	N/A	✓	✓

International best-practices

St. Maarten's Princess Juliana International Airport (SXM)

- With the completion of its new Departure Hall, SXM has included **Self-Bag Drop systems in a shared setting**, allowing multiple airlines to use it while still being able to customize functionality to each airline's unique requirements

Zurich Airport (ZHR)

- **ZRH integrated 20 self-service units** for baggage handling **in 2022**, which are available for SWISS, Edelweiss, Lufthansa and Austrian Airlines passengers, but other airlines are set to follow

Other examples

- At **Palma de Mallorca Airport (PMI)**, Air Europa is the only airline offering this service
- **Eurowings** provides it in 6 airports: 4 in Germany (BER, DUS, HAM and STR), in Stockholm (ARN) and Vienna (VIE)

SBDs at St. Maarten's Princess Juliana Int. Airport

SBDs at Zurich Airport

Source: ACI, Saint Maarten Airport, Zurich Airport, Palma Airport, Eurowings, ALG Analysis

Tools for the Digitalization of Passenger Experience (2/6)
Digital Travel Credential

Description and objectives

- **A Digital Travel Credential (DTC)** is a **virtual credential derived from a state-issued passport**. It is an exact digital representation of the electronic machine-readable travel document and contains the same information (biographical, biometrics), providing the same level of security as a physical passport
- It is **securely stored in the owner's smart device**, ensuring data integrity as it is derived directly from the national ID app and can only be shared with the owner's consent
- This technology **allows passengers to proceed check-in, immigration, and boarding without the need to show their passport**. At each step of the journey, AI-enabled tools link their unique facial features to their passport for instant verification
- Thus, **airport security processes are enhanced while the passenger journey is sped up**

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	N/A	✓	~	✓	✓

International best-practices

Aruba's Queen Beatrix Int. Airport (AUA)

- **Aruba Happy Flow** is an innovative process in which the passenger is only required to show the passport once, allowing to proceed through check-in, baggage drop-off, pass the border and boarding without showing it again

United States Airports

- US Customs and Border Protection has developed the **Mobile Passport Control (MPC) app**, which allows travelers to submit their photo, customs declaration and passport information to facilitate expedited re-entry
- Travelers with MPC gain access to dedicated lines reserved for them, ensuring seamless passage through immigration checkpoints

Other examples

- Using the enhanced Smart Gates in **Dubai Int. Airport**, pax registered go through passport control in a matter of seconds
- At **Tokyo Narita Int'l Airport**, **Face Express** enables seamless pax enrollment with biometric-enabled kiosks and auto bag drops

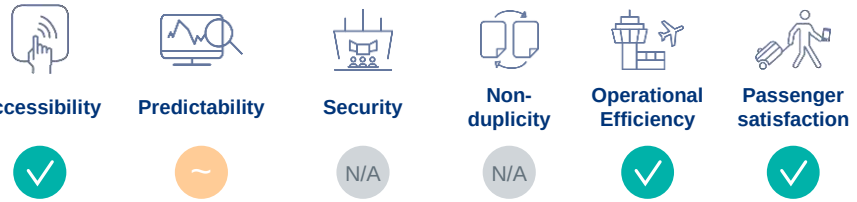
Source: Aruba Airport, US Customs and Border Protection, Dubai Airport, Narita Airport, ALG Analysis

Tools for the Digitalization of Passenger Experience (3/6)
Virtual queues

Description and objectives

- **Through mobile apps**, passengers may **reserve their positions in** check-in, security, passenger control, and boarding **queues being notified when it is their turn**
- Other solution is to book a time slot in which the passenger will go through the corresponding process
- This **reduces the time** passengers spend **queuing,** allowing them to spent more time shopping, at restaurants, or exploring other terminal areas
- Additionally, it provides **new opportunities for commercial retail and relaxation spaces** in terminals

Objectives



International best-practices

Better Virtual Queuing

- **Better Virtual Queuing** is an app that allows booking times for check-in, security, and passport control. It is available at multiple airports, including Seattle-Tacoma International, Los Angeles International Airport, JFK T4, Berlin Brandenburg Airport, and Miami International Airport, among others

Los Angeles International Airport (LAX)

- Los Angeles International Airport (LAX) allows to reserve a time slot to go through the screening area via a new pilot program, **LAX Fast Lane**, rolled out for United Airlines customers

Other examples

- **Delta** has launched virtual queuing **via the Fly Delta app**, allowing passengers to relax away from the gate area and **proceed to board when their specific seat, not just their flight, is boarding**

Source: Seattle Airport, Los Angeles Airport, JFK Airport, Miami Airport, Berlin Airport, Delta, ALG Analysis

Tools for the Digitalization of Passenger Experience (4/6)
Autonomous shopping

Description and objectives

- Shopping at duty-free stores in airports can be revolutionized to provide a **more autonomous experience for passengers**
- By simply tapping their credit or debit card at the entrance, passengers can choose the products, while the store tracks their movements and shopping patterns, automatically detecting the items they choose
- **Without the need for checkout queues**, sensors will detect the items purchased, charge the passenger's credit card accordingly, and print a receipt at the store's exit gate if required
- This **reduces the time passengers spent waiting to be attended to at stores**, while also providing a new shopping experience

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	N/A	N/A	N/A	~	✓

International best-practices

Hong Kong International Airport

- "Travelwell" is the **first autonomous shop at Hong Kong Int'l Airport**. Its advanced IoT technology tracks the products selected and charges customers automatically. They can simply tap their credit cards at the entrance, select the items, and leave the shop without stopping for cashier checkout

Dublin Airport

- The "Dublin Town To Go" store, at **Dublin Airport**, features innovative AI technology from contactless checkout solutions. To enter the store, passengers simply scan their debit or credit card; a combination of camera technology and weight-sensor-enabled shelving detects what each shopper is buying and charges their card once they exit the shop

Source: Hong Kong Airport, Dublin Airport, ALG Analysis

Tools for the Digitalization of Passenger Experience (5/6)
Airport App

Description and objectives

- Passengers can use **personal devices and integrated travel apps to manage every aspect of their journey** and consumer experience from reserving a table at a restaurant to manage virtual queues
- There are multiple options for customizing passenger experiences through apps, and airports are exploring new ways of doing business via e-commerce, with **platforms offering on-demand experiences** such as delivering food and drink in time for the flight, purchasing duty-free products online for delivery at the destination, as well as navigating through the airport
- Mobile apps could provide **real-time directions, gate information, and updates on amenities, helping passengers navigate the airport with ease**

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	~	N/A	N/A	~	✓

International best-practices

Frankfurt Airport

- **Frankfurt Airport** has launched an app designed to help passengers making optimal use of their time in the terminal buildings
- This app provides **information on getting to the airport**, **parking recommendations**, **shops and restaurants**, other service facilities, and **flight status updates**
- The app **guides passengers through the terminal to their gate**, highlighting nearby shops they might interested, and notifying them of any changes to their flight

Source: Frankfurt Airport, ALG Analysis

Tools for the Digitalization of Passenger Experience (6/6)

Remote check-in & E-luggage tags

Remote check-in

Description and objectives

- Airports can offer **personalized luggage pickup and checking-in services outside the terminal**
- This allows travelers to **move through the airport without their baggage**

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	✓	N/A	N/A	✓	✓

International best-practices - Cape Verde

- Remote check-in is implemented at two of Cape Verde's largest int'l airports, **Sal and Boa Vista**
- Travelers can **check-in and drop off their bags at hotels** and **head to the airport terminal luggage-free** when ready
- **Boarding passes and bag tags are issued by Cabo Verde Handling agents** at the travelers' holiday resorts, giving them more time to relax. The bags are then transported to the airport by the ground handling firm

E-luggage tags

Description and objectives

- **By 2030, paper baggage tags will be progressively replaced by electronic luggage tags,** which can be updated with passenger's journey details **and tracked via smartphone**
- Replacing paper tags with reusable electronic tags will not only **save passengers time spent checking-in** at the airport but will also have **environmental benefits**

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	N/A	~	N/A	✓	✓

International best-practices - Lufthansa

- **Lufthansa** offers the option of using an "electronic bag tag" thanks to the **BAGTAG** and **BagID** apps
- Passengers prepare the digital tags at home using their smartphones and attach them to their luggage. At the airport, they can directly check-in at the self-service bag drop kiosks or at the Fast Bag Drop

Source: Cape Verde Airports, Lufthansa, ALG Analysis

Content

To transform airport operations, it is essential to adapt and integrate new systems that support a collaborative and predictive environment

Digitalization of Airport Internal Management

- **Digitalization** is crucial for Airport Management as it **enhances operational efficiency by automating daily tasks** and eliminating information and process silos
- **Technological enablers** can be implemented to **support critical capabilities**, including the development, updating, and monitoring of the Airport Operating Plan, balancing demand and capacity, performance-based operations, and incident and emergency management
- **These systems are thought to complement the existing airport systems in order to increase the operational efficiency and predictability and evolve towards the Total Airport Management**

AOP tool

(Airport Operation Planning)*

DCB tool

(Demand Capacity Balance)

PMP tool

(Performance Monitoring Platform)

IEM tool

(Incidents & Emergencies)

**The Airport Operations Plan (AOP) ensures a unified airport operation plan among local stakeholders, providing real-time knowledge of the current situation and detecting deviations to facilitate early decision-making and corrections. Unlike AOP, Airport Collaborative Decision Making (A-CDM) focuses on achieving common situational awareness among stakeholders to create a pre-departure sequence that aligns with the AOP (A-CDM will be discussed in the next subchapter)*

Source: ALG Analysis

Digitalization of Airport Internal Management (1/4)
Airport Operations Planning

AOP Management tool & International best-practices

The **AOP Management tool should be the main system used to develop, update and monitor the Airport Operations Plan (AOP)** through mechanisms that reduce delays, knock-on effects and adverse situations.

The AOP Management should include, at least, the following functionalities:

- **Facilitate the development and sharing** of the Airport Operating Plan during the whole operational framework
- **Allow the real time monitoring of the operational performance** comparing predicted and real values
- **Enable the data sharing among stakeholders** and **consolidate all the relevant information** under a single rolling plan

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	~	✓	✓	✓	N/A

Spain: Palma Mallorca Airport AOP (AENA & Indra)

- The In-Airport paradigm introduces advanced methods for efficient aircraft process management, essential for airport business core and profitability. The **Airport Operations Plan (AOP)** ensures a unified operational plan among stakeholders, providing real-time situational awareness and facilitating early decision-making

UK: London Heathrow Airport AOP

- The **Airport Operations Plan (AOP)** at London Heathrow (LHR) enables airport stakeholders to share real-time information on arrivals, departures, and towed movements, improving efficiency and transparency. AOP provides accurate Target Take Off Times to Eurocontrol's Network Manager, enhancing European ATM Network planning and reducing slot delays

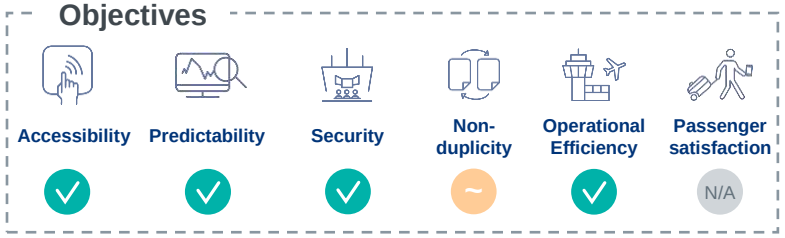
Source: Aena, Indra, London Heathrow, ALG Analysis

Digitalization of Airport Internal Management (2/4)
Demand Capacity Balance

DCB Management tool & International best-practices

The DCB Management tool facilitates the balance of demand versus capacity using pre-arrival and pre-departure sequences, as well as the available information of operational constraints to detect possible imbalance problems and propose solutions [usually in way of Target Times of Arrivals (TTA) and Target Times of Departure (TTD)]. The DCM Management tool should include the following functionalities:

- **Enhance the demand-capacity balance of the airport**, alerting when issues arise with demand and/or when insufficient capacity is reached
- **Allow real time management of the demand and capacity balancing,** and the detection/evaluation of possible issues resulting from adverse events
- **Enable the assessment of the impact of adverse events in the AOP** and the evaluation of what-if scenarios depending on the resolution



UK: NATS Demand Capacity Balancing (DCB)

- The **National Air Traffic Services (NATS)** in the UK uses the Demand Capacity Balancing (DCB) system to optimize air traffic flow and efficiently manage airport capacity. Integrating real-time data from weather, flight schedules and air traffic control, their DCB tool predicts demand and manages capacity to reduce delays and maintain smooth operations

USA: FAA Traffic Flow Management System (TFMS)

- The FAA's **Traffic Flow Management System (TFMS)** balances air traffic demand with airport and airspace capacity in the United States. By aggregating data from radar, flight plans, and weather reports, TFMS provides a comprehensive view of air traffic, enabling strategic and tactical management to mitigate congestion and optimize flow

Australia: Airservices Australia Demand Capacity Manager (DCM)

- **Airservices Australia uses the Demand Capacity Manager (DCM)** tool to manage air traffic flow and balance demand with airport capacity. DCM helps predict traffic patterns, optimize resource allocation, and implement measures like ground delays and rerouting to enhance efficiency and reduce delays at major airports

Source: NATS, FAA, Airservices Australia, ALG Analysis

Digitalization of Airport Internal Management (3/4)
Performance Monitoring Platform

PMP Management tool & International best-practices

Many of these Performance Monitoring Platform tools are custom-developed in-house by the airports to precisely meet their specific needs and requirements

Performance Monitoring must be supported by a platform that gathers, processes and manages all the available information to provide a quantitative vision of the operation in the form of dashboards for the real-time (especially conceived to be used in the NextGen ASOC) and the pre-tactical stages to inform about the operational expected throughput. The PMP tool should:

- **Facilitate the evaluation and monitoring of the airport performance** during the whole operational framework
- **Allow the AOP management** by alerting of possible imbalances in the short/mid term triggered by KPIs outside thresholds
- **Enable the evaluation of the operation** to improve the AOP for the next day and significative changes in the operation

Objectives

Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
✓	~	✓	~	✓	N/A

Belgium: Nallian for Air Cargo at Liege

- Liege Airport, a major cargo hub in Europe, has enhanced its efficiency, transparency and reliability **using the Nallian for Air Cargo suite**. This data-sharing platform, coupled with collaborative applications, allows the airport and its stakeholders to operate seamlessly. With over 700,000 tons of cargo annually, Liege Airport aims to lead Europe by leveraging a cloud-based platform for secure and integrated operations

UK: Heathrow Airport's Airport Operations Centre

- **Heathrow Airport's APOC** employs a sophisticated performance monitoring platform to oversee airport operations. It features real-time dashboards and pre-tactical planning tools that track performance metrics. The platform enhances operational efficiency by providing comprehensive data analysis. It supports proactive decision-making and helps manage capacity and resources effectively, ensuring optimal airport performance

Source: ACI, Liege Airport, London Heathrow Airport, ALG Analysis

Digitalization of Airport Internal Management (4/4)
Incidents and Emergencies

IEM Management tool & International best-practices

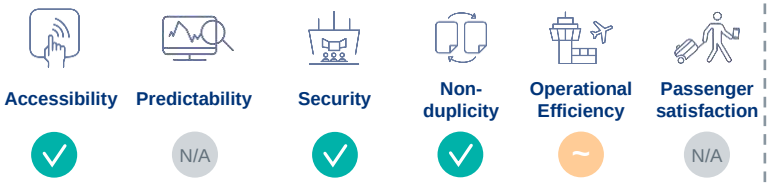
The IEM is a new way of operating based on airport systems predictability for aircraft, passenger and baggage flows, and which also requires the proactive management of adverse events.

Currently, the TCIAA manages any of those events manually, which involves multiple trivial tasks that often interfere with crucial stakeholder activities.

For that reason, it is highly **recommended to implement an Incidents and Emergency Management tool,** which provides a single solution to reduce the complexity of managing adverse events. The IEM tool should:

- **Centralize the management** of adverse events
- **Allow collaborative on-time resolution**
- **Automate the adverse events response** and monitoring

Objectives



San Francisco Airport: Veoci

- **Veoci** is a performance monitoring platform that has been adopted by several major international airports, including San Francisco International Airport and Incheon International Airport. The platform provides a centralized solution for managing incidents, emergencies, and business continuity
- Key features of Veoci include incident reporting, resource management, communication tools, and advanced data analytics. This comprehensive platform allows airports to streamline their response to adverse events, improve collaboration, and gain valuable insights to optimize their operations

Sydney Airport: Noggin

- **Noggin** is another incident and emergency management platform utilized by airports around the world, such as Sydney Airport and Auckland Airport. Noggin offers a comprehensive suite of modules for planning, response, and recovery during disruptive events
- Its capabilities include incident logging, resource tracking, communication management, and robust post-incident analysis. This holistic approach enables airports to effectively prepare for, mitigate, and learn from various types of incidents that can impact their operations

Source: ACI, San Francisco Airport, Sydney Airport, ALG Analysis

Content

A-CDM is an initiative developed to improve efficiency and punctuality of airport operations through collaboration between all stakeholders

A-CDM description and value proposition

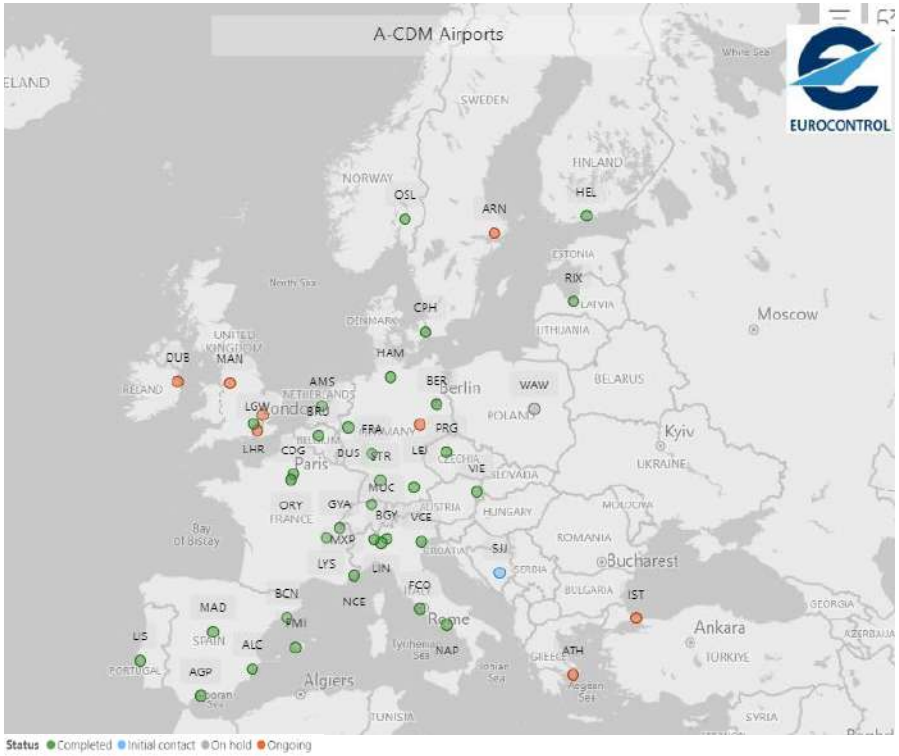
Description

- **ICAO describes A-CDM as** a **methodology that fosters cooperation and information exchange between** key airport **stakeholders** to **improve decision-making** and **optimise airport operations**. This includes improving capacity planning and management, as well as reducing delays and increasing operational predictability
- The A-CDM concept **emerged in Europe in response to the need to improve operational efficiency at congested airports.** The **initial development** of A-CDM was carried out **under the SESAR** (Single European Sky ATM Research) **initiative**, which is a European project aimed at modernising air traffic management in Europe

Value Proposition

- The purpose of A-CDM is to **improve** the **timeliness and efficiency of airport operations through collaboration** and the sharing of accurate and timely information. **By sharing real-time data**, stakeholders can make more informed decisions, **leading to better utilisation of available resources**, reduced delays and a smoother passenger experience

Current European examples



A-CDM involves integration of information systems and adoption of standardised procedures for data exchange, in addition to close collaboration between all actors involved, staff training and adaptation of technological systems

Source: ICAO, Eurocontrol, ALG Analysis

The A-CDM model proposes a work culture based on transparency and exchange of operational data and information from every player

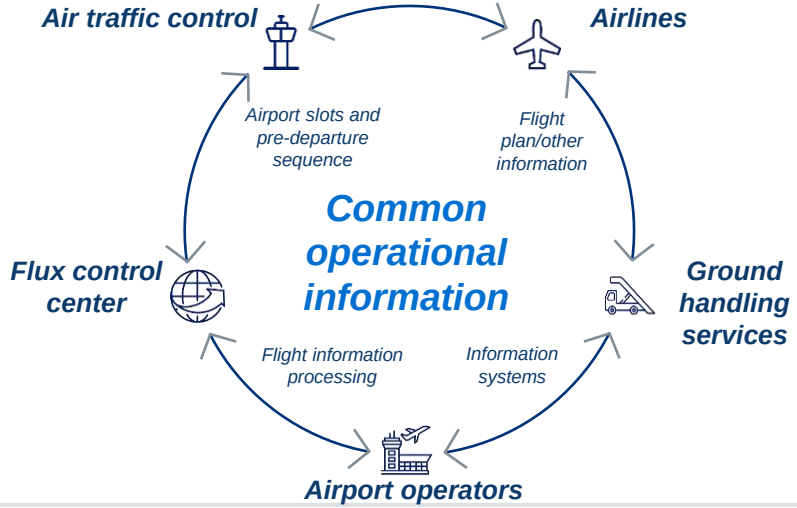
Collaborative communication with stakeholders

Main characteristics and information shared with A-CDM

It interconnects the data processing systems of the different players

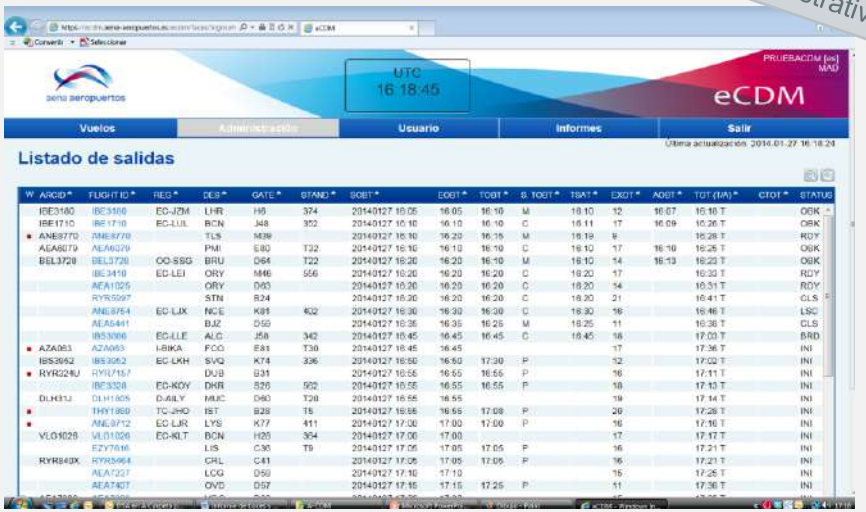
Provides a **single set of common** flight status **data**

Sets up a **platform for information exchange** between stakeholders



Example of a user interface of an A-CDM platform

Illustrative



- Different data and **information** is **published** and shared **by all the players involved in the airport and air operations**
- Having a **unique and centralized data base limits** the **potential errors** that could arise from not having updated data
- **Any change, delay, cancellation or other issues are posted** in the A-CDM collaborative tool, so preparation and **airport organization results more efficient**

Source: Eurocontrol, Aena, ALG Analysis

The A-CDM information exchange supports decision making for each of the key stakeholders and facilitates the model implementation

Needs for a successful implementation of A-CDM

- Having an A-CDM platform
- Deliver available information in real time
- Standardising formats for information to be transmitted and stored
- Alerting stakeholders to events or calculations by means of messages
- Directly linking generic and local A-CDM processes that trigger events
- Employ an interactive and independent Human-Machine Interface (HMI)

Without information exchange, the A-CDM methodology cannot be properly implemented, hindering the ability to obtain a comprehensive point of view of the airport's activities

Source: ALG Analysis

The information homogenisation guarantees its correct interpretation and avoids misunderstandings among the parties involved

Collaborative philosophy and data shared via A-CDM

It is necessary to **homogenise the format of the data shared** among all players **to avoid inconsistencies and errors** in the information shared. This is why the **use of universal standards is required**:

- The standards used should **focus on ensuring safety and reliability requirements to avoid creating oversaturation and unnecessary cost** increases
- The **format** to be used for the messages to be exchanged **should be agreed between all players**
- Besides, it is **recommended that existing airport information systems (AODB, RMS and FMS) are used** to take advantage of established interconnections and current information sharing

Operational data required by the A-CDM Platform

Planning data
- Flights, airport resources for aircraft
- Aircraft messaging

Administration data
- User profiles
- Data access permissions
- Functionalities

Post-execution data
- Consolidated flight data (times, resources used, messaging)

Real-time data
- Flights of the day
- Airport resources for those flights
- Real-time messages from those flights

Common data
- Aeronautical data (airlines, aircraft type, airports, etc)
- Airport data (resources, handlers, etc)

This collaborative working philosophy involves a learning process in which one of the key objectives is to build trust by sharing operational information with players that could be competitors

Source: ALG Analysis

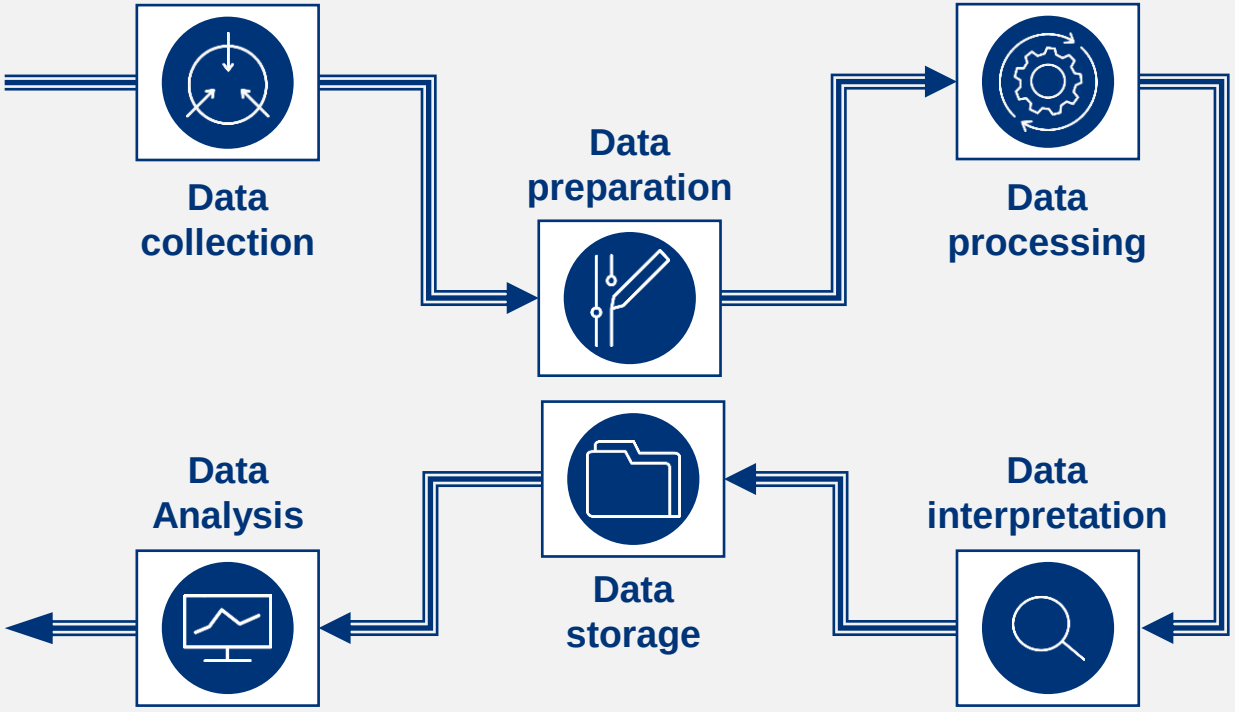
The data processor is one of the main elements to ensure that real-time estimates are available for each flight

Data processor role and data processing phases

The **data processor** is in charge of taking the information coming from the different actors to **calculate the target times according to the evolution of the flight**:

- **Prioritise the data according to each of the sources** and as established in the A-CDM Operational Procedures Manual
- **Analyse the stored information for statistical purposes** and for the improvement of the stored standard values
- **Communicate** any **potential issue to** the applicable **stakeholders**

Stages of data processing



In addition to a collaborative work philosophy among all parties, ensuring the data processor performs as expected would translate into good risk management by preventing potential issues thanks to agile communication

Source: ALG Analysis

Interconnectivity enables the exchange of A-CDM information in an automated way between all players

Potential benefits of A-CDM

In order for A-CDM information to be shared in real time, **it is necessary for all players involved in the operation to always have the A-CDM information Platform available. Interconnectivity of all systems is the most secure and efficient way to achieve this**, either directly or using one of the existing channels

Benefits of players' integration into A-CDM	Accessibility	Predictability	Security	Non-duplicity	Operational Efficiency	Passenger satisfaction
Optimisation of response times: compliance with procedures within tolerances	N/A	✓	✓	✓	✓	~
Automation: eliminating human error	✓	N/A	✓	✓	✓	N/A
Standardisation of information: same format and characteristics for all data collected	✓	~	✓	✓	✓	N/A
Transparency of the operation: full knowledge for all stakeholders	~	✓	✓	✓	✓	N/A
Instant access to information: available to ramp staff, airline CCOs and airport staff	✓	✓	✓	~	✓	~
Improved communication between actors: use of automated channels for easy and timely communication	✓	N/A	✓	✓	✓	N/A
Information security: each company will manage who will see operational information and how they will see it	N/A	✓	✓	✓	✓	N/A

Source: ALG Analysis

In airports where A-CDM platform has already been deployed, several savings arise in terms of time, environmental impact and cost

Main improvements from A-CDM

Improvements	Descriptions	International Examples
Fuel savings	After the implementation of the A-CDM platform and the **improvement of efficiency in airport and airline operations**, the amount of **fuel consumed decreases**. Besides, **there appears considerable fuel cost savings**	15 – 40 kg/ATM of fuel saved *(2.5-3.5 MUSD)*
CO_2 savings	Moreover, along with fuel savings, **less CO_2 is emitted to the atmosphere, generating CO_2 savings for both airport operator and the aircraft operator, in line with the environmental objectives** and recommendations **of international organisms** such as ICAO, IATA or ACI	40 – 120 kg/ATM of CO_2 not emitted
Taxi-time reduction	Thanks to airport and aircraft movement optimization, the airport enjoys a **taxi-time reduction**, which, **in addition to TOBT and TSAT higher accuracy**, translates into **better punctuality for both type of ATMs, departures and arrivals**	2 – 4 mins reduction of mean taxi-time

Ultimately, these improvements lead to significant cost reductions from fuel savings, CO_2 reductions where ETS[1] applies, decreased costs from congestion and delays, and less infrastructure due to enhanced operational efficiency

Source: Airport Collaborative Decision Making (Eurocontrol), ALG Analysis
Note: Four airports of +25Mpax had been selected to indicate the different parameters (Brussels, Munich, Paris Charles De Gaulle, Frankfurt)
[1]: Emissions Trading System, European Carbon-Credit price regime

Content

The technology development plan considers strategic actions, objectives, and action blocks to be developed over the coming years

Rationale of the action plan

4 Actions

- Technology Needs Assessment and Systems Building
- Digitalization of Passenger Experience
- Digitalization of Airport Internal Management
- Implementation of Collaborative Tools for Airport Operations (A-CDM)

6 Objectives

- Accessibility
- Predictability
- Security
- Non-duplicity
- Operational Efficiency
- Passenger satisfaction

4 Action Blocks

Planning and Assessment

1. Prioritize tools and processes for digitalization
2. Analyze internal processes
3. Requirement analysis
4. Engage stakeholders for collaboration

Tendering and Procurement

1. Conduct benchmarking against industry standards
2. Conduct technology procurement
3. Evaluate and select vendors and partners
4. Negotiate contracts and agreements

System Development and Integration

1. Staff Training and capacity building
2. Integration and customization
3. Ensure seamless integration with existing systems
4. Test and validate system performance

Implementation and Monitoring

1. Automate routine tasks and processes
2. Monitor and evaluate performance and impact
3. Continuously monitor for improvements
4. Collect and analyze feedback for optimization

Timeline

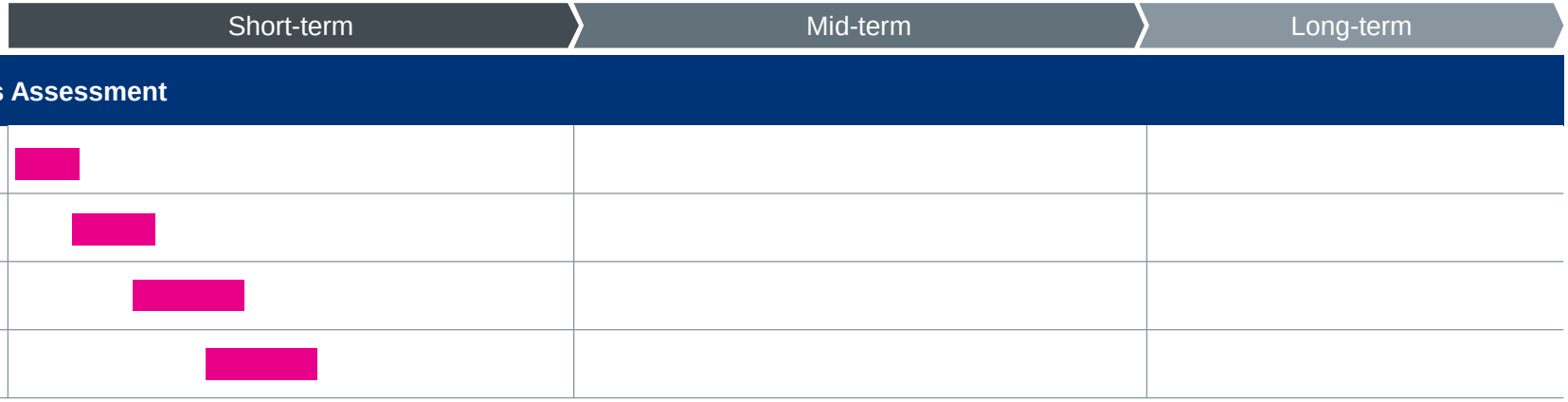
Short-term	Mid-term	Long-term

Source: ALG Analysis

Action Plan Roadmap:
Technology Needs Assessment and Systems Building

Roadmap for Technology Needs Assessment and Systems Building

TCIAA PLS GDT/XSC SLX/NCA



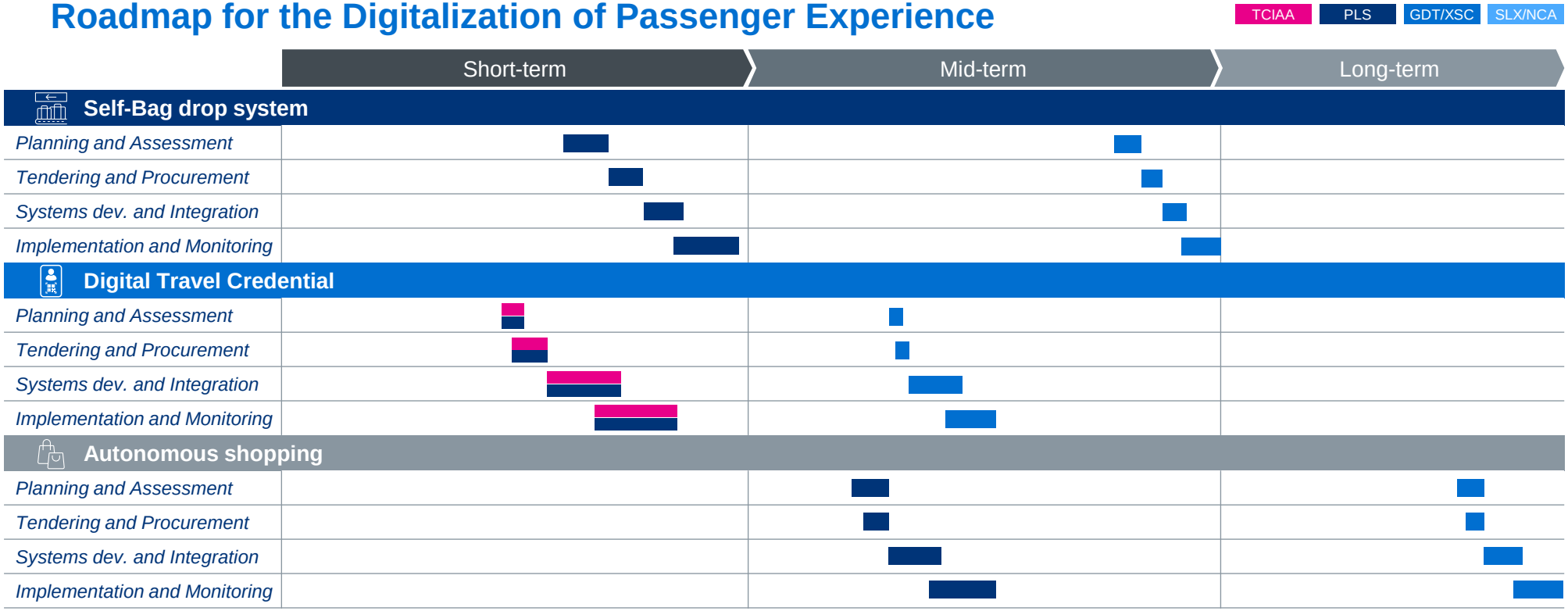
- Technology Needs Assessment and Systems Building **is implemented across the entire organization** to identify new technologies to implement within the following actions: Digitalization of Passenger Experience, Airport Internal Management and Implementation of Collaborative
- It requires a **structured and methodical approach which includes** analysis of the current technology, identification of the future requirements, a comprehensive gap analysis, and finally its implementation
- It should be **conducted in the short-term** to anticipate global and regional market trends and determine the operational and financial scope of the TMP

The Technology Needs Assessment and Systems Building will ensure the TCIAA stays ahead of market trends by strategically implementing new technologies that enhance operations efficiency and improve overall performance

Source: ALG Analysis

Action Plan Roadmap:
Digitalization of Passenger Experience (1/2)

Roadmap for the Digitalization of Passenger Experience

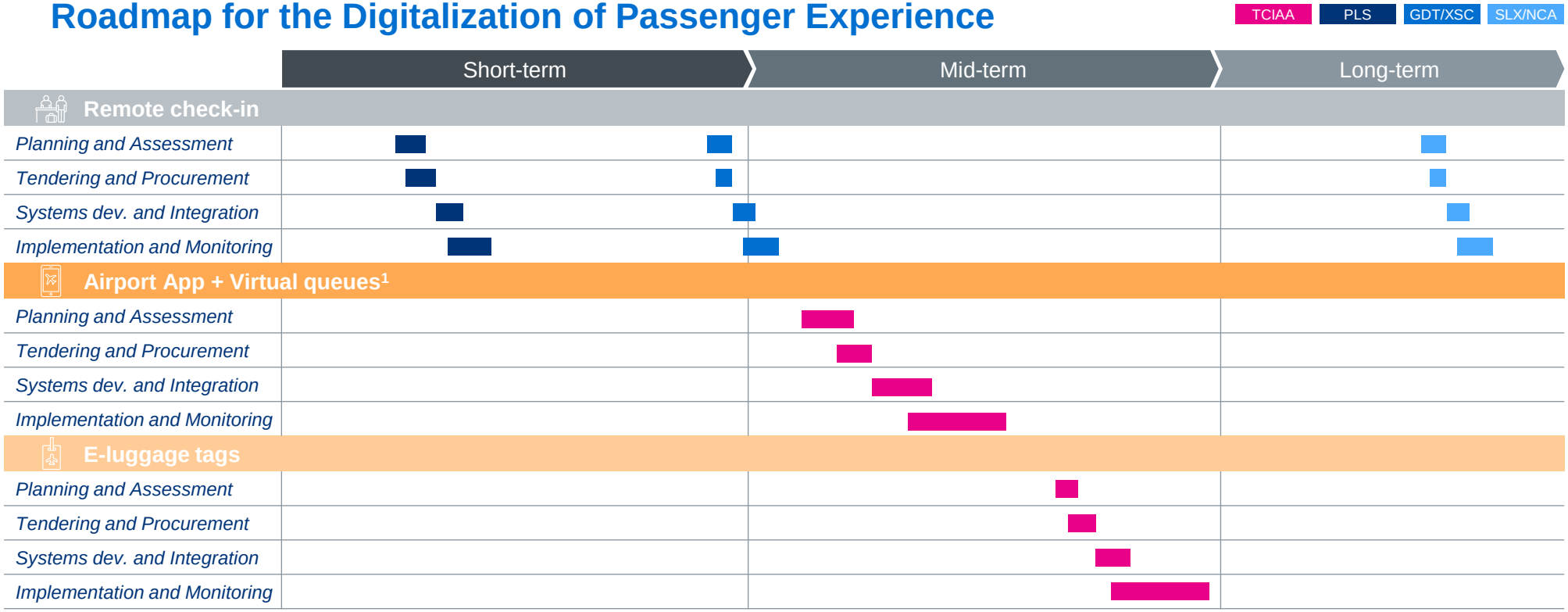


- The **digital travel credential** would be **developed by the TCIAA in collaboration with the Government**, primarily for security reasons
- After the implementation of most of these tools in Providenciales (to be mainly developed by the private operator once the new terminal building is developed), **Grand Turk (GDT) and South Caicos (XSC) should be prioritized in the mid-term,** considering the anticipated significant increase in international passenger volume. No further developments are planned for the other domestic airports

Source: ALG Analysis

Action Plan Roadmap:
Digitalization of Passenger Experience (2/2)

Roadmap for the Digitalization of Passenger Experience



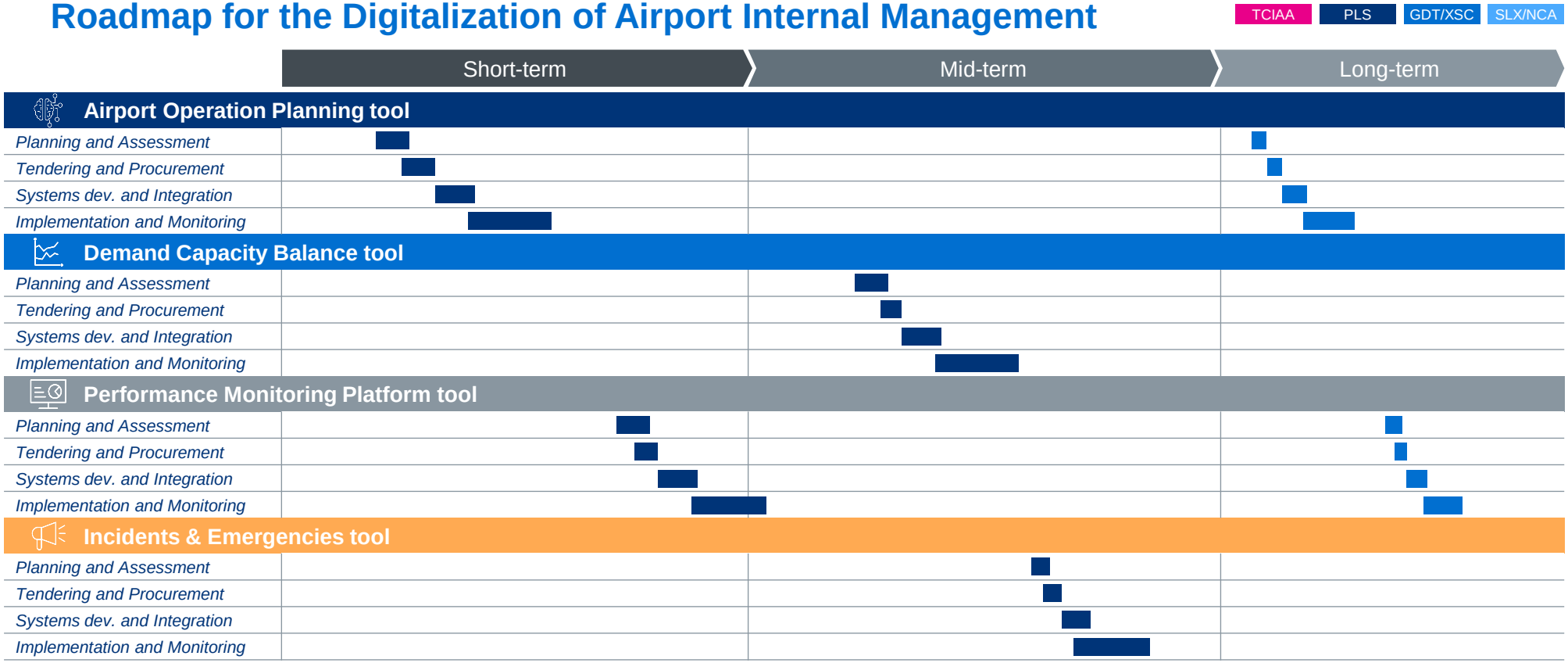
- **Remote check-in provides significant added value for high-yield tourists** and was specifically requested by several hoteliers during ALG on-site visits, so it should be considered as one of the priorities for improving passenger's experience through the airport network
- TCIAA should **lead the implementation of a global airport app and e-luggage system** across the entire network, in collaboration with the private operator of PLS

Source: ALG Analysis

[1]It is considered that "Virtual queues" will be a service offered within the Airport App

Action Plan Roadmap:
Digitalization of Airport Internal Management

Roadmap for the Digitalization of Airport Internal Management

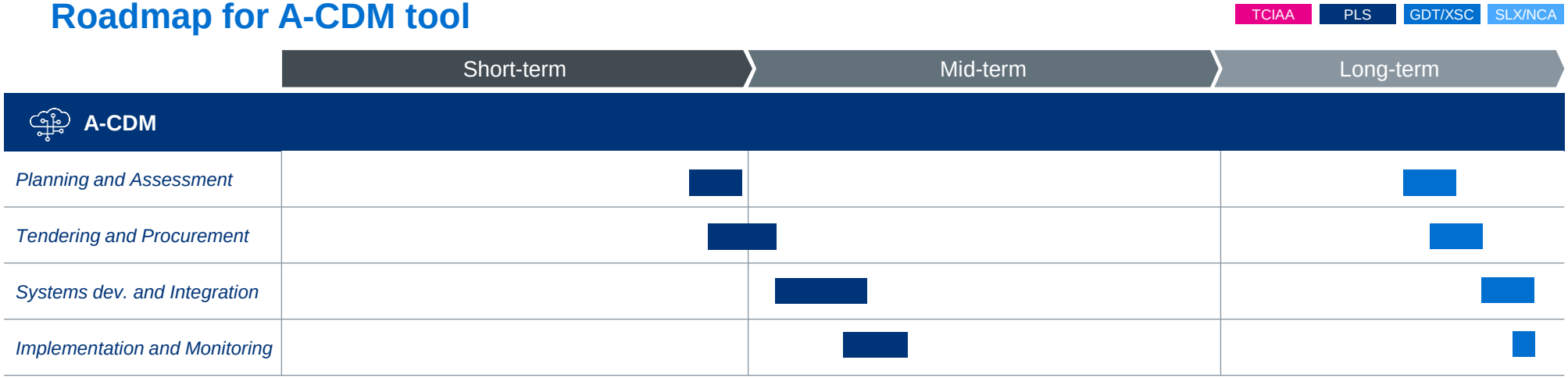


These tools primarily apply to PLS, with long-term plans for GDT and XSC, even though these will be partial developments due to the expected traffic volumes; no further actions are planned for other locations

Source: ALG Analysis

Action Plan Roadmap:
Implementation of for A-CDM tool

Roadmap for A-CDM tool



- **A-CDM involves the integration of various systems, making it a complex process**
- It requires a **structured approach** including thorough analysis, tendering, comprehensive training, implementation and continuous monitoring; and should be led by PLS private operator in collaboration with the rest of the stakeholders involved, including the TCIAA
- **The implementation of A-CDM will follow the Airport Operations Plan (AOP),** ensuring both components integrate the most advanced concepts and guidelines
- In the long-term, **A-CDM may be applied to Grand Turk (GDT) and South Caicos (XSC),** although with a **lesser degree of development** compared to the main airport. No additional developments are expected beyond this

Although the process is complex, it will significantly enhance operational efficiency at PLS, especially during peak hours; in the long-term, efforts will be made to replicate this on a smaller scale at GDT and XSC

Source: ALG Analysis

Content

KPIs within these 5 Key Performance Areas can be used to assess the progress and success of the Technological Development Plan's objectives

Key Performance Areas (KPAs) for the Technology Development Plan

IT Quality	Traffic	Security	Passenger/User Satisfaction	Profitability
IT Quality KPIs focus on measuring the **performance, effectiveness**, and **availability** of the existing technology	**Traffic** KPIs measure the **frequency and feature usage** providing insights into **passenger/user engagement** and **popularity**	Tracking **Security** metrics is **crucial** in digital processes to **protect sensitive data, detect and respond to security threats,** and **ensure compliance** with industry standards	**Passenger/User Satisfaction** indicators help understand **how delighted users or passengers are** with the apps, services, systems, etc.	**Profitability** metrics help **control IT expenditures**, **optimize resource allocation** and make informed investment decisions

As technology continues to evolve, it is important to monitor these KPAs and consider whether it is necessary to track additional areas or KPIs, aiming to measure the overall success and goal achievement of the technology development

Source: ALG Analysis

KPIs must be “SMART” (specific, measurable, achievable, relevant and timely) to review systems and service performance

Key Performance Indicators (KPIs) for the Technology Development Plan

	KPI	Measure	Unit
IT Quality	# of total incidents	Number of total issues reported by passengers, airport employees or users	#
	# of open incidents	Number of issues not yet resolved reported by passengers, airport employees or users	#
	MTRI	Meantime To Resolve an Incident (MTRI) is the average time it takes for the support team to resolve reported issues	*h*
	# of critical incidents	It counts the times a system or app is no longer performing as it should and needs to be fixed as soon as possible to prevent further disruption	#
	MTTR	Mean Time To Repair (MTTR) measures the time it takes for a technician to resolve their repair requests	*h*
	ATBF	Average Time Between Failures (ATBF) measures the average time between system failures and in which it is not operational	*h*
	Server downtime	Server downtime measures the total time an app or system is unavailable due to IT issues, from routine maintenance to unforeseen events	*h*
Traffic	# of pax/users	Total passengers, users or employees that have used an app, system or service since the begging of operations of the technology in question	#
	# of new pax/users	Total new passengers, users or employees that have used an app, system or service since a stablished reference period (last month/year/..)	#
	# of pax/user per system	Total passengers, users or employees that have used an app, system or service per unit of the technology in question	#
	Churn rate	Percentage of passengers/users who stop using a service or app	%

	KPI	Measure	Unit
Security	# of security incidents	This metric quantifies the count of security breaches, vulnerabilities or incidents related to cybersecurity risks	#
	Security-rel. downtime	Security downtime measures the total time an app or system is unavailable due to security issues related to cybersecurity risks	*h*
Passenger/ User Satisfaction	Overall satisfaction	General satisfaction of passengers/users with the apps, systems and services provided. It is rated on a predefined scale (1 to 5)	*1-5*
	Ease of use	Evaluates how user-friendly and accessible the apps, systems and services are for passengers or users. It is rated on a predefined scale (1 to 5)	*1-5*
	Availability of staff	Measures the promptness and presence of staff members when passengers require assistance	*1-5*
	Helpfulness of staff	Assesses the effectiveness and friendliness of staff in providing assistance and resolving issues	*1-5*
Profitability	Deployment cost	Total expenses incurred in the process of implementing and integrating new technology or systems	*$*
	IT cost/pax	Total costs allocated per passenger, related to IT infrastructure, software, support, and services	*$*
	Maintenance cost/pax	Total maintenance expenses allocated per passenger, including maintaining and repairing facilities, equipment, and technology systems	*$*
	IT ROI	IT Return on Investment (ROI) assesses the value and effectiveness of the investments in technology	*%*
	IT Budget variance	IT budget variance measures the difference between actual IT expenses and the budgeted amounts	*%*

Source: ICAO, ALG Analysis

Note: Not all the above KPIs apply to every proposed tool. For each action block, system, service, app it must be assessed which ones are suitable for measuring its performance

ALG

Pere Mas
pmas@alg-global.com

Ana Gómez
agomez@alg-global.com

alg-global.com

BARCELONA
Roc Boronat, 133, 10th Floor
08018 Barcelona, Spain
T +34 934 632 300