ACI EUROPE
AIRPORTS COUNCIL INTERNATIONAL

Regional Airports and Innovation

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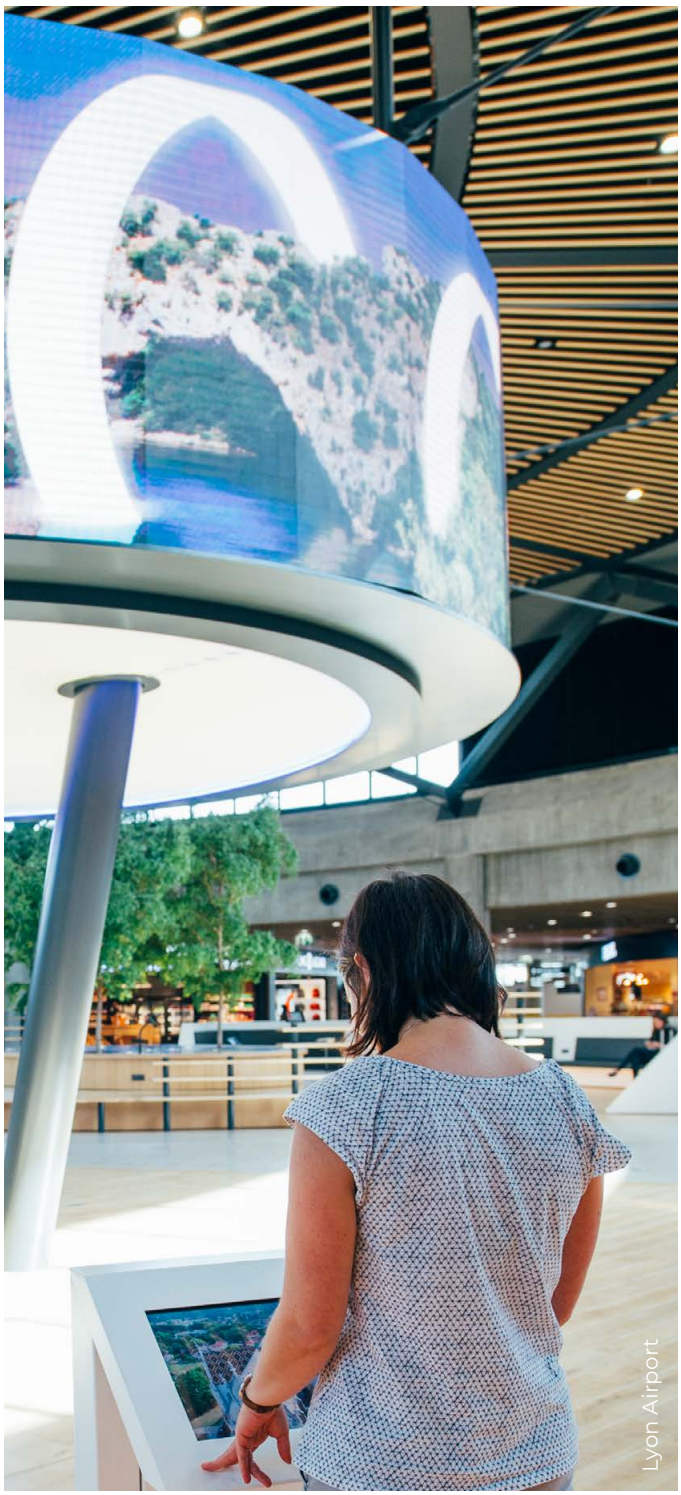
1. Preface

Innovation is at the heart of the aviation industry's transformation, and regional airports are at the forefront of this evolution. As the aviation sector faces increasing environmental concerns, rapid technological advancements, and shifting passenger needs and expectations, regional airports serve as innovation centres where new technologies and operational models can be tested, refined, and eventually scaled.

This document explores the role of regional airports[1] in driving innovation and fostering collaborative networks in the innovation system, the types of innovation shaping their future, and the strategies required for them to thrive in an evolving landscape. It also provides actionable recommendations to support and accelerate innovation within regional aviation.

This document is intended primarily as a policy framework rather than a technical or technology-specific report. Its purpose is to provide insights, considerations, and strategic guidance on how regional airports can serve as enablers of innovation and regional development. While technology is referenced as a critical enabler, the emphasis here is on policy design, institutional arrangements, and the broader ecosystem that supports innovation in regional contexts. This perspective aims to inform stakeholders—including policymakers, airport authorities, and regional planners—on how to shape policies that position regional airports as active contributors to innovation and economic resilience.


Lyon Airport

1 An airport should be considered as regional if it:
- Primarily serves short and medium range routes and
- Primarily serves point-to-point destinations

2. Introduction

Innovation is not a luxury—it is a necessity for the long-term viability of regional airports[1]. These airports provide critical connectivity for businesses, tourism, and communities, often serving remote or underserved areas. Unlike major hub airports, regional airports operate with tighter margins and must be more agile in adopting new solutions.

Innovation is central to the growth and competitiveness of any industry, and in aviation, it enhances operations, passenger experiences, and sustainability efforts. For regional airports, innovation is a strategic necessity. By implementing cutting-edge technologies and innovative practices, regional airports not only enhance their functionality but also strengthen their roles in the broader transportation ecosystem.

THIS DOCUMENT WILL:

DEFINE INNOVATION IN THE CONTEXT OF REGIONAL AIRPORTS.

EXPLORE TYPES OF INNOVATION (TECHNOLOGICAL, OPERATIONAL, SUSTAINABILITY, CUSTOMER EXPERIENCE, BUSINESS MODELS, ORGANISATIONAL).

EXPLAIN WHY REGIONAL AIRPORTS ARE INNOVATION CENTRES.

PRESENT TRENDS SHAPING INNOVATION AT REGIONAL AIRPORTS.

PROVIDE A COOKBOOK FOR INNOVATION PROJECTS.

PROVIDE ADDITIONAL CONCRETE RECOMMENDATIONS FOR REGIONAL AIRPORTS.

HIGHLIGHT SELECTED CASE STUDIES OF INNOVATION PROJECTS AT REGIONAL AIRPORTS.

1 Innovation has proven to be the only way to sustainable growth. This is indicated by the European Central Bank, identifying innovation as one of the fundamental pillars for economic progress and concluding that the application of new technologies allows more to be produced with the same number of factors of production, and that this has a direct impact on wages and business profitability (European Central Bank: How does innovation lead to growth?)

3. What is Innovation?

In the aviation industry, innovation refers to the introduction of new ideas, technologies, processes, products, or services that enhance efficiency, safety, security, sustainability, and the passenger experience.

In the context of airports, innovation is not solely about adopting cutting-edge technology but also about rethinking how airports operate, engage with communities, and respond to industry challenges. Regional airports, in particular, are uniquely positioned to lead in these areas due to their flexible, agile environments, which foster the rapid adoption and testing of novel solutions.

INNOVATION CAN TAKE VARIOUS FORMS:

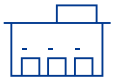
Incremental

Small, continuous improvements (e.g., streamlined security processes).

Disruptive

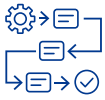
Major breakthroughs that redefine the industry (e.g., electric aircraft, AI-driven operations).

AT REGIONAL AIRPORTS, INNOVATION CAN MANIFEST IN:



Premises

(infrastructure, sustainability, smart terminals).



Processes

(automation, security, baggage handling).

People

(staff training, passenger experience, accessibility).

4. Types of Innovation at Regional Airports

Regional airports adopt several types of innovation, each addressing specific needs while enhancing the overall airport ecosystem. Key categories include:

TECHNOLOGICAL INNOVATION

Technology is transforming every aspect of airport operations. Innovations include:

Biometric Identification & Contactless Processing

Utilising facial recognition, iris scanning, and fingerprint ID for seamless check-in, security, and boarding.

AI & Machine Learning

Predictive maintenance, passenger flow management, chatbot assistants.

Digital Twins

Real-time virtual replicas of airport infrastructure for better decision-making and efficiency.

5G & IoT Connectivity

Smart sensors, real-time monitoring of baggage, aircraft, and facilities.

Automated Baggage Handling & Security

AI-powered baggage screening, robotic sorting, and CT scanners for faster security checks.

SUSTAINABILITY INNOVATION

With a growing emphasis on environmental responsibility, many regional airports are at the forefront of adopting sustainable practices, setting an example for larger airports to follow. Regional airports have a unique opportunity to lead in sustainable aviation by implementing:

New energy aircraft

Charging stations for electric and hybrid-electric aircraft and infrastructure for hydrogen-powered planes.

Sustainable Aviation Fuels (SAF)

Partnerships with airlines to use SAF.

Carbon-Neutral Operations

Solar panels, wind turbines, waste management, and net-zero terminal buildings.

Green Ground Handling

Fully electric ground vehicle fleets, hydrogen-powered ground power units (GPU) in operation, sustainable de-icing fluids, sustainable taxing and taxibots.

OPERATIONAL INNOVATION

Innovation is making regional airports more innovative and efficient:

AI-Driven Baggage Handling

Air Traffic Management (ATM)

Digital towers, automated runway surveillance.

Predictive Analytics

Enhance ground operations and allow smoother coordination among the airport's different stakeholders.

Lean Airport Management

Optimising turnaround times, baggage handling, and gate operations through IoT-based monitoring solutions

CUSTOMER EXPERIENCE INNOVATION

Passengers expect a seamless, tech-enhanced travel experience:

Hyper-Personalisation

AI-driven passenger recommendations, targeted retail offers, and innovative wayfinding.

Smart Kiosks & Mobile Apps

Self-service check-in, baggage drop, and real-time flight updates.

Seamless Intermodal Connectivity

Integrated ticketing and baggage transfer with trains, buses, and taxis.

Digital services and contactless solutions, real-time mobile updates

BUSINESS MODEL INNOVATION

To remain financially viable, regional airports are exploring new revenue models:

Non-Aeronautical Revenue Streams

Expanding retail, hospitality, and logistics services.

Public-Private Partnerships (PPPs)

Collaborative funding for innovation projects.

Smart Airport Cities & Aerotropolis Concepts

Mixed-use developments around airports for commercial, residential, and industrial use.

ORGANISATIONAL INNOVATION

According to UNESCO[1], it refers to the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.

Organisational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to non-tradable assets (such as non-codified external knowledge), or reducing the costs of supplies.

New Business Practices

Implementing flexible work practices, agile management methods, and data-driven decision-making processes.

Workplace Organisation

Redesigning workspaces for better collaboration, adopting remote work models, and boosting employee engagement through digital tools.

External Relations

Strengthening partnerships with local governments, airlines, and other stakeholders to foster collaboration and improve service offerings.

Improved Communication Channels

Introducing digital platforms for better internal and external communication, improving coordination between departments and stakeholders.

Strategic Decision-Making

Implementing innovative management structures and decision-making processes to enhance responsiveness and adapt to changing market conditions.

This focus on organisational innovation helps regional airports streamline their operations, improve staff productivity, and enhance their capacity to manage complex challenges.

1 UNESCO Glossary terms

Malta Airport

SOCIAL INNOVATION

Regional airports play a vital social role by connecting smaller communities and supporting the local economy. Regional airports must enhance their social impact:

Accessibility and Inclusion Improvements

Enhanced facilities for all passengers, regardless of their unique characteristics.

Noise Reduction Initiatives

New flight paths, soundproofing for nearby communities.

Enhanced Working Conditions for Airport Staff

Training programs, wellness initiatives.

5. Why Regional Airports Are Innovation Centres

Regional airports are vital centres for aviation innovation due to their operational scale, flexibility and adaptability. These airports offer controlled environments for testing and refining new ideas, technologies, and practices. Some key contributions of regional airports as innovation centres include:

Skellefteå Airport

Testbeds for New Technologies

Regional airports often serve as testing grounds for emerging aviation technologies, which may eventually be scaled up to larger airports. Less complex environments allow for controlled testing of innovations.

Rapid Iteration & Feedback

Due to their smaller operational scale, regional airports offer a faster feedback loop, allowing them to adapt and refine innovations more quickly. The close-knit nature of regional airports, with stakeholders, also facilitates a collaborative approach to innovation, where feedback from passengers, carriers, and other stakeholders, as well as public authorities, can be readily incorporated into the development process.

Operational Flexibility and Early Adoption

Regional airports are more adaptable to implementing emerging technologies due to a simplified organisation and infrastructure. Early adoption enables regional airports to position themselves as leaders in innovation, often setting standards that can later be adopted by larger hubs.

Controlled Testing Environments

The simpler operational environments at regional airports make them ideal for conducting controlled trials of new technologies. Regulatory bodies often use these airports as sandboxes for testing compliance and industry standards, allowing for relaxed regulations in controlled environments.

Scalability of Innovation

After successful trials at regional airports, innovations can be expanded to larger hubs and across the aviation industry.

Boosting Regional Economies and Expanding Aviation Networks

Investing in innovation at regional airports not only benefits aviation but also strengthens the surrounding community. Regional airports serve as gateways that connect regional economies to global markets, attracting tourists, generating jobs, and drawing investment. Additionally, these airports support the expansion of Europe's air network by enhancing connectivity and relieving congestion at major hubs.

6. Current Trends in Regional Airport Innovation

This section outlines a selection of current trends in regional airport innovation, highlighting emerging practices and approaches that illustrate the evolving role of airports in regional development. The trends presented here are not exhaustive but serve to illustrate the diversity of innovation activities taking place across different contexts.


Stuttgart Airport

5G and IoT Connectivity

The rollout of 5G and increased adoption of IoT devices enable smarter, more responsive airport operations. Real-time data collection and automated monitoring enhance operational efficiency while improving the passenger experience by supporting connected devices for easy navigation and communication.

Digital Twins and Predictive Analytics

The use of digital twins and predictive analytics enables real-time monitoring, providing valuable insights that allow for proactive decision-making and predictive maintenance. By simulating airport infrastructure and systems, airports can optimise operations, reduce costs, and minimise disruptions.

AI and Machine Learning

AI and machine learning applications are expanding in airport operations, from improving customer service through chatbots to predicting and managing flight disruptions and monitoring the turnaround process. Predictive analytics enables airports to anticipate operational issues and respond in real time, enhancing resilience and efficiency.

Autonomous Airport Systems

The concept of autonomous airport systems is gaining traction as regional airports seek to optimise efficiency while managing limited human resources. These systems include automated airside vehicles, AI-driven scheduling tools, and remote-operated control towers—all designed to reduce operational costs and enhance reliability. For example, autonomous snowploughs and lawn mowers are being trialled at airports in northern and rural regions, where consistent maintenance is crucial but staffing can be a challenge. In the terminal environment, technologies such as intelligent lighting, HVAC automation, and predictive analytics for passenger flow management are helping small airports operate more sustainably and responsively. While full autonomy remains a longer-term ambition, the incremental adoption of innovative, interconnected systems is already reshaping how regional airports operate daily.

Robotics for Baggage Handling, Airfield Maintenance and Ground Support

Robotics is playing a growing role in transforming ground operations at regional airports. Automated baggage handling systems—once the domain of large hubs—are increasingly scalable and affordable, offering mid-sized facilities faster processing times and fewer manual errors. On the airfield, robotic solutions for maintenance tasks such as runway inspection, vegetation control, and pavement cleaning improve safety and free up staff for higher-value activities. Additionally, robotic ground support equipment (GSE), including autonomous tugs and cargo loaders, is being explored as a way to increase turnaround speed and reduce emissions. Although adoption rates vary widely depending on airport size and investment capacity, robotics offers a promising path toward greater resilience and precision in airport operations.

Advanced Air Mobility (AAM)

Advanced air mobility (AAM) solutions, like electric VTOL aircraft, offer innovative transportation methods that connect airports with urban centres. By incorporating AAM, regional airports improve access and connectivity, expanding service offerings for underserved regions.

Seamless Biometrics and Contactless Travel

Biometric identification and contactless processing technologies streamline the passenger experience and reduce physical interactions, allowing a fully digitalised journey. Technologies like facial recognition and fingerprint scanning for security and boarding allow passengers a faster, smoother experience.

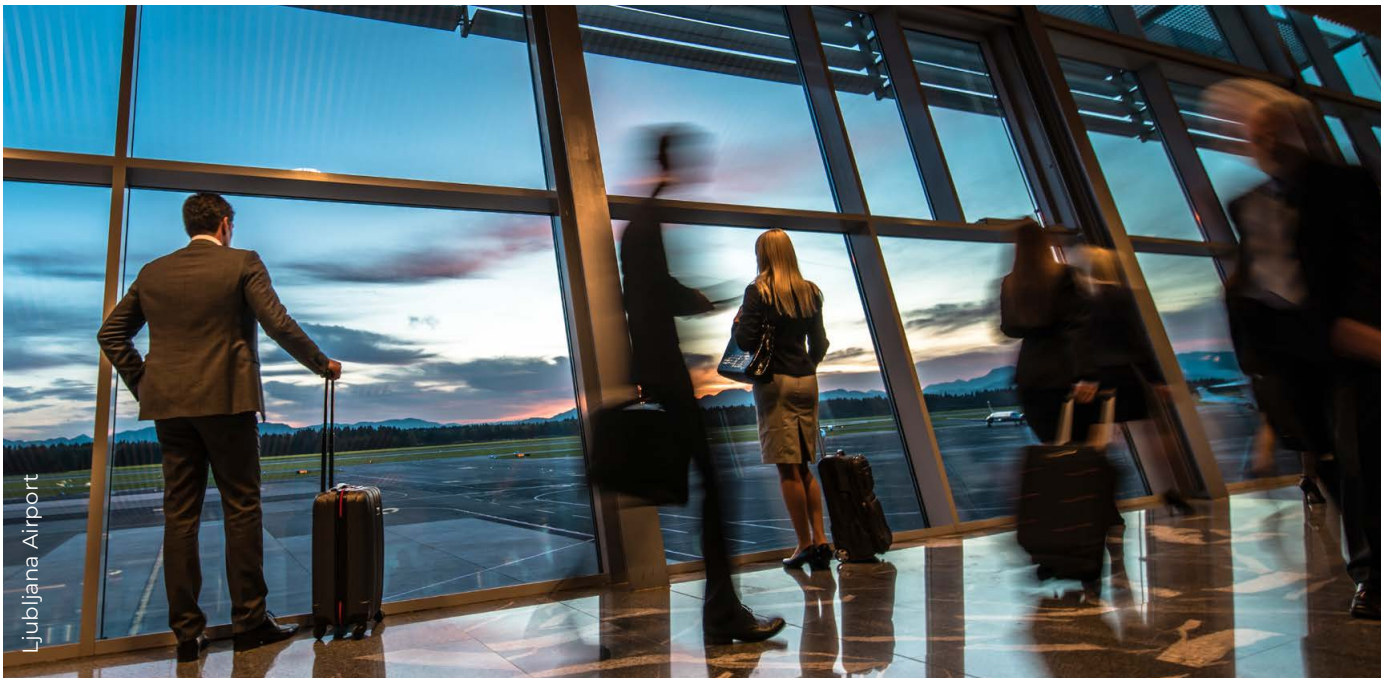
Personalised Passenger Experience

Leveraging data analytics, AI, and IoT, airports are moving towards highly personalised services based on passenger preferences and travel history. This could include custom boarding procedures, targeted offers from airport retailers, and even individualised routing through airport spaces.

Sustainability and Green Airports

Regional airports are likely to adopt more comprehensive green initiatives, such as integrating renewable energy sources and exploring their use for ground support equipment, innovative solutions for carbon capture and utilisation, achieving green building certifications, and implementing circular economy practices focused on reducing waste and recycling materials.

Regional Airports are also expected to be testing grounds for the first electric and hydrogen-powered aircraft, potentially unlocking new business models that offer zero-emission flights. This shift will contribute to the industry's sustainability targets, making regional airports leaders in green operations.



Ljubljana Airport

Aviation Security

Advanced solutions, such as Explosive Detection Systems (EDS) C3 for cabin baggage, designed to enhance threat detection without requiring passengers to remove liquids or electronics, are becoming more widely available. However, these systems may not always be compatible with the physical space and operational constraints of regional airports. This highlights the vital role regional airports play in advocating for and supporting the development of aviation security technologies tailored to their specific needs.

In the area of cabin baggage screening, more affordable and compact solutions, such as the EDS C1, are already in use. These can be effectively paired with innovations such as Automated Prohibited Item Detection Systems, which maintain high levels of security while helping to control operational costs.

Regional airports also serve as valuable test environments for emerging technologies that may be difficult to trial in high-traffic airports. For example, solutions for enhancing perimeter protection—such as automated drone patrols and surveillance systems—can be developed and refined in regional settings.

Moreover, strong partnerships with national authorities are essential. These relationships enable regional airports to respond to evolving threats more effectively, without introducing disproportionate burdens on their operations.

Cybersecurity

As with major airports, safeguarding critical systems and data is vital for regional airports to ensure operational continuity, maintain public trust, and comply with increasingly complex regulatory requirements. Given the interconnected nature of air transport, a cyber incident at a regional airport could have cascading effects across the broader aviation network.

While regional airports may not need to be at the forefront of cybersecurity innovation, they must be empowered to adopt innovative, pragmatic approaches that enhance cyber resilience. With limited resources, their focus should be on implementing effective risk mitigation measures rather than expending effort on navigating overly complex compliance processes.

Strategies such as peer reviews to guide early-stage cybersecurity improvements and close collaboration with authorities to ensure compliance with overlapping regulations can be facilitated through the adoption of common compliance frameworks. These frameworks are examples of innovative cyber approaches that regional airports could adopt.

7. Developing and running an Innovation Project

Innovation projects differ from traditional enterprise projects in several fundamental ways. They move at a different pace, operate with unique success criteria, and prioritise reducing uncertainty over achieving immediate operational results. The primary objective of an innovation project is to test and validate a proposed solution in a controlled yet realistic setting. This cookbook provides a structured, step-by-step approach to conducting innovation-driven R&D projects within a regional airport environment.

STEP 1: DEFINE A CLEAR PROBLEM STATEMENT

A well-defined problem is the foundation of a successful innovation project.

Identify the Challenge:

Clearly articulate the specific problem you aim to address within the airport environment. Ensure it is well-defined, measurable, and directly relevant to airport operations or passenger experience.

Provide Context:

Explain why this problem is significant, who it affects, and how it impacts airport efficiency, passenger satisfaction, safety, etc.

Set Objectives:

Define what success looks like. Establish clear goals for measuring the improvements achieved through the innovation project.

STEP 2: FORMULATE A TESTABLE HYPOTHESIS

Every innovation project should begin with a hypothesis that guides experimentation.

Develop a Hypothesis:

Construct a testable statement that proposes a solution to the identified problem. Example: “Implementing an AI-driven passenger flow management system will reduce security wait times by 30%.”

List Assumptions:

Identify key assumptions underpinning the hypothesis. These are the factors that must be tested and validated throughout the project.

Determine Metrics:

Establish measurable indicators to assess whether the hypothesis is validated or needs adjustment.

STEP 3: SET A SHORT AND FIXED TIMEFRAME

Innovation projects thrive on rapid iteration and should not be allowed to extend indefinitely.

Define a Project Timeline:

Limit the project duration to a maximum of six months. A concise timeframe forces focus and accelerates decision-making.

Set Key Milestones:

Establish clear phases with defined deliverables, such as prototype completion, testing, and evaluation stages.

Allow for Iteration:

If the hypothesis is not fully validated within the timeframe, refine it and iterate rather than extending indefinitely.

STEP 4:

ADOPT RAPID PROTOTYPING

Quickly developing and testing prototypes minimises risk and accelerates learning.

Start with Low-Fidelity Models:

Begin with a simple concept (napkin sketches) and PowerPoint mock-ups to visualise the idea.

Progress to Digital Prototypes:

Use tools like Figma to create more detailed designs and user interfaces.

Develop a Mock-up Application:

Build a basic interactive prototype to simulate real-world functionality.

Test a Functional Version:

Deploy a working version with backend services to evaluate feasibility in an airport setting.

Prioritise Speed Over Perfection:

Focus on continuous improvement rather than achieving an ideal solution in the first iteration.

STEP 5:

MAKE DATA-DRIVEN DECISIONS

Validating an innovation project requires empirical evidence to support its effectiveness.

Establish Data Collection Methods:

Define how performance data will be gathered throughout the project.

Analyse Findings:

Use collected data to assess the effectiveness of the proposed solution.

Refine Based on Insights:

Adjust the approach based on real-world results rather than assumptions.

STEP 6:

IDENTIFY AND MITIGATE RISKS

Every innovation project comes with uncertainties that must be managed proactively.

Identify Potential Risks:

Assess risks related to operational disruptions, regulatory compliance, cybersecurity, and passenger experience.

Develop Mitigation Strategies:

Outline contingency plans to address foreseeable challenges and potential risks.

Monitor Continuously:

Adapt risk strategies in response to project developments and findings.

STEP 7:

PLAN FOR SCALABILITY AND SUSTAINABILITY

If successful, an innovation project should be ready for broader implementation.

Assess Scalability:

Determine if the solution can be expanded across multiple airport operations.

Prepare for Integration:

Consider the necessary adjustments to existing airport processes to support full-scale implementation.

Ensure Long-Term Viability:

Evaluate the project's sustainability, including financial feasibility, regulatory compliance, and environmental impact.

STEP 8:

DOCUMENT AND REPORT OUTCOMES

Comprehensive documentation ensures that lessons learned are not lost.

Maintain a Project Log:

Record all progress, key decisions, and insights throughout the project to track its development.

Prepare a Final Report:

Summarise the project's objectives, findings, successes, challenges, and recommendations for future initiatives.

Share Knowledge:

Distribute findings within the organisation to inform future innovation efforts and drive continuous improvement.

Regional airports operate in complex environments where innovation can significantly enhance efficiency, safety, and passenger experience. By following this structured approach—starting with a clear problem statement, formulating a testable hypothesis, working within a defined timeframe, utilising rapid prototyping, making data-driven decisions, mitigating risks, planning for scalability, and thoroughly documenting results—regional airport innovation projects can maximise their impact and success rate.

8. Additional Recommendations

To build on the advantages and successes of regional airports as innovation centres, a set of strategic recommendations will help drive continued growth, enhance operational efficiency, and maintain competitive relevance.

ASSESS THE IMPACT OF LEGISLATION

A restrictive interpretation of specific articles of the EU General Data Protection Regulation, the Digital Markets Act, the Digital Services Act and the upcoming Artificial Intelligence Act by EU and national authorities entails new regulatory challenges for innovation. It may impact your current and future projects.

Ensure compliance with the legislation in force and international standards,

Liaise with your National Data Protection Authority and

Educate regulators and explain your project.

PRIORITISE AND LEAD IN SUSTAINABLE PRACTICES

Implement Carbon-Neutral Operations:

Regional airports should prioritise becoming models of sustainability by achieving carbon neutrality. Join the *Airport Carbon Accreditation* Programme. Other measures include green building designs, electric ground vehicles, and on-site renewable energy generation (such as solar and wind).

Adopt Sustainable Aviation Fuels (SAF):

Airports should partner with airlines to promote the use of SAF, which significantly reduces carbon emissions. By incentivising the use of SAF in regional routes, airports can reinforce their commitment to environmental stewardship.

Torino Airport

EMBRACE DIGITAL TRANSFORMATION FOR OPERATIONAL EFFICIENCY

Integrate Digital Twin and Predictive Analytics:

Investing in digital twin technology and predictive analytics will help regional airports optimise operations, simulate complex scenarios, and prepare for disruptions. This real-time monitoring supports proactive decision-making, reducing downtime and enhancing safety.

Implement IoT and 5G Connectivity:

The adoption of IoT devices connected via 5G networks enables the collection of data, automation, and seamless communication across airport operations. This network can enhance equipment maintenance, optimise traffic flows, and streamline airport operations, resulting in substantial cost savings and increased operational efficiency.

FOSTER PARTNERSHIPS FOR TECHNOLOGICAL ADVANCEMENT

Collaborate with Technology Providers and Startups:

Regional airports should leverage their flexibility to partner with technology providers and innovative startups. This collaboration enables access to cutting-edge solutions and co-developments tailored to airport-specific needs.

Engage with Local Governments:

By working with local authorities, regional airports may secure funding and support for pilot projects and infrastructure improvements.

Participate in industry associations:

Active participation in industry bodies like ACI EUROPE[1] can further facilitate the sharing of successful innovations across the sector.

1 *Notably the Regional Airports Forum and the Innovation Forum*

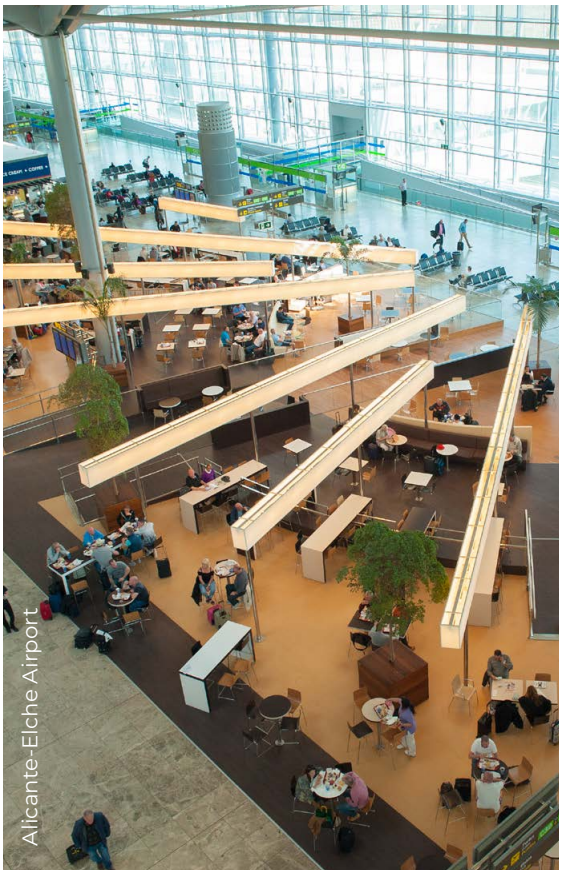
INVEST IN PASSENGER-CENTRIC INNOVATIONS

Enhance Biometric and Contactless Services

Airports should continue to invest in biometric identification systems (e.g., facial recognition for security and boarding) and contactless check-in processes to create a faster, more seamless passenger experience.

Leverage AI and Data Analytics for Personalised Services

Airports can utilise AI to analyse passenger preferences, enabling tailored travel experiences. This could include personalised retail recommendations, real-time updates on airport services, and custom alerts for boarding and baggage status.


Alicante-Elche Airport

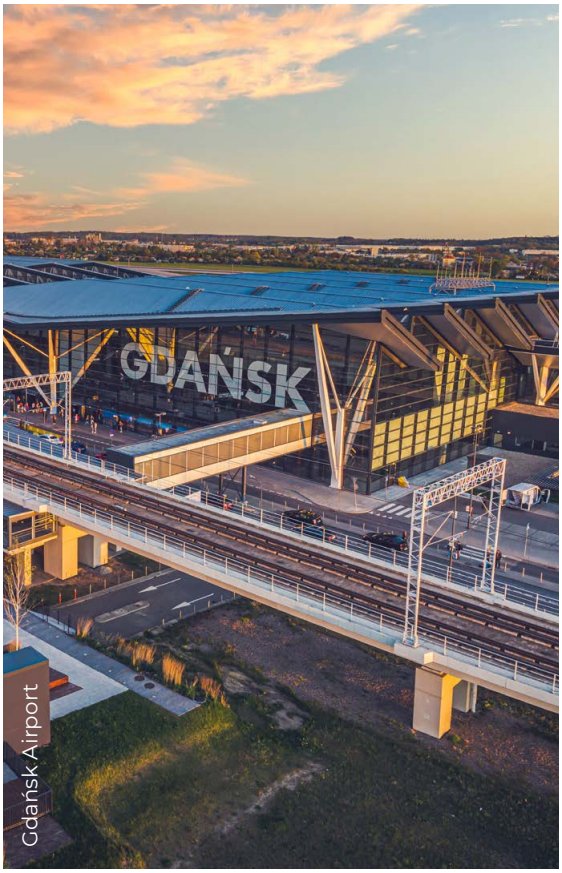
DEVELOP MULTIMODAL TRANSPORTATION INTEGRATION

Collaborate with Public Transit and Local Transport

To reduce reliance on private vehicles, regional airports should integrate with public transit, including rail and bus systems, making airports more accessible and promoting sustainable travel options.

Focus on Advanced Air Mobility (AAM)

Regional airports can prepare for the integration of advanced air mobility solutions, such as eVTOLs, by developing the necessary infrastructure and regulations. These vehicles offer quick, on-demand transportation options that connect regional airports to urban centres efficiently.



Gdańsk Airport

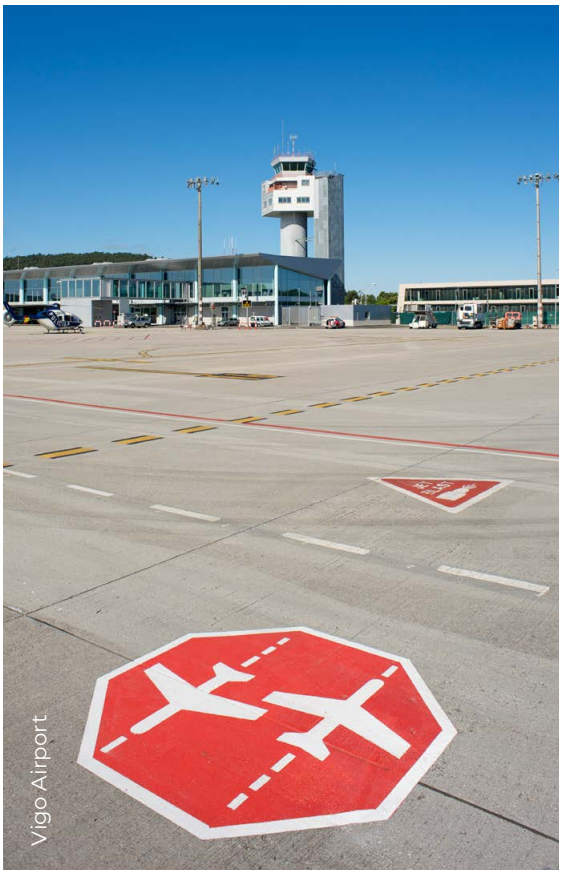
FOCUS ON DEVELOPING NICHE MARKETS AND SPECIALISED SERVICES

Cater to Business and Cargo Aviation Needs

Regional airports can differentiate themselves by specialising in specific markets, such as business aviation, cargo logistics, or e-commerce. By catering to these needs, they can attract a distinct clientele and foster long-term revenue sources.

Explore Opportunities in Advanced Air Mobility (AAM)

With the rise of eVTOLs, regional airports can establish themselves as nodes for AAM, providing connectivity for underserved regions and expanding transportation options for passengers and cargo.


Vigo Airport

CAPITALISE ON KNOWLEDGE, CULTURE, AND DATA INTELLIGENCE

Regional airports should capitalise on the power of knowledge, organisational culture, and data intelligence to strengthen their strategic positioning.

Harness institutional expertise

Refine operational methodologies

Make data-driven choices

By structuring knowledge-sharing processes, encouraging adaptability, and embedding analytics into decision-making, regional airports can optimise performance, anticipate challenges, and deliver more responsive services. This integrated approach will ensure they remain innovative and competitive in an evolving aviation landscape.

Ivalo Airport

ENCOURAGE KNOWLEDGE SHARING AND INDUSTRY DIALOGUE

Promote Open Knowledge Sharing Initiatives

Regional airports should establish forums or networks to share experiences and best practices related to innovation with other airports. By exchanging information about technological successes and challenges, airports can help each other avoid common pitfalls.

Host Regular Industry Workshops and Conferences

By organising workshops and conferences focused on innovation, regional airports can create platforms for industry leaders, technology providers, and government representatives to discuss trends and collaborate on projects, fostering a culture of shared learning and continuous improvement.

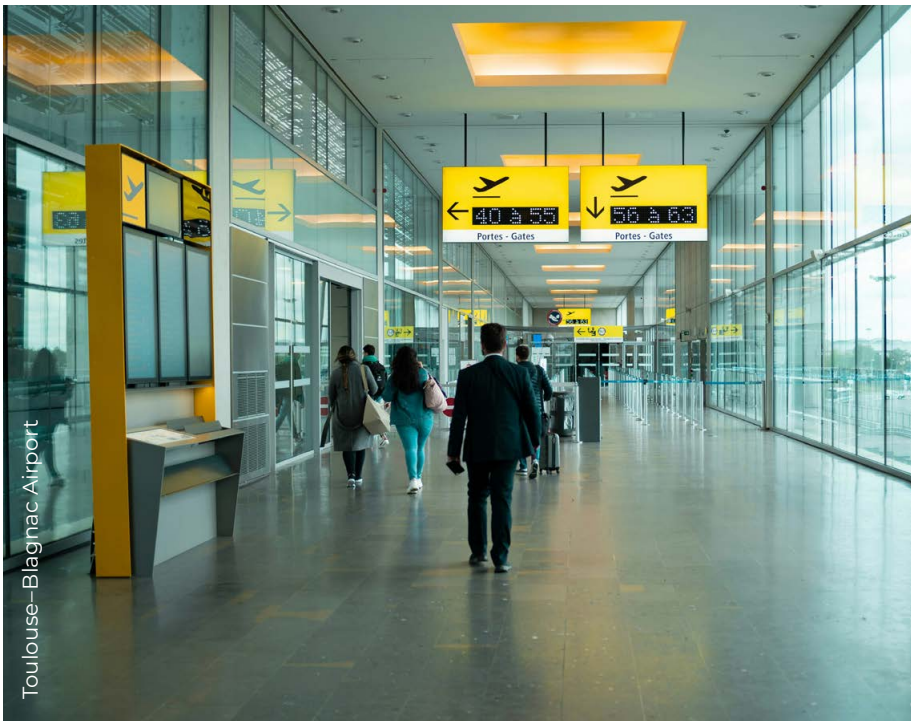
VIEW INNOVATION AS AN ESSENTIAL INVESTMENT FOR FUTURE COMPETITIVENESS

Allocate Resources to Research and Development (R&D)

By viewing innovation as an essential, future-oriented investment, regional airports can secure funds to support R&D efforts, ensuring they remain at the forefront of industry trends.

Create Incentives for Continuous Innovation

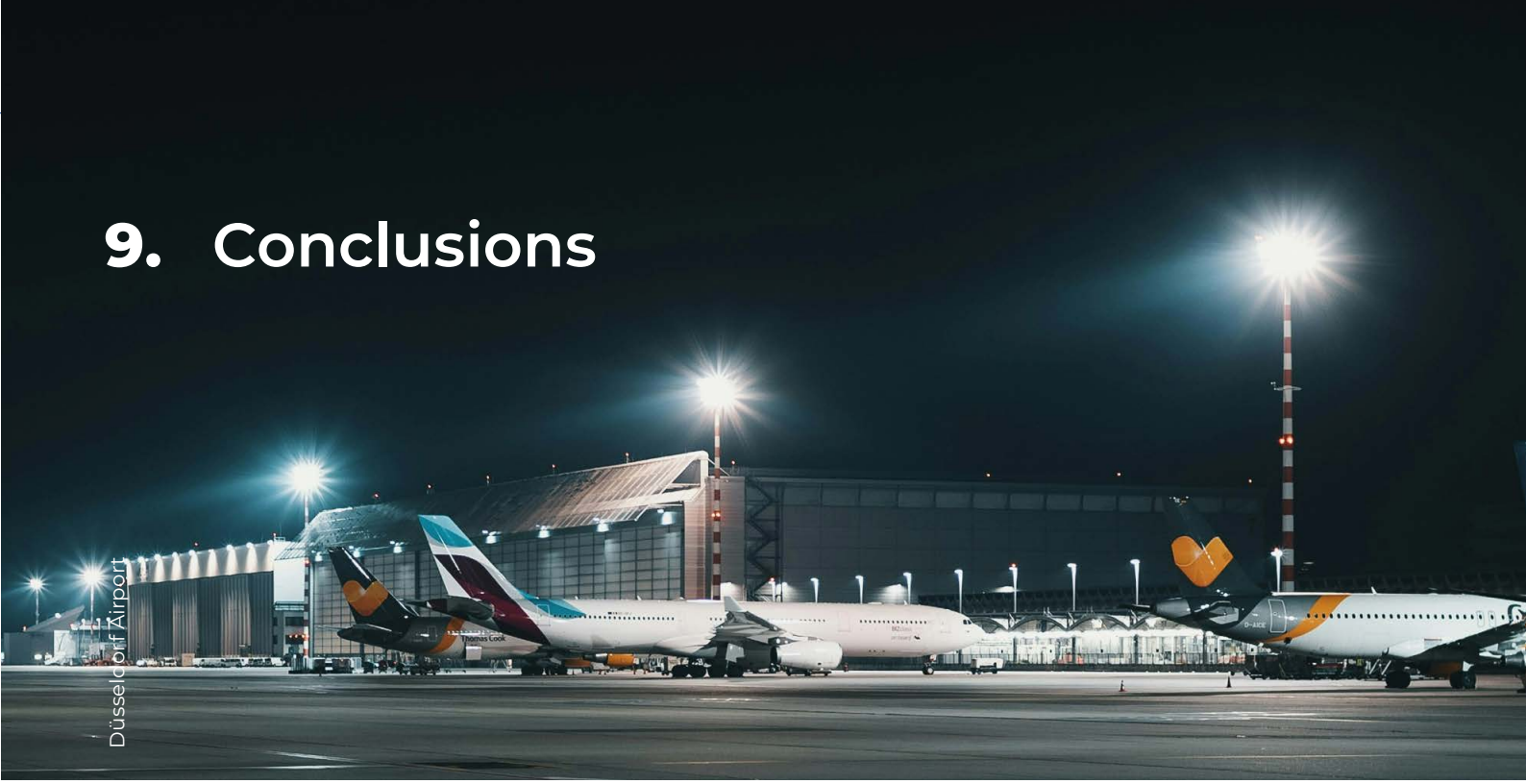
By establishing internal innovation hubs, offering grants for experimental projects, and recognising employee-driven improvements, airports can cultivate a culture that encourages ongoing innovation.



Toulouse–Blagnac Airport

By embracing these recommendations, regional airports can continue to thrive as pivotal players in the aviation industry's transformation. Their commitment to sustainability, operational efficiency, customer-centricity, and collaboration will not only benefit the airports themselves but also set a standard for innovation across the aviation sector globally. Through these efforts, regional airports can ensure they remain competitive, resilient, and capable of meeting the evolving needs of the industry and its passengers.

9. Conclusions



Regional Airports as Centres of Flexible and Agile Innovation

Regional airports operate in a less complex, more controlled environment than major hubs, allowing them to adapt rapidly to new technologies. This flexibility enables them to lead in pilot projects and experimental initiatives, which can be scaled up across larger aviation ecosystems.

Catalysts for Sustainability

The aviation industry is facing growing pressure to mitigate its environmental impacts, and regional airports are at the forefront of adopting sustainable practices. From renewable energy projects to carbon-neutral infrastructure and sustainable aviation fuel (SAF) trials, these airports demonstrate how the industry can work towards a lower carbon footprint.

Enhanced Customer Experience

Regional airports are increasingly focused on passenger-centric innovations. By implementing contactless processing, AI-driven services, and personalised amenities, they enhance the customer journey, reducing friction and offering a seamless travel experience that meets the expectations of today's travellers.

Economic Growth and Community Impact

Regional airports play a crucial role in local economic development by generating jobs, promoting tourism, and supporting local businesses. By attracting investments and driving tourism, these airports bolster regional economies and promote inclusive growth.

Drivers of innovation ecosystems

Regional airports benefit from strong connections with stakeholders, including local authorities, technology providers, and communities. This collaboration not only aids innovation but also fosters shared learning, contributing to industry-wide improvements in technology and practices.

Blueprint for Scalable Innovation

Regional airports serve as low-risk environments for trialling innovations that, if successful, can be scaled to larger airports and hubs. This scalability ensures smoother transitions and reduces the risk of implementing unproven technologies in complex environments. By pioneering innovations, regional airports create blueprints for the future, which the broader aviation industry can follow to adopt advanced technologies effectively.

10. Final Thoughts

Regional airports are innovation powerhouses. By embracing sustainability, digital transformation, and multimodal integration, they will remain at the forefront of aviation's future.

The time for innovation is now!

Madeira Airport

Annex: Case Studies

Malta Airport

CASE STUDY

ADVANCED SOLUTIONS FOR AUTONOMOUS JET BRIDGE OPERATION

VIGO (VGO), MENORCA (MAH), SEVILLA (SVQ)

Country: **Spain**

INNOVATION AREA(S):

- Digitalisation and Automation
- Artificial Intelligence (AI)

PARTNERS INVOLVED

TKE Airport Solution (Vigo)

Comsa (Menorca)

Adelte (Sevilla)

aena airports for you

PROJECT DESCRIPTION

The autonomous jet bridge project at Sevilla, Vigo, and Menorca Airports aims to validate remote, automatic control for passenger bridges, reducing on-site staff, boosting efficiency, cutting costs, and enhancing safety.

Sevilla focused on remote guidance system validation, digitising control stations and enabling remote operation via cameras and alerts.

Vigo implemented multi-phase solutions, including remote control, automatic docking with AI, obstacle detection using LiDAR and video analytics, and a dispatcher interface.

Menorca piloted autonomous operation without onboard operators, relying on radar sensors and video analytics for safety. Technologies include AI, computer vision, LiDAR, radar, and real-time processing, addressing automation needs to improve reliability, reduce turnaround times, and lower safety risks..

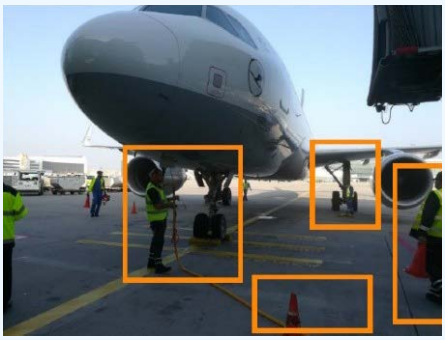
OBJECTIVES

- Enable remote and autonomous bridge operation.
- Improve gate turnaround times and operational safety.
- Minimise incidents and optimise allocation of gate resources.
- Ensure perimeter safety during remote driving, especially in low-visibility conditions.

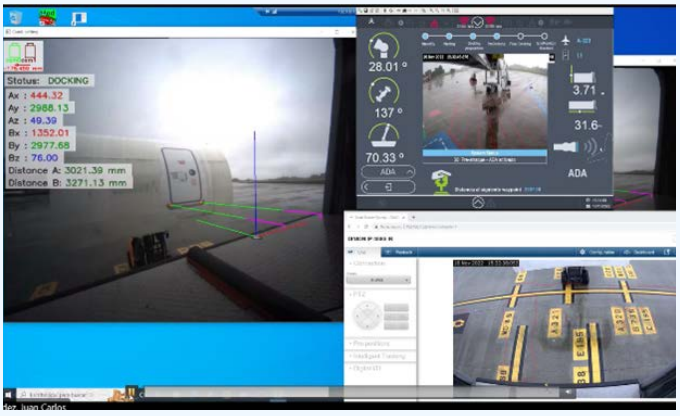
KEY PERFORMANCE INDICATORS (KPIS)

- Increase in turnaround efficiency per person (ADA/RADA).
- Reduction in time between docking connections.
- Reduction in disconnection time.
- Successful remote/autonomous operation with only visual supervision (only for Menorca).
- Improved detection of people and objects around sensitive zones using AI analytics.

Obstacle Detection for autonomous solution:



Remote Control System



IMPLEMENTATION PROCESS

Timeline and Key steps:

Sevilla Airport:

- Start: January 2020
- End: June 2021
- Focused on validating remote control system, digital control panel upgrades and camera installation.
- Vision system integrated with airport security protocols for remote access.

Vigo Airport:

- Start: December 2020
- End: May 2025
- Phased implementations:
  - RCS (Remote Control System): DIC 2020 – JUL 2023
  - ADA / RADA: JUL – SEP 2023
  - Docking guide with LiDAR: MAY 2024 – FEB 2025
  - Obstacle detection: FEB – MAY 2025
  - Dispatcher interface: FEB – MAR 2025

Menorca Airport:

- Start: October 2024
- KPI assessment: May 2025
- Estimated end: October 2025

Stakeholders:

- Aena operations, engineering and IT teams (Sevilla, Vigo and Menorca)
- Technology providers (Adelte in Sevilla, TKE Airport Solutions in Vigo and COMSA in Menorca)
- Airport safety and FIS departments
- Aena Innovation Team

Challenges:

- Real-time sensor integration with safety protocols
- Maintaining reliable detection performance under night-time or low-light conditions
- Ensuring interoperability between AI modules, vision systems, and manual backups
- Coordinating multiple technologies into one cohesive Dispatcher interface

Financing:

In Vigo, the project was funded by CDTI (national public funding) as an R&D initiative with dedicated innovation financing.

In Sevilla and Menorca, the project was carried out under zero-cost collaborative agreements between Aena and its partner (each party covers its own operational expenses).

KEY OUTCOMES AND BENEFITS

- In Sevilla, the implementation resulted in significant cost and time savings by eliminating the need for physical presence on site during boarding bridge guidance.
- Integration with the airport's security system added an extra layer of operational control and traceability.
- Demonstrated safe and efficient remote/autonomous operation of jet bridges in real airport conditions.
- Reduced connection and disconnection times, directly improving gate utilisation.
- Increased safety and early incident detection via AI-powered obstacle monitoring.
- Menorca's radar-camera system shows that visual-only remote driving is feasible when supported by robust analytics.
- Paves the way for further deployments in other airports (e.g., AGP, ALC, BCN, PMI).
- Increased safety and early incident detection via AI-powered obstacle monitoring

Unexpected Benefits:

- Enhanced interdepartmental coordination via the Dispatcher interface.
- Broader institutional confidence in AI-powered infrastructure solutions.

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LESSONS LEARNED

- Transitioning to digital remote systems requires early integration with existing airport security infrastructure to ensure seamless access and data flow (Sevilla).
- Proper sensor and camera placement, high-resolution imaging, and adequate lighting are essential, especially at night when most operations (e.g., cargo loading or late-night flights) are performed.
- LiDAR greatly enhances spatial awareness, but radar and camera combinations can be just as effective in well-monitored environments.
- Dispatcher centralization reduces fragmentation and simplifies resource management.
- Training and involvement of operational teams from the beginning improves adoption and reduces friction.

SCALABILITY AND TRANSFERABILITY

The project is highly scalable and transferable to both regional and hub airports. After successful pilot tests in Sevilla (SVQ) and Vigo (VGO), the technology was deployed across all boarding bridges at Madrid-Barajas Airport (129 bridges and 3 remote operation centres), making it the first major airport worldwide to do so. Building on this milestone, autonomous jet bridge operation pilots are now underway in Menorca (MAH) and has been already tested in Vigo (VGO).

Factors to consider:

- Adaptation of visual/AI systems to local infrastructure and climate conditions
- Assessment of airside traffic patterns to define required sensor coverage
- Staff training for remote supervision and Dispatcher coordination
- Compliance with national aviation and safety standards
- Availability of reliable power and data connectivity for real-time operation

CASE STUDY

USING DRONES, 5G AND ARTIFICIAL INTELLIGENCE TO DETECT FODS AT SAN SEBASTIÁN AIRPORT

SAN SEBASTIÁN AIRPORT (EAS)

Country: **Spain**

INNOVATION AREA(S):

Digitalisation and Automation

PARTNERS INVOLVED:

INETUM

Figure 1 *Project Team working on the validation phase*

PROJECT DESCRIPTION

Routine runway inspections are vital for detecting FOD (Foreign Object Debris), posing safety risks. Current visual checks by staff involve driving along the runway.

This project aims to use advanced technology, specifically drones that capture real-time images via 5G for AI-based object detection.

Defining the AI validation for FOD detection was key, utilising computer vision to identify anomalies.

Incorporating AI could improve daily tasks and training, with potential to expand into other fields.

OBJECTIVES

First, the search for FOD detection technologies arises from a strategic decision by the organisation to improve airport operational safety. This fully aligned with our Innovation & Digital Transformation Strategy. This innovative project was the result of the process of know-how transfer between the innovation team. After a pooling of different technologies and case studies to validate the benefits of 5G, the innovation team came up with the idea to fulfil a demand identified by the safety team.

To achieve this, certain milestones must be validated, thereby proving the technical and operational feasibility of the innovative solution.

- Validate communication between the drone and the server over the 5G network.
- Validate the system's detection capability & validate the AI FOD detection algorithm.
- Validate the end-to-end solution as a FOD detection system
- Analyse the integration of the solution into operational airport procedures.

KEY PERFORMANCE INDICATORS (KPIS)

Detection capability:

This is defined as the system's ability to detect objects, measured as a percentage under certain operating conditions (object dimensions, distance between objects).

Detection accuracy:

It is defined as the ability of the system to determine and report the real location of the object with respect to a given reference point.

Detection Reliability:

Detection reliability is defined as the ability of the system to discriminate false positives, based on a catalogued classification of FODs.

IMPLEMENTATION PROCESS

Key steps:

The project duration was 12 months, but we want to highlight the activities carried out before the project launch, given their relevance to innovation project design. In the months preceding the kick-off, we develop the tasks critical to the project's success and the fulfilment of the specific objectives outlined in the previous slide. Being a pioneering project, characterised by uncertainty and risk, the Concept of the solution, along with the minimum requirements for the drone, hardware and software, needed to be defined. Another open question that needed to be addressed was the Methodology for validating the FOD detection solution.

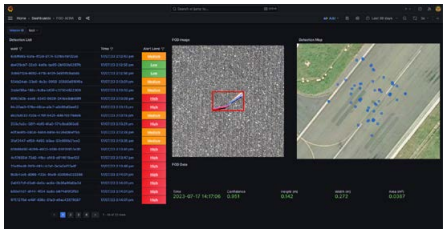

Figure 2 *Screenshot dashboard*

Timeline:

- Start: January 2024
- 1st validation tests: June 2023
- 2nd validation tests: November 2023
- 3rd validation tests: December 2023
- End: January 2024

Stakeholders:

The team for this project consisted of: airport management knowledge provided by us, a project manager profile provided by Inetum, and specific support on drone operation by Invicsa. Vicomtech developed the AI algorithm. Private network 5G provided by Cellnex under a collaboration agreement.

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Challenges:

The first three months of the project activities were focused on how to answer several innovation challenges:

The relationship between the height at which the UAS flies and the resolution of the camera. Priority is given to the flying height at which.

The combination of the UAS flight speed and the FPS at which the camera works results in a high-quality image without distorting it.

The lack of relevant documentation on this, so we had to approach the first visit to the airport with a plan to determine an affordable approach that would meet these challenges.

Financing:

Contract launched by Aena (Innovation Budget)

KEY OUTCOMES AND BENEFITS

- Verify the technical feasibility of the development of the solution.
- Verify the operational feasibility of the introduction of the solution in the management of airport operations.
- Through this project, the benefits of the use of drones at airports in terms of efficiency have been confirmed.

The use of drones in airports opens up a wide range of use cases, creating a vast ecosystem of companies and start-ups that can benefit.

Collaboration with these actors is crucial for the industry's adaptation and the transformation of business models to address the challenges of making general aviation compatible with UAVs operating within airports. Through this project, the benefits of using drones at airports in terms of efficiency have been confirmed.

There are many positive impacts of integrating drones into the maintenance and surveillance process for staff, including the reduction of the risk of occupational accidents and dangers. This directly leads to a positive effect on employees, as well as incorporating new technological and digital skills into their work environment with a new tool, reducing stress levels, increasing dedication to the task, and enhancing productivity.

On the other hand, the integration of drones raises the existing safety level to a new standard, preventing FODs from being ingested by aircraft engines, which can cause significant financial losses.

Unexpected benefits:

The combination of these technologies opens a world of possibilities to increase the high standards already existing in airport management.

LESSONS LEARNED

- Training of the algorithm is the crucial factor for the future success of its development.
- Tests in a real environment have identified areas for improvement.
- The introduction of a high-resolution camera would double the flight height, exponentially reducing inspection time while maintaining detection capability.

Advice for other regional airports:

- Focus on training the detection algorithm under many environmental and meteorological operating conditions.

SCALABILITY AND TRANSFERABILITY

The project is scalable to other regional airports, and to ensure successful transferability to different contexts, the procedures of various airports and 5G coverage should be considered.

CASE STUDY

SMART QUEUING SYSTEM AT AIRPORT PROCESSES

IBIZA AIRPORT (IBZ)

Country: **Spain**

INNOVATION AREA(S):

Operational Efficiency

PARTNERS INVOLVED

Via Guide GmBh

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PROJECT DESCRIPTION

At airport checkpoints, like security, queues are manually set and may not match actual passenger flow, especially in seasonal airports. This makes real-time adjustment difficult.

To address this, a system with adaptive gates is proposed to optimise maze length based on demand, improving passenger experience by reducing unnecessary walking, and enabling staff to focus on assistance rather than queue management.

OBJECTIVES

The objective is to implement a system that adapts the length of mazes in the processes (security control, immigration, gates, etc) according to the passengers detected with Xovis (or similar sensor) at any time.

Improvement in passenger processing time through security check control, increase passenger satisfaction.

KEY PERFORMANCE INDICATORS (KPIS)

Reduction of average processing time

Increase in Percentage of Passengers Processed per Time

Increase in ASQ waiting time at security controls

Increase in ASQ courtesy & helpfulness of security staff

Figure 1 *Security Control Maze*

IMPLEMENTATION PROCESS

This was one the winner ideas at Aena's Intrapreneurship Programme in 2024.

- June 2024: Winner Team, as part of Ibiza Airport Staff wants to deploy it there
- September 2024: ViaGuide was contacted and willing to collaborate
- September to December 2024: System design
- February 2025: Contract Signed for one year pilot
- March 2025: System Delivery & Installation
- 1st April, 2025: Start of trial and adjustment
- 10th April, 2025: System operating 24/7
- Expected end: 31st March 2026

Stakeholders:

- Ibiza Airport Team
- Aena Innovation Team
- Technology Provider

Challenges:

There weren't any major challenges: adjusting attendance to system configuration (parameters, connection between the systems etc) took a couple of weeks, but it was solved through good communication with all the parts.

Financing:

- Contract launched by Aena withing its Intrapreneurship Programme INNOVA (Innovation Budget).

KEY OUTCOMES AND BENEFITS

- Enhance Passenger Experience
- Improve security process efficiency
- Airport staff, that before was changing manually security maze configuration, now can help passengers in tray zone, thus reducing complaints in this area.
- Passengers have a better experience passing through the security control in less time, especially in less crowded times
- The geometry of the maze, with magnetic poles and automatic doors is more harmonic, without the irregularities caused by human intervention. This gives a positive sensation that improves passenger experience too.

LESSONS LEARNED

- It's an easy system to install (if Xovis or other flow management measuring system exists) with immediate benefits

Advice for other regional airports:

- Adjust properly the amount of passengers that trigger every step of the maze

SCALABILITY AND TRANSFERABILITY

- The project is scalable to other regional airports and should be easy to install in any airport with enough room for queueing.

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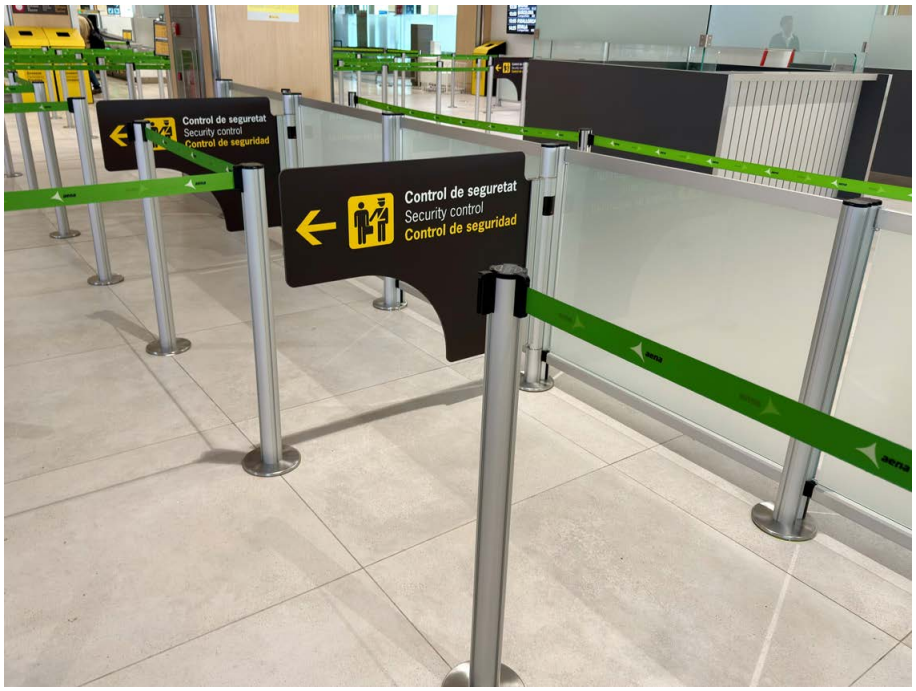

Figure 2 *Automatic Door Detail*

CASE STUDY

DEVELOPMENT OF A DRONE PILOT TEST FOR THE REVISION OF VISUAL AIDS AT AIRPORTS

A CORUÑA AIRPORT (LCG)

Country: **Spain**

INNOVATION AREA(S):

Digitalisation and Automation

PARTNERS INVOLVED

Instituto Tecnologico Gallego (ITG)

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PROJECT DESCRIPTION

The pilot agreement aims to test the operation of the use of drones for the daily inspection of visual aids on the airfield, including verifying that lights and signs are without apparent external damage and maintain adequate brightness.

OBJECTIVES

It aims to identify the technical and operational feasibility of the use of drones for the mentioned use case, identify the technological and operational challenges of introducing drones in the airport environment, as well as establish a draft business model.

Initial tests (project ongoing)

IMPLEMENTATION PROCESS

This pilot project is part of a global strategy to validate new technologies and improvement processes for the virtualisation of operations control.

Specifically, the innovation of this project lies in the application of drones to a need in airport management, such as the inspection of the daily review of visual aids. This technological solution offers a series of significant advantages in terms of safety, efficiency and optimisation of resources.

The implementation process is still in an exploratory phase.

Stakeholders:

- A Coruña Airport Operations and Maintenance
- Air Navigation Service Provider
- Aena Innovation Team
- Technology provider

KEY OUTCOMES AND BENEFITS

This test will allow the validation of a technology that will improve operational safety by enabling greater efficiency in the daily review of the Airport's visual aids.

Financing:

The project was conducted as a collaborative pilot under a zero-cost agreement, with no financial transcation involved between the airport and the technology provider (each party covers its own operational expenses)

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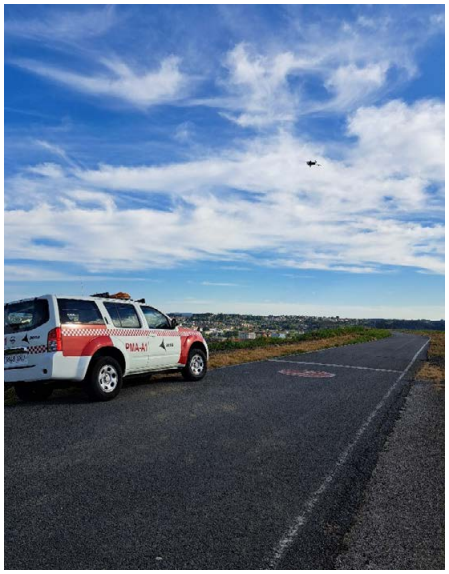


CASE STUDY

EFFICIENT EMERGENCY LIGHTS AT PAMPLONA AIRPORT

PAMPLONA AIRPORT (PNA)

Country: **Spain**

INNOVATION AREA(S):

Operational Efficiency

PARTNERS INVOLVED

Zemper

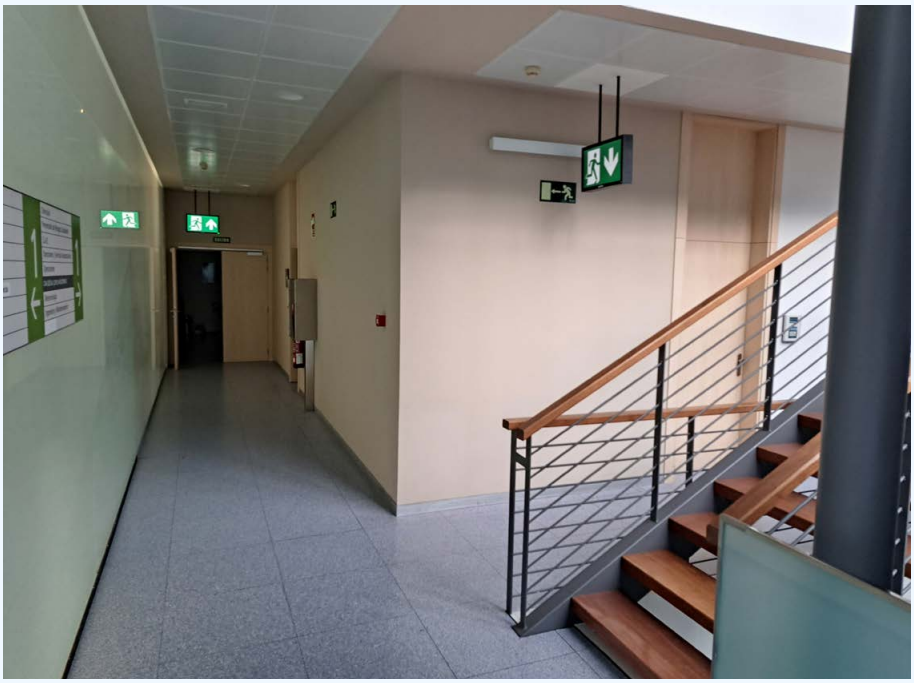
PROJECT DESCRIPTION

The project's goal is to test a new emergency lighting system at Pamplona Airport, aiming to improve safety with energy-efficient, autonomous lights that offer 40 metres of visibility. The pilot deploys these lights in a specific area, including a central management case and a fire signal simulator. Validation involves proper installation, connectivity, and scenario reviews to ensure system readiness. The project evaluates response times, device performance, and integration, intending to enhance visibility and security during emergencies.

OBJECTIVES

Validate a solution with a lower energy consumption.

Improve the security and safety response for the staff in case of an event.



KEY PERFORMANCE INDICATORS (KPIS)

Technical KPIs

Activation time in case of an event and system operability in case of a power shortage.

Improvement of light visibility.

Evacuation routes' adaptability.

Alternative message usage.

Battery autonomy.

Brightness modulation to improve user attention.

Wireless system communication.

Evaluation of system management simplicity.

Energy efficiency KPIs

Power consumption reduction.

Maintenance costs reduction.

IMPLEMENTATION PROCESS

Key Steps:

- Definition of objectives and scope with Pamplona Airport stakeholders.
- Agreement on pilot locations (office level in the airport).
- Installation of signals, lights and central command.
- Configuration integration of devices in the emergency network.
- Pilot execution over an agreed time window.
- Data collection, analysis, and validation of results against KPIs.

Timeline:

- Start: March 2025
- End: September 2025

Stakeholders:

- Pamplona Airport Operations, Security and IT Teams
- Aena Innovation Team
- Technology provider

Challenges:

- Ensuring optimal device deployment to optimise efficiency.
- Managing wireless connectivity limitations due to the building's structure and materials.

Financing:

- The project was conducted as a collaborative pilot under a zero-cost agreement, with no financial transaction involved between the airport and the technology provider (each party covers its own operational expenses).

KEY OUTCOMES AND BENEFITS

- Successfully tested signals real time updates based on the geographical alarm source.
- Reduction of power consumption validated
- Reduction of maintenance cost due to a centralized signals report system.

LESSONS LEARNED

- Choosing the lights deployment site is critical for a correct service.
- Analysis of the building materials and structure, since some materials and thick columns or walls affect the wireless connectivity.

Advice for other regional airports:

- Start with a well-scoped pilot and defined KPIs.
- Early involvement of operations and IT teams.
- Ensure all solution elements are properly interconnected to the network.
- Test under different situations and also review displays information in a normal situation.

SCALABILITY AND TRANSFERABILITY

The project is fully scalable and transferable to other airports.

Factors to consider:

- Power infrastructure connections availability for light connections.
- Wireless connections limitations due to building structure or materials.
- Properly match the type of building usage and distribution with the models to be deployed.
- Integration of the system in the IT network, meeting all IT security requirements.
- Compliance with regional regulations.

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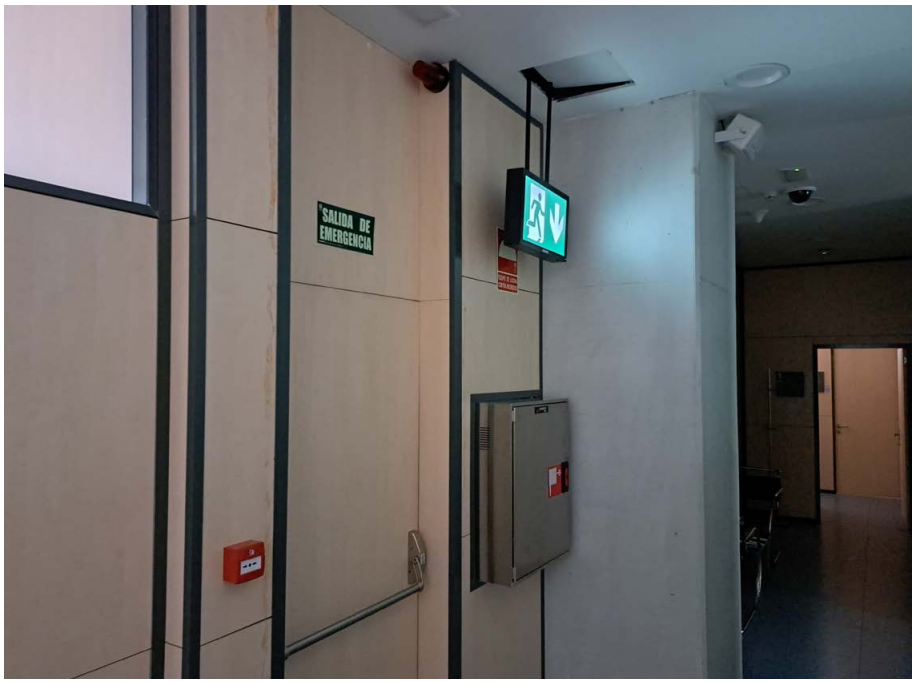

CASE STUDY

VIDEO ANALYTICS FOR CARGO AT ZARAGOZA AIRPORT

ZARAGOZA AIRPORT (ZAZ)

Country: **Spain**

INNOVATION AREA(S):

Artificial Intelligence (AI)

PARTNERS INVOLVED

All Read

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PROJECT DESCRIPTION

The project tests video analysis technology at Zaragoza Airport to improve cargo transport and vehicle access control. It replaces manual processes with real-time automated recognition using artificial vision.

Video cameras at key entry/exit points capture vehicle license plates, trailer plates, and cargo codes (BIC + ISO) for automatic, high-accuracy identification.

Unlike traditional manual or legacy systems prone to errors, this initiative employs AI-driven computer vision, OCR, and machine learning trained on extensive data-sets to recognise information accurately under various conditions.

The project aims to validate AI's performance, comparing it with traditional methods in speed, accuracy, and efficiency.

OBJECTIVES

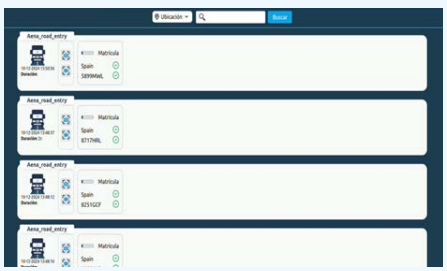
Validate the technical feasibility and accuracy of AI-based video analysis for cargo control and access monitoring.

Improve the speed and automation of identifying vehicles and cargo containers.

KEY PERFORMANCE INDICATORS (KPIS)

Correct reading rate of license plates (vehicles, trailers) and container codes (BIC + ISO), excluding illegible cases.

Process time from vehicle transit to data capture and result delivery.



IMPLEMENTATION PROCESS

Key Steps:

- Definition of objectives and scope with Zaragoza Airport stakeholders.
- Agreement on pilot locations (entry and exit points).
- Installation of video analysis hardware (cameras and edge processing units).
- Configuration of AI models and real-time data integration.
- Pilot execution over an agreed time window.
- Data collection, analysis, and validation of results against KPIs.

Timeline:

- Start: February 2023
- End: December 2024

Stakeholders:

- Zaragoza Airport Operations, Security and IT Teams
- Aena Innovation Team
- Technology provider
- Key Logistics operator

Challenges:

- Ensuring optimal camera positioning to minimize occlusions.
- Managing variations in lighting and vehicle speed.
- Ensuring data privacy and compliance with airport security protocols.

Financing:

- The project was conducted as a collaborative pilot under a zero-cost agreement, with no financial transaction involved between the airport and the technology provider (each party covers its own operational expenses).

KEY OUTCOMES AND BENEFITS

- Successful recognition of readable license plates and container codes.
- Response time, enabling near real-time operational use.
- Demonstrated reduction in manual checks and associated labor costs.
- Potential for increased security and traceability in cargo logistics.
- Foundation for future integrations with airport logistics and security systems.

LESSONS LEARNED

- Proper camera positioning is essential to ensure clear visibility and minimise data loss.
- Camera quality and proper lighting focus are critical factors, especially at night, when the majority of truck entries occur. Poor lighting conditions can significantly impact the accuracy of the recognition system.
- Real-world testing revealed edge cases like partially occluded plates or dirty containers, helping refine the AI models.
- Importance of a robust fallback plan when AI confidence is low (e.g., alerting manual review team).

Advice for other regional airports:

- Start with a well-scoped pilot and defined KPIs.
- Involve operations and IT teams early.
- Ensure the AI model is trained with data from similar environments (vehicle types, container types).
- Test under different weather and lighting conditions.

SCALABILITY AND TRANSFERABILITY

The project is fully scalable and transferable to other airports.

Factors to consider:

- Availability of infrastructure for camera installation.
- Type and volume of vehicles and cargo traffic.
- Customization of AI models to local conditions (e.g., plate formats, lighting).
- Integration with local systems for access control and logistics management.
- Data privacy and compliance with regional regulations.

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CASE STUDY

FROM CUSTOMER SERVICE TO CUSTOMER CARE (I-CARE) USING AI

BOLOGNA AIRPORT (BLQ)

Country: **Italy**

INNOVATION AREA(S):

Artificial Intelligence (AI)

Aeroporto di Bologna

PROJECT DESCRIPTION

Aeroporto di Bologna's traditional customer service, managed via physical InfoPoint and basic digital channels, faced limitations like long response times and operator overload due to increasing requests.

This year, the company is adopting AI, developing a training, strategic plan, and roadmap for use cases. It will also define organisational structures to govern AI, aiming to seize opportunities and mitigate risks. One focus is on advancing the conversational chatbot, transitioning from an NLP engine to LLMs.

OBJECTIVES

The 2023 project aimed to optimise information processes to enhance the passenger experience. The Customer Care team focuses on passenger satisfaction by providing efficient, accurate responses to inquiries, information, assistance, and complaints via various channels such as the information desk, phone, email, and chatbot.

KEY PERFORMANCE INDICATORS (KPIS)

The following KPIs will be used, in the future, for monitoring the service quality:

First Response Time (FRT): Average time to respond to the initial request.

Average Handle Time (AHT): Average time to resolve a request.

First Contact Resolution (FCR): Percentage of requests resolved at first contact.

Deflection Rate: Percentage of requests handled by the chatbot without human intervention.

Customer Satisfaction (CSAT): User satisfaction rating after interactions.

IMPLEMENTATION PROCESS

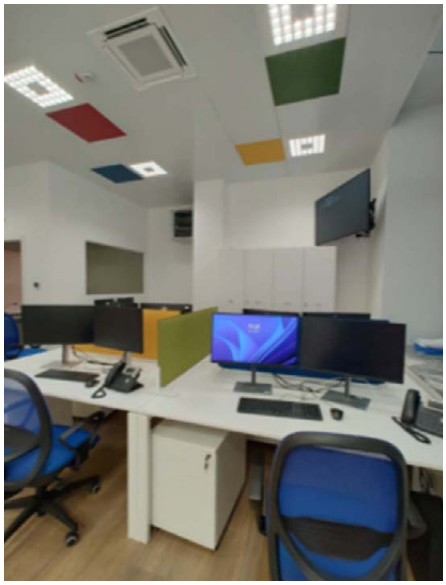
- During 2023 and 2024, AdB, together with an external partner, implemented the project "From Customer Service to Customer Care". The Project has the following objectives:
  - Analysis of the organisation, processes and technologies of Customer Service
  - Design of the Customer Care Operations model
  - Overall service improvement (quality and efficiency) aimed at a better Customer Experience

  The project was carried out in three phases:
  - PHASE 1 – Assessment of processes and organisation - ACTUAL
  - PHASE 2 – Process and organisation design - TO BE
  - PHASE 3 – Summary
- During the year 2023, the assessment phase (ACTUAL) was carried out, which included the analysis of all contact channels and interactions that our customer has with our airport (phone calls, front office, chatbots, emails, etc.). In this phase, several critical issues emerged, thanks also to the analysis of the complaints received.
- Then, in the design phase (TO BE) the Management was presented the project having as its objective the creation of a specific Customer Care area, the creation of a new space (new offices) and a new organisation dedicated to the interaction with the passenger on all channels (digital and non-digital).

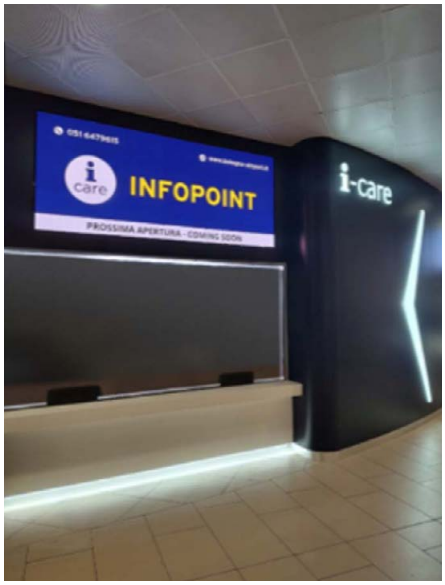
KEY OUTCOMES AND BENEFITS

- The Customer Care team monitors requests, provides initial responses, or forwards them to relevant departments.
- Complaints, managed through CRM, are assigned to the Quality department.
- Service is optimised via reorganisation, implementing a centralised information system, relocating the office to a decentralised area, and focusing on system upgrades and staff training.
- Customer Care assists passengers using advanced systems such as an information desk (7/7, 5:00- 24:00), Microsoft Dynamics CRM with an enriched Knowledge base for effective responses (7/7, 6:00- 22:00), a CTI system Routing calls based on agent language and topics (7/7, 6:00- 22:00), and a chatbot providing 24/7 email assistance.
- The Messenger channel is active; WhatsApp will be added by June 2025, followed by LLM integration to improve response quality, translation, and privacy.
- Touchpoints across the terminal allow passengers to contact operators.
- CRM data is analysed monthly, quarterly, and annually, shared with internal and external entities to identify issues and suggest improvements.
- These efforts have significantly enhanced passenger assistance.

i-Care office interior



i-Care center



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LESSONS LEARNED

- Engaging staff by involving them in project phases is crucial to foster commitment.
- Regional airports should build dedicated, well-trained teams that focus on customer service, leveraging AI and digital systems to improve quality.

SCALABILITY AND TRANSFERABILITY

- The project is repeatable and adaptable to other regional airports. It can be implemented without significant reinvention. To be considered that the platform adopted are based on subscription services.
- Clearly documented and standardised processes are crucial.
- Standard operating procedures (SOPs) ensure consistency and make onboarding new staff easier.

CASE STUDY

CORK AIRPORT SECURITY FORECASTING AND LANE PLANNING TECHNOLOGY

CORK AIRPORT (ORK)

Country: **Ireland**

INNOVATION AREA(S):

Operational Efficiency

CORK AIRPORT

OBJECTIVES

The key objective is efficient queue performance.

PROJECT DESCRIPTION

Cork Airport is renowned in Ireland for its efficient security queues and friendly service. Since 2022, passenger growth has led the security team to collaborate with *daa Labs* and *daa Business Data* to develop a new security forecasting tool. Built internally by *daa Labs*, it enables precise planning of security resources.

Like many regional airports in Europe, flight waves cause peaks and troughs in passenger flow, making accurate resource planning essential to ensure optimal staff deployment.

In 2024, 99% of passengers cleared security in 20 minutes or less, with market research praising the swift queues.

Using machine learning and data like passenger numbers, trends, events, arrival times, processing rates, and airline load factors, the tool forecasts necessary security personnel and lanes every 15 minutes.

This forecast, combined with flexible, demand-based staffing, aligns security capacity with passenger volume.

CCTV software monitors passenger flow in real-time, providing queue estimates and automated alerts to managers if service levels fall short, enabling quick response.

KEY PERFORMANCE INDICATORS (KPIS)

Queue times are the most important KPI.

Accuracy in terms of lane planning and forecasting has resulted in a minimal margin of error when comparing forecasts vs. actuals. In the past number of months, despite increased passenger numbers compared with last year, the lane plans and forecasts were out by just 10 passengers on occasions.

IMPLEMENTATION PROCESS

- Using an older technology that was introduced in 2019, the platform was rebuilt, bringing data across from various sources, and the machine-learning infrastructure was built on a cloud platform.
- The first stage was arranging the various data sources, of which there were many, including airport operating systems, flight timetables, load factors, passenger presentation times, etc.
- The second stage involved the training of the models built to forecast lane planning and passenger throughput accurately.
- The third stage was an evaluation stage, where the models were assessed for accuracy and any improvements/amendments were made.
- The final stage was the integration with existing business processes, including the visualisation stage using Power BI.
- Throughout the implementation stage, stakeholders from across the business collaborated closely, with weekly forums being held for security, planning, regulation and IT team members.
- Key to the entire process was having a “human in the loop” with the ability to tweak or make amends to any of the data sources as they were being processed.

KEY OUTCOMES AND BENEFITS

- The platform is a potent operational tool, replacing significant manual processes and forecasting. As machine learning becomes more familiar with the process, it requires less human intervention, and team members begin to trust the platform.
- Queue times and passenger throughput remain incredibly efficient, and having a swift security experience ensures that passengers have a pleasant airport experience, which is key to the continued success of the airport and the airport brand.
- Through efficient planning and improved machine learning, even though passenger numbers have increased by c. 15% - 20% this year, security queue time performance has been better in 2025 compared with last year.
- Through good communication and cross-functional relationships, the platform can provide rolling 30-day updates on forecasts and has reduced the scope for error by a significant amount.

LESSONS LEARNED

- Throughout the project, each area of the business strived for continuous improvement.
- Trust of team members in the data and technology grew significantly, and they believe and trust the forecasts.
- Increased engagement between IT and security has resulted in a more collaborative approach to essential business functions – i.e. security screening.
- Good communication from airline customers, including the provision of better data, results in a better experience for both the airline's and airport's customers.
- Sharing queue time expectations with passengers reduces stress, and providing an average queue time at security of 5 minutes improves the passenger experience and increases passenger spend with more time airside rather than in queues.

SCALABILITY AND TRANSFERABILITY

- The solution is deployable in any airport, with sufficient planning, effort and skills.

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CASE STUDY

AGE FRIENDLY INITIATIVE

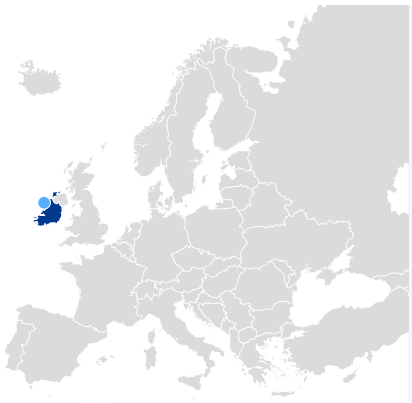
IRELAND WEST AIRPORT (NOC)

Country: **Ireland**

INNOVATION AREA(S):

Passenger Experience Enhancement

Community Engagement & Regional Development



OBJECTIVES

Enhance the airport experience for customers by improving services and facilities, ensuring the transformation meets the Age Friendly Recognition Programme's requirements, and delivering a more age-friendly environment.

PROJECT DESCRIPTION

Over the last decade, airports worldwide have seen consistent growth in travellers, especially as the ageing population takes advantage of better health and longevity, playing a key role as users of airports and airlines. In 2018, Ireland West Airport began becoming an Age Friendly Airport with Mayo County Council and Age Friendly Ireland, aiming to improve services and meet the Age Friendly Recognition Programme.

The airport consulted with older customers through local government's Older People's Councils and conducted 'walkability audits' examining seating, signage, footpaths, parking, toilets, and access routes. The audits identified improvements, leading to a plan to upgrade amenities.

Post-consultation, the airport added extra seating, a disability changing facility, new signage, covered boarding steps, dedicated seating in the departures area, upgraded equipment, and staff training. Consequently, it gained national and international recognition, becoming the first airport to be officially recognised as Age Friendly by the World Health Organisation (WHO).

Consultants Dr. Sean O'Riordain and Jack Keyes helped develop Age Friendly Airport Guidelines, available at www.age-friendlyireland.ie, serving as a model for other airports and transport hubs worldwide. Key features include low noise, resting areas, safe pathways, pedestrian access, accessible toilets, security, good public transport, and clear signage.

This international recognition and partnership exemplify what can be achieved through resource collaboration.

IMPLEMENTATION PROCESS

Following a walkability audit and an independent consultant's audit, an action plan was created from both reports for Ireland West Airport. A findings report was given to airport management, detailing issues and recommendations. The airport responded within 3 months, confirming some problems were fixed and others are in ongoing improvement. Besides the walkability audit, an independent airport audit was conducted, including a detailed study and a Q&A session with staff. An action plan was developed, combining inputs from the walkability team, the Older People's Council focus group, consultants, and the Mayo County Council, outlining issues and suggested timelines. Key steps and recommendations included:

- Re-configuration of the Public Transport drop-off/collection point to provide more adequate weather proofing to be included in the future airport development plan.
- Placement of directional signage at the information desk.
- Directional car parking signage located adjacent to the pedestrian crossing was relocated as it blocked pedestrian access to the terminal.
- Age Friendly Training Modules - Staff have received training in Customer Service with emphasis on people with reduced mobility.
- Check-in agents have been trained to assist customers through the airport, to help with documents for check-in and putting luggage on the conveyor belt, directing, escorting or assisting passengers through security
- Assistance is also provided to the aircraft on departure and arrival. On arrival, staff members help passengers with baggage and, when necessary, offer to bring passengers out to their car.
- A specific portal for older persons may be considered for the airport website to bring people to the existing and excellent guidance on the site.
- The timeline for completion of the project was approximately 6 months from receipt of the Audit and recommendations report.
- Guided by Age Friendly Ireland, Ireland West airport followed the commonly used four stage process which has underpinned Age Friendly Programme approaches across a number of service delivery and physical environments.

Step 1 – Set Up

- Formation of an Age Friendly Airport Steering Group
- Involve key personnel and decision-makers from relevant airport departments, ensuring they are aware of the Age Friendly process.
- Engage with the local Age Friendly Alliance through the local authority.
- Include older people and their representative bodies in the steering group.

Figure 1 *Age Friendly Assistance Help Point*

Step 2 - Audit & Consult

- Conduct walkability audits
- Conduct surveys
- Conduct focus groups
- Collation of key issues and suggestions for action

Step 3 - Plan

- Analyse consultation findings
- Identify domain areas
- Frame Age Friendly actions

Step 4 - Act

- Communicate what has been committed to
- Begin implementation
- Review and monitor actions
- Refresh actions and implementation plan as part of a continuous improvement cycle

Stakeholders involved throughout the process included Airport Management, Mayo County Council, Age Friendly Ireland, and members of the Older Peoples Council. The formation of an Age Friendly Airport Steering Group, comprising members of these groups, was also established to oversee and manage the project.

- During a busy summer, the airport emphasised non-disruption during the audit, stressing strict security code adherence for 12 team members.
- Participants showed ID, with security and arrivals team members providing passports. Once cleared, they received Airport Identity Badges.
- The action plan included timelines, with physical works requiring approval managed by the airport.
- Implementing audit recommendations was costly but aligned with the airport's goal to become Ireland's first Age Friendly Airport.

Financing

The financing of the initiative was an investment by the airport to carry out the required enhancements arising from the audit.

KEY OUTCOMES AND BENEFITS

Enhanced Passenger Experience:

Ireland West Airport significantly improved accessibility, wayfinding, seating, and customer support, transforming the travel experience for older passengers and promoting inclusive design across the terminal.

Economic Opportunity:

By becoming age-friendly, the airport is better positioned to attract older travellers—a growing demographic in leisure tourism—thereby supporting future passenger growth and regional economic development.

Recognition and Leadership:

The airport was the first in the world to be recognised as an Age Friendly Airport by the World Health Organisation (WHO) and won the Chambers Ireland Award and the Age Friendly Transport Award, highlighting its leadership in accessibility.

Collaboration and Influence:

The airport worked closely with Age Friendly Ireland and the Mayo County Council, resulting in the creation of guidelines that can now be used as a model for other airports globally.

Unexpected Benefits:

The international recognition and awards were a welcome and unanticipated result, positioning the airport as a global standard-bearer for age-friendly travel.

LESSONS LEARNED

The walkability audit revealed accessibility challenges that had previously gone unnoticed, showing the value of direct engagement with older passengers. Minor design changes made a big difference, reinforcing that accessibility is an ongoing process, not a one-time fix.

Collaboration with Age Friendly Ireland, the Mayo County Council, and user networks was essential. Success also depended on the airport management's openness to feedback and commitment to change.

Airports considering similar initiatives should prioritise consultation, flexible planning, and strong partnerships to create spaces that are truly inclusive for all ages.

SCALABILITY AND TRANSFERABILITY

This initiative is highly adaptable and can be implemented by other regional airports. Success depends on strong partnerships with local Age Friendly organisations and meaningful engagement with older passengers. A consultative and collaborative approach, supported by airport management's commitment to accessibility and openness to change, is key to ensuring the initiative meets local needs and delivers lasting impact.

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CASE STUDY

SELF CHECK-IN DESKS AND BAG DROPS

LIMAK KOSOVO INTERNATIONAL AIRPORT J.S.C (PRN)

Country: **Kosovo**

INNOVATION AREA(S):

- Digitalisation and Automation
- Passenger Experience Enhancement
- Operational Efficiency

PROJECT DESCRIPTION

The "Self Check-in Desks and Bag Drops" project enhances airport efficiency and passenger experience by automating check-in.

Six kiosks and ten bag drop units, compliant with IATA standards, were installed to allow passengers to scan passports, choose seats, print baggage tags, and drop luggage automatically.

Benefits include reduced staffing and improved satisfaction, with more balanced, less stressful terminal traffic during peak hours.

Completed in three months, the system integrated with existing infrastructure and included centralised data modules, exemplifying successful digital transformation and scalable automation for future growth.

OBJECTIVES

- Reduce passenger processing time and minimise queue lengths
- Increase operational efficiency and reduce dependence on human resources
- Enhance passenger satisfaction and promote contactless services
- Contribute to the airport's digital transformation
- Indirectly reduce CO_2 emissions (shorter processing times, lower energy consumption)

KEY PERFORMANCE INDICATORS (KPIS)

- Kiosk and bag drop usage rate: 10% (after first 6 months)
- Reduction in personnel demand: 2% (especially in pre-counter processes)
- Passenger satisfaction score: increased from 4.1 to 5.0 (out of 5)
- CO_2 emissions: reduced through shorter processing and reduced movement
- Baggage handling error rate: 2% decrease

IMPLEMENTATION PROCESS

Key Steps:

- Preliminary analysis and needs assessment (1 month)
- System and supplier selection (2 months)
- Hardware and software installation (2 months)
- Integration and testing (1 month)
- Staff training and system commissioning (1 month)
- Passenger guidance and information support (ongoing)

Timeline:

- Total duration: 8 months
- Pilot usage: Started within the first 2 weeks
- Full deployment: Completed by the 8th month

Stakeholders:

- Airport management
- ICT and infrastructure teams
- System provider
- Airlines

Challenges and Solutions:

- Integration issues: Resolved via software updates on API and data protocols
- Passenger habits: Addressed through informative displays, staff guidance, and visual signage

Financing:

- Covered entirely by the airport's internal budget

KEY OUTCOMES AND BENEFITS

- Significant reduction in average passenger processing time
- 10% decrease in traditional counter congestion
- Increased contactless transactions (advantage post-COVID)
- Higher passenger satisfaction
- Improved personnel productivity
- Smoother passenger flow with fewer bottlenecks

Positive impacts:

- **Airport:** Balanced terminal usage and reduced operational stress
- **Passengers:** Fast, autonomous, and contactless experience
- **Airlines:** Accelerated ground handling processes
- **Environment:** Reduced energy consumption and carbon footprint
- **Community:** A modern technology investment and a digitalisation example for the region

LESSONS LEARNED

Key Takeaways:

- System integration is the most critical phase and should be supported with early testing
- Elements impacting passenger experience (visuals, signage) are small but essential
- Well-trained ground staff play a crucial role during the adoption phase

Recommendations:

- Conduct passenger profile analysis and design interfaces accordingly
- Choose local system providers for quicker technical support
- Establish on-site observation teams for immediate intervention during initial usage

SCALABILITY AND TRANSFERABILITY

Scalability:

- The system is modular and easily adaptable to terminals of various sizes
- The number of kiosks and bag drop units can be adjusted based on terminal capacity

Transferability Conditions:

- Passenger profile and habits
- Infrastructure compatibility
- Staff training and local support availability
- Language options and guidance infrastructure
- Airline integration processes (API and data protocols)

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CASE STUDY

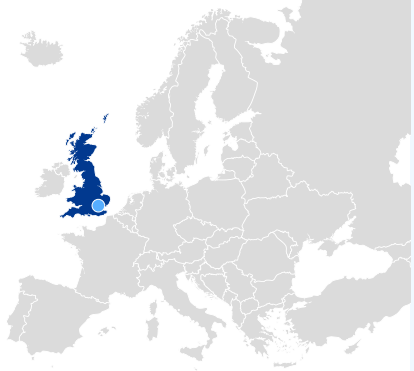
IMPLEMENTING AN ENGINEERED MATERIALS ARRESTING SYSTEM (EMAS) AT LONDON CITY AIRPORT (LCY) TO MAXIMISE SAFETY AND OPERATIONAL EFFICIENCY

LONDON CITY AIRPORT (LCY)

Country: **United Kingdom**

INNOVATION AREA(S):

Operational Efficiency



PROJECT DESCRIPTION

LCY has taken measures to enhance operational safety and improve efficiency for its airline customers. In October 2023, the airport began using Engineered Material Arresting System (EMAS) beds, which safely and predictably stop an aircraft that overruns, minimising damage and injury.

EMAS is an innovative safety feature particularly useful at LCY, where space is limited.

It was necessary to accommodate next-generation aircraft, forming part of LCY's runway end safety area (RESA).

Due to LCY's strategic location near central London, with high buildings in Canary Wharf, the City of London, and active waterways like the Royal Docks and the Thames, EMAS's compact design provides a reliable safety solution within a smaller footprint.

The airport installed two EMAS beds, each with approximately 2,000 blocks, at either end of the runway. Each bed contains crushable material that gradually decelerates aircraft, ensuring a safe stop.

OBJECTIVES

Maximising safety – ensuring a controlled deceleration zone to minimise risk in the event of a runway overrun.

Optimising spatial efficiency – maximise safety within LCY's constrained location without requiring extensive land acquisition.

Accommodating next-generation aircraft – safely introduce larger, quieter, cleaner aircraft such as the Embraer E195-E2 and, in future, the Airbus A320neo.

IMPLEMENTATION PROCESS

The implementation process required a substantial capital investment and a significant commitment of project management time. From the initial planning stages to final delivery, the scope of the project spanned over four years, ensuring thorough development and execution.

Any construction in an airport environment is complex and challenging, but this implementation required exceptionally careful management due to the installation at either end of the sole active runway.

Key stakeholders in the process included the Civil Aviation Authority (CAA) and the partner manufacturer. Close collaboration was critical to maintaining compliance with aviation standards and ensuring the successful integration of the system.

KEY OUTCOMES AND BENEFITS

EMAS has brought a range of safety benefits to LCY. It provides a controlled deceleration zone, reducing the risk of injury or damage in the event of a runway overrun. In addition, given LCY's constrained location near the water and urban areas, EMAS offers a compact solution to maximise safety without requiring extensive land acquisition.

EMAS has also delivered several commercial benefits. By installing EMAS, LCY can safely accommodate new generation, larger aircraft types, such as the Embraer E195-E2, within its existing runway dimensions.

Similarly, earlier this year, LCY submitted an application to the Civil Aviation Authority (CAA) that would, if approved, enable the Airbus A320neo to operate at the airport.

LCY is seeking to introduce cleaner, quieter aircraft as part of its plans to grow in the most sustainable way possible. The application would enable LCY to reach its permitted passenger capacity with fewer flight movements, stimulating economic growth while maintaining operational efficiency. It would open up a range of possible new routes for passengers while incentivising airlines to modernise their fleet from older to newer generation aircraft, such as the Airbus A320neo, which are more fuel efficient.

LESSONS LEARNED

One of the key lessons from the EMAS project at LCY was the value of early and continuous stakeholder involvement. Engaging stakeholders from the outset ensured alignment during the critical design and scope phases, helping to steer the project effectively and meet key milestones. The success of the project was also underpinned by a highly prepared and disciplined working team, who demonstrated exceptional operational awareness, particularly in maintaining a presentable and functional area for daily operations despite the close proximity of the installation works. Additionally, close collaboration with the manufacturer proved vital in overcoming design and operational challenges, fostering a proactive and solutions-focused environment throughout the project lifecycle.

SCALABILITY AND TRANSFERABILITY

Each EMAS bed is specific and bespoke to each airport and its fleet mix. However, LCY has successfully established the principle as one of the early adopters of the EMAS technology and engineering in Europe. (There are now, in 2025, only 6 airports using the system in Europe). This demonstrates what can be achieved on constrained sites to improve operational efficiency.

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CASE STUDY

CONSTRUCTION OF SKELLEFTEÅ DRONEPORT

SKELLEFTEÅ CITY AIRPORT AB (SFT)

Country: **Sweden**

INNOVATION AREA(S):

Advanced Air Mobility (AAM)

PROJECT DESCRIPTION

The Skellefteå Droneport, one of Europe's largest urban droneports operated by Skellefteå Airport as part of the Arctic Aviation Hub , aims to be a leader in urban drone technology. While drone technology exists, regulations for long-distance and beyond visual line of sight flights are still evolving. Skellefteå is proactively building infrastructure and expertise in anticipation of future regulations, as full drone service implementation could take at least three years. The airport's operational role facilitates infrastructure development early, supporting sustainable mobility solutions and innovation. The droneport offers a testing environment with offices, an indoor hangar, an extensive testing area, and connectivity to the city and Skellefteå Science City. It will also provide drone training to enhance local and national skills. The expected operational start is summer 2025. The facility features sustainable Bio-Zero asphalt, modular buildings, and advanced tech like 5G and DJI Dock 2. It aims to accelerate the commercialisation of drone services, supporting societal challenges with smarter, safer, and cost-effective solutions.

OBJECTIVES

The main objective was to build an operational city close droneport from scratch and to find the organisational setup between relevant stakeholders.

KEY PERFORMANCE INDICATORS (KPIS)

Success was measured through five key performance indicators:

1. Establishment of an operational droneport
2. Verified and documented building and permitting process for replication
3. Defined operational set-up with stakeholder responsibilities
4. Completed financial documentation and first-year operational budget
5. Approval of one or more drone projects operating at the droneport

All KPIs were successfully met by the end of May 2025, ahead of the official inauguration on 10 June 2025.

IMPLEMENTATION PROCESS

Describe the implementation process, including key steps, timelines, and stakeholders involved.

- Drone project at the airport: 2021-2022
- Workshop regarding future projects: 2022
- Pre-study regarding droneport: 2022-2023
- Decision to build : 2023
- Planning: 2023-2024
- Construction phase: 2024
- Final construction and inauguration: 2025

Skellefteå Municipality has designed and prepared the site (incl. water supply etc.) together with Skanska. Skellefteå Airport has been responsible for, among other things, electrical wiring and buildings above ground.

Skellefteå Airport has the operational responsibility for the droneport.

Skellefteå Municipality own the ground and is paid an annual fee from Skellefteå Airport.

There was no template regarding anything, so everything has been invented from scratch. From drawings, building permits, measures, etc. This has all been solved through close cooperation by the stakeholders involved, but also through creative thinking outside the box, bravery in decision making and a shared vision to build a unique infrastructure.

Financing:

The work to prepare the ground has been taken on by the municipality and the power company Skellefteå Kraft. The cost of buildings, fences, electricity, permit fees, consultants, etc., has been taken by the airport. Labour costs have been taken within each company using already existing staff and expertise.

KEY OUTCOMES AND BENEFITS

- The key outcome has been that Skellefteå Airport has built and now operates one of Europe's first and largest city-close droneports.
- The possibility to share competencies and resources. It has also led to closer cooperation between the airport and the municipality and other key stakeholders. It has also put the spotlight on the possibilities of AAM for companies, public entities and citizens in the region.
- During the process, the need for education and new skills regarding AAM has been highlighted. This has led to many ideas, cooperations and projects connected to education and drones. This has also triggered collaboration with schools and will mean that the droneport will be more focussed on education and training than we first anticipated.

LESSONS LEARNED

- Many lessons learned building a city-close droneport without a manual, including permits, specs, dimensions, and stakeholder involvement. Key insights into infrastructure needs for unmanned air traffic emerged. Organisationally, the municipality handles ground operations, while the airport oversees airborne activities and safety. This is Sweden's first regional airport, responsible for operations beyond its premises.
- The advice would be to build on a small scale and modular. To do this together with the local municipality and other local stakeholders. To use existing procurement agreements at the airport for the infrastructure at the droneport. To do a business case based on buying versus leasing of infrastructure. In the case of Skellefteå Droneport it was a mix of these.

SCALABILITY AND TRANSFERABILITY

- The project can be expanded to other regional airports. Although integrating manned and unmanned aviation is complex, it might be advisable to manage unmanned flights outside the CTR of the regional airport, particularly closer to urban areas where most drone services are likely to occur.
- The factors that would need to be considered for successful transferability to different contexts are: local aspects regarding geography, operational scope of the regional airport, integration of UAM together with other local stakeholders, possibilities to share employee competencies and different kinds of infrastructure, procurements, etc., at both the airport and the droneport.

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CASE STUDY

VIRTUAL REALITY GROUND HANDLING TRAINING FOR IRREGULAR HANDLING PROCEDURES AT STUTTGART AIRPORT

STUTTGART AIRPORT (STR)

Country: **Germany**

INNOVATION AREA(S):

- Digitalisation and Automation
- Operational Efficiency
- Virtual Reality (VR)

WORLD BUSINESS PARTNER INVOLVED

Draxon

PROJECT DESCRIPTION

Since December 2023, Stuttgart Airport has evaluated trends and technologies through its innovation initiative, focusing on VR for airport training. SAG Stuttgart Airport Ground Handling GmbH saw VR's potential for training employees across various scenarios, revisiting the technology after earlier dismissals due to low visual quality and high effort. Now, VR is more mature and suited for practical use, especially for training ground handling staff in diverse scenarios, including irregular ones with wide-body aircraft. VR aims to enhance learning, increase training flexibility, and motivate employees through gamification. The project first develops wide-body aircraft training before expanding to security and dangerous goods training. STR partnered with Berlin-based startup Draxon, leveraging its VR expertise and innovative subscription business model, enabling cost-effective, collaborative content development sponsored by multiple airports.

OBJECTIVES

Increase the **availability and quality** of training for ground handling staff through on-demand, flexible VR modules

Overcome bottlenecks caused by the limited availability of **specialist trainers**

Enable use of **off-peak hours** for training to optimise operational efficiency

Improve **learning outcomes** through immersive, visual, and language-flexible VR environments

Minimise **distractions** during training (e.g., from smartphones or peer conversations)

Reduce **training-related costs** by eliminating the need for external travel and accommodations (e.g., for wide-body aircraft training)

Enhance **employee motivation and engagement** through gamification and interactive learning

Support **continuous learning** with refresher trainings delivered in a more accessible and enjoyable format

Improve **employee retention** and overall job satisfaction

Contribute to a **reduction in handling-related accidents** through higher-quality, scenario-based training

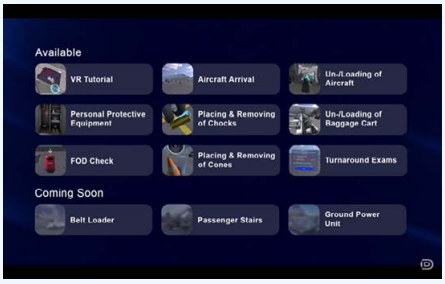

Figure 1 *Summary of available trainings as of June 2025*

Figure 2 *Virtual training environment*

KEY PERFORMANCE INDICATORS (KPIS)

- **Increased test success rates** in training assessments, compared to prior formats
- **Reduction in external training costs**, including travel, accommodation, and instructor fees
- **Higher training participation rates**, particularly in voluntary and refresher sessions
- **Reduction in training-related downtime**, through better alignment with off-peak schedules
- **Decrease in handling-related incidents or accidents**, particularly in wide-body aircraft operations
- **Improved employee feedback** scores related to training satisfaction and relevance
- **Uptake of VR training across language groups**, indicating broader accessibility
- **Time savings** in onboarding or upskilling processes
- **Employee retention improvements**, especially among younger demographic groups

IMPLEMENTATION PROCESS

The project began as 'Digital Pioneers' at Stuttgart Airport in December 2023, involving employees from various departments to explore trends and technologies. Over a year, they created prototypes aligned with STR's goals to develop innovation skills and promote cross-departmental influence. In July 2024, a VR safety training prototype was shown, aiming at safety and firefighting. Post-project, interest grew for expanding VR into full projects across departments, leading to discussions about use-cases, including VR for SAG's aviation trainings. Management assessed feasibility and suppliers, with Paul Schwarzenholz of Draxon proposing VR training for ground handling. The project, funded by STR's aviation department and managed by SAG, involves partnerships with other airports and experts to leverage VR content libraries, benefiting training quality and scalability. By spring 2025, initial onboarding prototypes were tested, moving towards a full-scale wide-body operation module set for fall 2025, with plans for additional modules on aircraft security and dangerous goods handling.

KEY OUTCOMES AND BENEFITS

Introducing VR at STR enhances training by making sessions more accepted and engaging, as shown in tests. Though the Stuttgart apron isn't shown, a generic approach still works well. The project allows testing various contents, constantly reevaluating and improving training methods by offering new perspectives and visualisations.

User interaction is intuitive, even for those with little gaming or VR experience, with no reports of discomfort like motion sickness, indicating mature technology.

Long-term use will better reveal impacts on safety, learning, and business viability.

LESSONS LEARNED

Despite the limited full airport VR prototype implementations, the technology has continuously developed, allowing rapid deployment and customisation to customer needs. Hardware costs are now less significant due to VR's progression towards commoditization. STR uses Meta Quest 3 VR glasses for training.

The VR technology was openly approached by most project participants, even among older staff. Interactions are intuitive, based on visual explanations and haptic feedback, though some support for training content questions is necessary. Stakeholders must provide materials and meet specific requirements for content development, fostering active information exchange.

This project highlights the importance of reevaluating discarded products, reshaping the business model to improve viability and reduce barriers through agile methods like prototyping and cross-department collaboration. STR leverages these insights with their innoCREW, an agile team driving innovation via prototypes and MVPs aligned with current trends. Additionally, STR offers expertise to external stakeholders through its consulting subsidiary, Cost Aviation.

Figure 3 *Ground handling employee testing VR trainings*

SCALABILITY AND TRANSFERABILITY

By participating in a subscription platform, this VR project is available to all subscribing partners. The STR module for wide-body aircraft handling will launch in Spring 2026. The platform's active members increase its value. Since it focuses on general training, it may be limited in local procedures, but it still offers diverse training opportunities. VR devices are not standalone; a hybrid approach with an experienced trainer is needed to support users, with one trainer supervising up to four VR users, enabling scalable VR training compared to traditional classrooms.

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CASE STUDY

TORINO AIRPORT GROUND TRANSPORTATION DASHBOARD: DATA-DRIVEN INTERMODAL SUSTAINABILITY

TORINO AIRPORT (TRN)

Country: **Italy**

INNOVATION AREA(S):

- Intermodal Connectivity
- Artificial Intelligence (AI)
- Passenger Experience Enhancement
- Sustainability / Carbon Reduction

TORINO AIRPORT

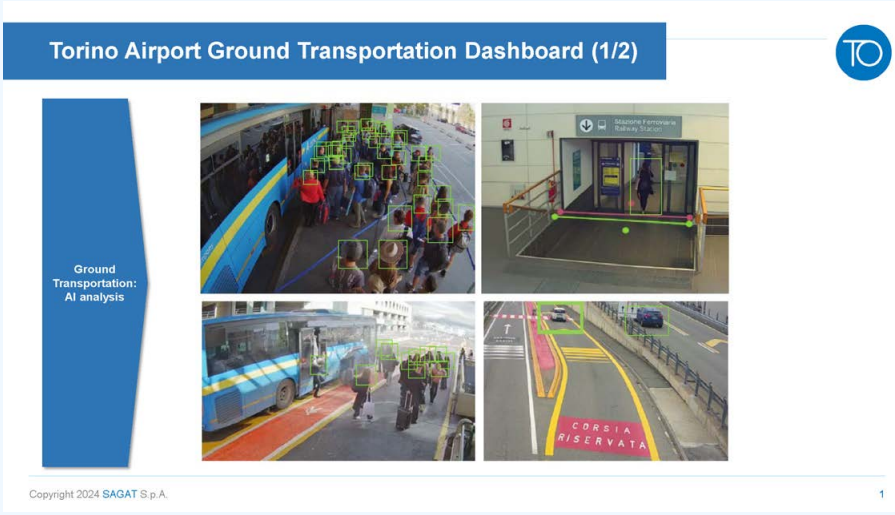
PROJECT DESCRIPTION

Starting in 2022, Torino Airport (SAGAT) analysed ground transportation to improve airport connection services, benefiting passengers. The strategy aims to enhance city-airport links and the attractiveness of the "Torino destination," aligning with airline commercial logic and sustainability goals in the "Green Airport" plan.

In 2023, a detailed "dashboard" was developed, integrating data from various sources (bus and train usage via video analysis, car sharing, Limo, airport parking, shuttle services, and vehicle transits) to monitor passenger travel behaviour and market share of transport modes. These insights help assess the impact of the rail link service introduced in January 2024 and predict ongoing growth.

From 2024, these surveys also estimate ground transportation's environmental impact by calculating CO_2 emissions for Scope 3 within the *Airport Carbon Accreditation* programme.

The system employs computer vision technologies to analyse video feeds at four bus stops and railway underpasses, integrating the data with information from parking areas and vehicle movements, recognising the vehicle type (i.e., taxi, private car, truck, etc.).



OBJECTIVES

Improve the intermodal accessibility of the airport.

Reduce the environmental impact of ground transportation.

Provide a data-driven decision-making tool for mobility planning.

KEY PERFORMANCE INDICATORS (KPIS)

% of passengers using collective means (over 1/3 in 2024).

Estimated reduction in CO_2 emissions (Scope 3).

Number of transportation modes monitored in real-time.

IMPLEMENTATION PROCESS

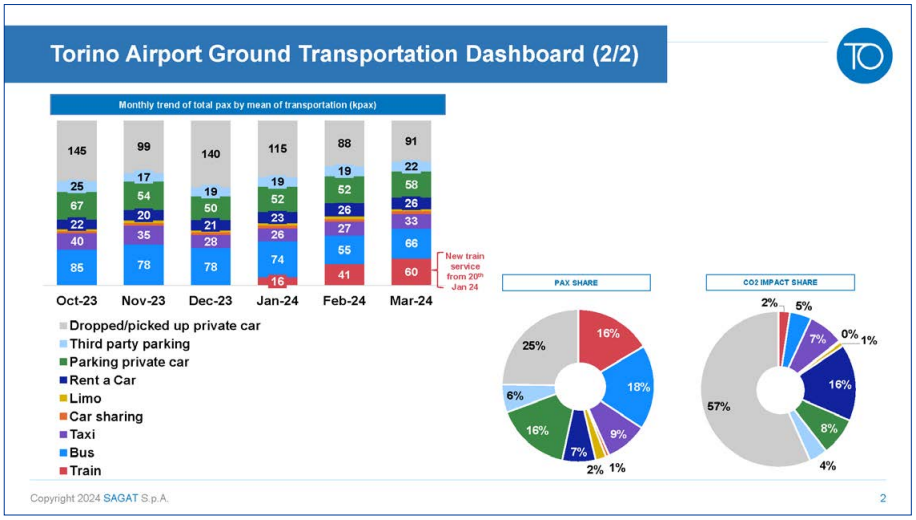
The project, which first started with a six-month proof of concept in collaboration with a start-up specialising in computer vision to test the application of AI to video analysis, took 3 years to be fully implemented. In more detail, these were the main steps that were developed over the three years:

2022: Installation of cameras and start of analysis and data collection. 2023: Development of the dashboard and system integration. 2024: Operational launch and first year of complete monitoring.

Stakeholders involved: Ground Transportation Committee, public and private transport operators, technology providers.

Challenges:

- Integration of heterogeneous data sources, assumptions of emission models and accuracy of AI models.
- Multifaced approach to obtain increasingly accurate data over the three-year period, performing cross-checks to test the reliability of the data provided by AI.
- Compliance with privacy regulations by placing specific signage on the video surveillance authorised by the company's data Protection Officer near each camera used for video analysis and ensuring a short term storage of the images.



KEY OUTCOMES AND BENEFITS

The increased use of collective transportation, supported by active railway connections since January 2024, highlights peak times when bus and train services are insufficient for airport passenger volume. This has been crucial for achieving Level 3+ in the *Airport Carbon Accreditation* programme.

Improved strategic planning with stakeholders, based on shared data, enhanced passenger satisfaction on access quality (ASQ KPI rising from 3.68 in 2022 to 3.96 in 2024).

Unexpected benefits include strengthened ties with transport operators through data sharing and service adjustments based on demand and traffic forecasts. This collaboration has also opened new advertising opportunities and increased non-aviation revenues through space rentals.

LESSONS LEARNED

The integration of heterogeneous data requires strong governance and cross-functional collaboration.

Advice to other regional airports: Data transparency fosters stakeholder engagement and the sharing of sustainability goals.

SCALABILITY AND TRANSFERABILITY

The project is highly scalable and replicable in other regional airports, provided that:

- Digital infrastructures for data collection are available.
- Collaboration with public and private transport operators.
- Emission calculation models adaptable to the local context.

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CASE STUDY

GATE GARDEN – OPEN-AIR TERMINAL CONCEPT

VARNA AIRPORT (VAR)

Country: **Bulgaria**

INNOVATION AREA(S):

- Passenger Experience Enhancement
- Infrastructure Innovation

WORLD BUSINESS PARTNERS INVOLVED

AVOLTA

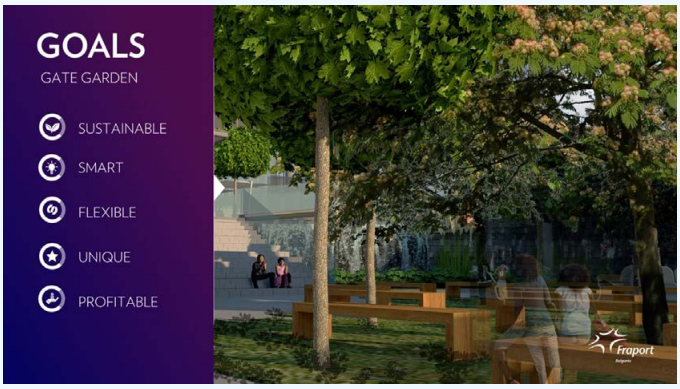
Lagardère

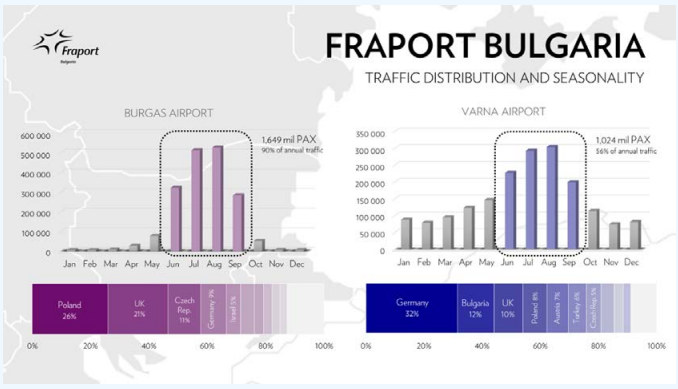
PROJECT DESCRIPTION

Inspired by the COVID-19 pandemic and Bulgaria's accession to the Schengen area, the "buildless" concept for Terminal 2 at Varna Airport redefines airport infrastructure. This innovative approach, focused on sustainability and passenger well-being, addresses the increased demand for terminal space by creating a unique open-air extension. Abandoning heavy air-conditioning, complex fire systems, and large glass facades, this design dramatically reduces both operational and embodied carbon footprints. The project achieves a significant reduction in the use of carbon-intensive materials like concrete, steel, and aluminium, leading to approximately a five-fold decrease in embodied carbon compared to traditional construction. The lack of a fully enclosed, air-conditioned space also slashes operational emissions by around 80%. This design maximises efficiency by allowing areas to function in a "swing" mode for both Schengen and non-Schengen passengers, adapting to fluctuating traffic. The expansion transforms the airport from a transactional hub into a destination in its own right. It provides a unique, human-centric experience with a focus on fresh air, natural light, and greenery. Passengers can enjoy beautiful views of the apron and runway from a terrace, creating a relaxing environment. The design prioritises minimal circulation time by allowing direct boarding from the terrace, maximising "joy time" for travellers. A data-driven approach, including an analysis of historical meteorological data and traffic forecasts, ensured the design was tailored to the local climate. This helped determine the optimal use of the open-air terrace during peak times. The project also emphasises social interaction through a public garden-inspired design with benches and fountains, fostering a sense of community. By integrating natural elements with a "Biophilic brutalism" aesthetic, the concept softens the terminal's monumental character, creating a harmonious and inviting space.

OBJECTIVES

Increase airside terminal area by approx. 40%, providing flexibility for Schengen operation (the terrace is a swing area), while providing a unique passenger experience and commercial offers by enlarging the commercial area by 65%.





KEY PERFORMANCE INDICATORS (KPIS)

Reduction in embodied carbon footprint (approximately 5 times) and operational carbon footprint (by 80%); improvement in passenger processing time by providing gates for boarding straight from the terminal; increase in non-aeronautical revenue.

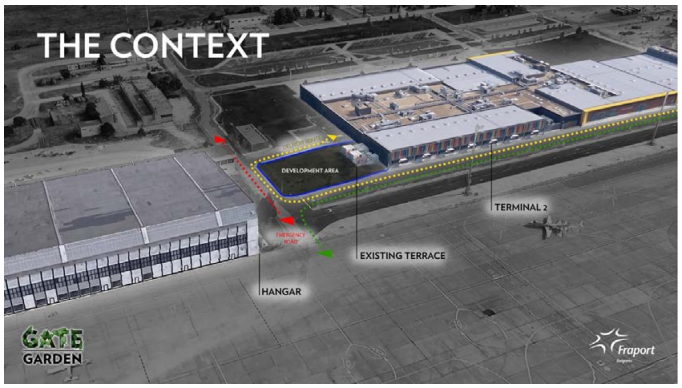
IMPLEMENTATION PROCESS

The project had a timeline of 6 months for design, 6 months for permitting, and 8 months for construction. It involved a wide range of stakeholders, including government bodies such as the Ministry of Transport and the Civil Aviation Authority, as well as commercial operators like Avolta, Lagardère, and McDonald's.

Two key challenges were addressed during implementation. The first was coordinating a consolidated design from numerous different design teams hired by various stakeholders. This was overcome through a series of approximately 400 brainstorming and coordination meetings. The second challenge was constructing during the winter season between high seasons, which posed a risk of delays due to wet processes. This was mitigated by reducing the use of damp construction methods and opting for prefabricated metal structures for commercial outlets, which could be assembled in cold and wet weather. Additionally, using pavement for the semi-underground level avoided the need for a full-scale concrete slab, further reducing risk and carbon emissions.

Financing:

General construction under Fraport Twin Star Airport Management scope in partnership with Avolta, Lagardere and McDonald's for interior and exterior commercial fit-out works.



KEY OUTCOMES AND BENEFITS

An innovative and sustainable approach which can be adopted by airports with summer seasonality.

- **Positive impacts:** Increased operational flexibility, reduced processing times, increased commercial offers, a unique passenger experience, and sustainable architecture.
- **Unexpected Benefits:** The strategic location of the Gate Garden, situated in proximity to both the apron and the landside, enables it to be used for public events by adjusting the Airside/Landside boundary.

LESSONS LEARNED

All systems and infrastructure shall be carefully designed, due to the design choice of visible concrete and greenery, typical of the Biophilic Brutalist architecture.

The advice to other regional airports would be to curate the plant species according to the local climate and culture.

SCALABILITY AND TRANSFERABILITY

The project is scalable and replicable in other regional airports, considering that a data-driven approach is crucial, due to the higher sensitivity of the concept to environmental factors.

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CASE STUDY

FLYPORT BY BALTONA EDUCATION AND ENTERTAINMENT CENTRE

WARSAW RADOM AIRPORT (RDO)

Country: **Poland**

INNOVATION AREA(S):

- Passenger Experience Enhancement
- Business Model Innovation
- Community Engagement & Regional Development

LOTNISKO WARSZAWA-RADOM

Figure 1 Educational Zone "From Dreams to Clouds"

PROJECT DESCRIPTION

The Flyport Education and Entertainment Centre is at Warsaw-Radom Airport, owned by Baltona S.A., a prominent Polish travel retail firm operating since 1946, now owned by Polskie Porty Lotnicze S.A. Since 2020.

The centre was created due to COVID-19's impact on aviation, to diversify revenue and boost airport appeal and local engagement, especially for Radom residents.

The edutainment focus suits Poland's rising segment, leveraging Baltona's experience, and centres on aviation with educational and interactive elements.

OBJECTIVES

The main goal was to create a project beyond Baltona's current segments, which depend on the airport industry, besides Baltona Shipchandlers. Additionally, Flyport aimed to offer a unique passenger experience at Warsaw-Radom Airport.

KEY PERFORMANCE INDICATORS (KPIS)

The main KPI is the number of visitors to the centre. Since it has only been in operation for six months, it isn't easy to assess the fulfilment of this KPI.

IMPLEMENTATION PROCESS

The project began with a decision influenced by post-COVID analysis and diversification goals, followed by developing a concept to leverage Baltona's and Polish Airports' advantages, including the Warsaw-Radom airport.

Benchmarking and competitive industry analysis helped establish a unique advantage. The contractor selection focused on experience in multimedia exhibitions, with New Amsterdam chosen.

Finalising the concept involved benchmarking visits to competitors. Legal and administrative steps included obtaining permits, with expert input on safety. Construction started in 2022 and led to ongoing adjustments to enhance user value.

Recruitment and training of animators commenced, along with a promotional campaign targeting potential visitors.

The centre's opening in September 2024 was preceded by an exclusive preview for Baltona and Polish Airports staff, aiding testing and CSR efforts. A guest satisfaction survey post-event confirmed positive feedback.

Challenges:

"Flyport by Baltona" is a pioneering project from the company's perspective. As a result, the process of its creation was fraught with challenges for the entire organisation. Implementing the centre required the application of diverse business models used by the company in its Travel Retail and F&B projects.

Financing:

The project was financed from its own funds thanks to the cooperation of Baltona and Polish Airports.

KEY OUTCOMES AND BENEFITS

A key benefit for the company is successfully entering a new industry. The experience with "Flyport by Baltona" can be leveraged in other segments, building unique competencies nationally and internationally. Baltona can also provide an exceptional passenger experience at Warsaw-Radom Airport.

Creating "Flyport by Baltona" required collaboration among many stakeholders. Its opening positively impacts many, mainly increasing Warsaw-Radom Airport's attractiveness, which has Poland's only extensive educational and entertainment centre- especially valuable for leisure travellers on holiday charters.

The centre, part of Radom's aviation traditions, is also a key tourist site. Visiting "Flyport by Baltona" can enhance Radom trip programs for groups and individuals.

The opening of "Flyport by Baltona" received very positive media coverage, with over 100 articles highlighting its values. This improved Baltona's image, emphasising that, despite its tradition, the company demonstrated innovation.

LESSONS LEARNED

The main conclusion is the importance of a well-developed concept. In addition, it is crucial to determine the competitive advantages of the project. The product must meet the needs of the potential customers.

The process itself should also have a precisely outlined schedule with margins for unexpected delays.

Careful selection of subcontractors is critical. They must have experience in working with industries that require special safety conditions.

As advice to the other regional airports, the creation of a similar centre is undoubtedly a massive organisational effort. Before committing to similar projects, it is essential to assess your organisation's readiness to take on such a challenge.

SCALABILITY AND TRANSFERABILITY

The project is scalable, and its various elements can be transferred to other airports. Certain elements can also be used outside airports.

A key factor is the available space and the integration of potential exposure into the current structure of the airport.

Figure 2 *Stand "Flight Control"*

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