The Airport of 2050+

Presentation on the FP7 project ‘The 2050+ Airport’

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October 21st, 2015
Aerodays 2015
London, UK
Presentation Overview

The 2050+ Airport project:

• Summary, consortium and stakeholders
• Vision & Objectives
• The three concepts:
  – The Time-Efficient Airport
  – The Ultra-Green Airport
  – The Cost-Effective Airport
• End results
• Questions
Project summary

The 2050+ Airport project:

- FP7 project, a small/medium scale focused research project
- Consortium of 8 partners lead by NLR:
  - NLR, TU Delft, INECO, CRIDA, SLOT, DLR, UPM, SMART

Duration: From September 2011 until March 2014 (30 months)

Budget: 2.6M euro (2M EU contribution)

Project objective: To explore three new airport concepts with radical and novel solutions to prepare airports for 2050 and beyond:

- The Time-Efficient Airport
- The Ultra-Green Airport
- The Cost-Effective Airport
Project stakeholders

Participating airports (by sub-contracting):
  • Amsterdam Airport Schiphol, the Netherlands
  • Fraport, Frankfurt, Germany
  • Kaunas Airport, Lithuania
  • Transilvania Airport, Târgu-Mures, Romania

Stakeholders active in the three workshops held, including:
  • Barajas airport
  • Zurich airport
  • Vilnius airport
  • Riga airport
  • Vienna airport
  • Milan Malpensa airport
  • Boeing RT
  • Airbus Germany
  • Eurocontrol
  • Aena
Project Aim & Set-up

The 2050+ Airport Project (2050AP) has aimed to:

- Develop a vision and a value driven concept development methodology (WP2)
- Develop three airport concepts following this methodology (WP4)
- Develop a validation framework to validate the concepts and increase their maturity level (WP3)
- Draw conclusions (WP5) and disseminate results (WP6)

Project Set-up:

1. Background Description: Vision 2050
2. Reference airport analysis
3. Solution Generation
4. Value Assessment
Project vision

Project vision: what will the world look like in 2050+? Changes:

- Demographic, societal, economical, geopolitical changes
- Environmental changes and expected energy demand/supply
- Technological & mobility (demand) changes

Conclusions Ultra Green:
- Sustainability of air transport strongly required for future social acceptance
- Expected increased pressure of governments towards sustainability

Conclusions Time Efficient:
- Severe competition from other modes of transport on time-efficiency (incl. high-speed trains, autonomous vehicles)
- Increased need to connect fast and seamlessly (ICT may provide full transparency)

Conclusions Cost Effective:
- Severe competition from other modes of transport on costs/revenues
- Increased fuel and other resource prices (e.g. land) -> need to make cost-effective use of resources
Three concepts: objectives

ADD VALUE FOR AIRPORT AND STAKEHOLDERS IN 2050

BE COST-EFFECTIVE (Area: Economics)
- Reduce cost
  - Reduce aeronautical cost
  - Reduce non-aeronautical cost
- Increase revenues
  - Increase aeronautical revenues
  - Increase non-aeronautical revenues

BE ULTRA-GREEN (Area: Subsustainability)
- Reduce energy consumption
- Reduce emissions
- Keep noise within legal limit
- Optimal use of resources
- Optimal use of water

BE TIME-EFFICIENT (Area: Mobility)
- Minimize throughput time of passengers
- Minimize throughput time of aircraft
- Have seamless intermodality
The Ultra-Green Airport Concept
Introduction to the UG concept

Why has the UG concept been developed?

- Minimize energy use
- Minimize noise nuisance and local emissions
- Make optimal use of resources
**Background of the UG concept**

**Challenges derived from Vision 2050**

- Stricter environmental requirements on noise, emissions, and resource usage
- The price of fossil fuels will increase compared to alternative energy sources
- Other modes of transport will more easily switch to alternative energy sources
- Long lead times make it hard to adapt to sustainability requirements
- The sustainability of the airport is dependent on ATM and aircraft developments
- Intermodal connectivity is key to balancing mobility and sustainability
- Pressure for low-fare will challenge sustainable developments
UG Reference airport analysis

Bottleneck analysis

Airside processes
- Large contributor to energy use = aircraft
- Considerable emissions = aircraft
- Large contributor to noise = aircraft

Landside processes
- Considerable energy use = ground vehicles
- Considerable energy use = Baggage Handling System
- Considerable emissions = ground power
- Considerable resource usage = landside processes

Infrastructure
- Considerable energy use = climate control
- Infrastructure constructed without lifecycle point-of-view

Intermodal transport services
- Considerable emissions = personal transport
- Considerable energy use = personal transport
UG concept solutions

Solutions to solve UG bottlenecks and meet objectives

**Airside processes**
- Electric engine accelerators for take-off
- Electric ground movement
- Cleaning and de-icing robots

**Landside processes**
- City & single central terminal
- Dual threshold runway / split runway
- Magnetic levitation for take-off and landing
- Automated apron services (incl. transport robots)
- Weather protected turnaround
- Shielding landing/take-off operations by landscape design

**Infrastructure**
- Automated seats

**Intermodal transport services**
Example idea of the UG concept

Transport robots to transfer baggage, consumables and cargo

Positive impacts:

• Flexible and scalable
• Reduction energy use baggage handling system (BHS)
• Noise reduction for ground personnel
Example idea of the UG concept

Electric ground movement

Positive impacts:

• Reduction in local emissions
• Reduction in taxiing noise
• Fuel savings for short haul flights
• More flexible gate operations (pushback, aircraft positioning)
Overarching concept description

The ultra green experience

- high speed train connection
- central city terminal
- cleaning / de-icing robot
- automated apron services
- baggage transport robots
- weather protected turnaround
- split runway
- maglev
- electric engine accelerators
- shielding

2050+ UG airport
The Time-Efficient Airport Concept
Introduction

Why has the TE concept been developed?

- To minimize delays for airlines and passengers
- To minimize waiting times
- To provide seamless connectivity to air travellers
TE Reference airport analysis

Bottlenecks:

- **Airside processes**
  - Turnaround related delays
  - ANSP related delays
  - Taxiing delays
  - Security check
  - Information misunderstanding or unavailability
  - Walking times
  - Check-in process
  - Sorting and transporting of baggage

- **Landside processes**
  - Unreliability of the network
  - Baggage handling between modes
  - Information related issues

- **Intermodal transport services**
  - Terminal size
  - Limitation of seamless intermodal transport

- **Infrastructure**
TE concept solutions

Solutions to solve TE bottlenecks and meet objectives

- **Airside processes**
  - Electric taxi systems
  - High speed rail system for taxiing
  - Automated de-icing systems
  - Underground piers
  - Automation of turnaround processes

- **Landside processes**
  - Walkthrough security corridor
  - APMs from terminal to aircraft standing position
  - Mobile phone based sequencing for boardings
  - Fast baggage sorting and containerising system
  - Automatic displaceable seats for passenger boarding

- **Intermodal transport services**
  - Automated electric taxis for door-to-airport transport
  - Integrated guidance systems

- **Infrastructure**
  - High-pier
  - Circular Terminal
Example idea of the TE concept

High speed rail system for taxiing

Positive impacts:
- Reduction in average taxi in/out times
- Pushback eliminated
- All weather system

Implementation issues:
- Infrastructure cost
- Airport operations disruption
- Certification
- Integration with ATC procedures and systems
Example idea of the TE concept

Automated de-icing

Positive impacts:
• Reduction in average taxi in/out times
• No need for de-icing platforms
• Reduction in delays

Implementation issues:
• Implementation costs
• Certification
• Reliability
Overarching concept description

The time efficient experience

- automated electric taxis
- integrated guiding systems
- walk through security corridor
- mobile phone based sequencing
- automated displaceable seats
- automated de-icing
- automated turnaround processes
- high speed/electric taxiing
The Cost-Effective Airport Concept
Introduction

Why has the CE concept been developed?

- To minimize the OPERATIONAL costs
- To reduce the investment costs
- To increase the revenues
Trends regarding cost structure

- **Staff**: decreases due to automation + trend of increased outsourcing
- **Repair and maintenance**: increases with increased use of technology as part of the airport infrastructure
- **Depreciation costs**: increases with increase of privately owned airports + increased use of technology
- **Energy costs**: increases due to an increased use of technology and forecasted increase in energy prices
- **Security costs**: increases (slightly) due to ever stricter regulations.
Trends regarding revenue structure

Trend: increase in non-aeronautical revenues over aeronautical revenues:

- **Passenger + aircraft related charges**: decrease due to increased competition.
- **Retail and food&beverage**: increase towards one of primary sources of revenues.
- **Parking and car rental services**: decrease assuming increase in use of public transport for larger airports + increased constraints on private cars.
# CE concept solutions

## Solutions to solve CE bottlenecks and meet objectives

<table>
<thead>
<tr>
<th>Idea</th>
<th>Rationale</th>
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<tr>
<td>Satellite Airport &amp; City Centre Terminal</td>
<td>Lean airport: small terminal, lower investment/depreciation costs, resource sharing</td>
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<tr>
<td>Sharing landside costs and revenues</td>
<td>Shared-property commercial facilities</td>
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<td>Screening on-the-go</td>
<td>THz-based security screening of walking passengers leading to lower security costs</td>
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<td>On-board self boarding</td>
<td>Reduces staff costs for boarding</td>
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<tr>
<td>Fully Integrated IT Services</td>
<td>Reduces info desk staff costs - use your smartphone!</td>
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<td>Remote Tower</td>
<td>Reduces ATC service costs</td>
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<td>Self-Cleaning Materials</td>
<td>No cleaning leads to a decrease in cleaning staff and may lead to faster turnarounds -&gt; improved service provision</td>
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<td>Synthetic Vision</td>
<td>Reduced costs for runway/taxiway lighting</td>
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<td>Active buildings</td>
<td>Reduced energy costs through heat recuperation, LED/FIPEL lighting, etc.</td>
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Example ideas of the CE concept

Satellite Airport & City Center Terminal

*Intermodal transportation hub including airport terminal.*

- In an extremely cost-sensitive world, resource sharing will be crucial.

- This may result in intermodal transportation hubs in city centers connected to satellite airports via high-speed rail.

- The central transportation hub provides passenger access and security checks for all transport modes, thus sharing resources (staff, infrastructure, retail, support services).

- The satellite airport is lean and cost-efficient.
Example ideas of the CE concept

On-board self boarding

Aircraft systems aware of who’s on board.

- Terminal is equipped with e.g. camera surveillance allowing automatic identification of passengers
- Passengers are provided with personalised information and can proceed to the aircraft without being checked and having to wait (non-stop)
- Boarding is done automatically using e.g. biometric identification (retina scan), fingerprint recognition, identification by the smart communication device, etc.
Overarching concept description

The CE airport

Far from the city centre

Connected to the intermodal transportation node

Commercial activities out of the terminal

Small terminal building compared to the throughput

The sole purpose of the terminal is passenger processing via built in automated systems providing maximum throughput.

Passengers are connected to terminal systems via smart devices receiving and providing the required information without any human interaction: the Walkthrough Terminal.

Entry to the terminal is located at the high density traffic transportation node providing all required intermodal connections.

Since the airport generates traffic and thus customers for the commercial activities located in the central transportation node the airport is entitled to a share of the revenues.

The intermodal transportation node is located in the city centre connected to the terminal via high speed transportation facilities.
Project End Results

The end result consists of:

1. A value driven methodology for airport concept development
2. Three Innovative airport concepts:
   - The time-efficient airport:
     *To minimise throughput time of aircraft and passengers by providing seamless flow through the air transport system*
   - The ultra-green airport:
     *To make the airport self sufficient in its energy needs, operate in a climate neutral way and limit its noise exposure*
   - The cost-effective airport:
     *To create an airport with extremely low operating costs generating high revenues*
Project End Results (2)

3. Several concept elements/solutions forming the building blocks, e.g.:
   • Electric Guided Taxi System
   • Underground container loading
   • Electric Engine Accelerators for take-off
   • Automated People Movers
   • MagLev for TOL

4. A validation framework to increase concept maturity level and assess the impact of concept elements on relevant KPIs:
   • e.g. cost, emissions, noise, energy/water use, time-efficiency A/C, time-efficiency PAX, revenues, intermodality
Thank you for your attention!

More info at:
http://www.2050airport.ineco.eu

Questions?