PARE Article
Meeting Societal and Market Needs

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PERSPECTIVES FOR AERONAUTICAL RESEARCH IN EUROPE

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INTRODUCTION

By 2050, passengers and freight experience must be improved, in order to meet the increasing demand for travel and to handle more easily unforeseeable events. Travel services should be affordable, quick, reliable, efficient, seamless and sustainable, based on a resilient air transport system and capable of automatically reconfigure the journey, including transfer to other transport modes, if necessary.

To guarantee this improvement, the Advisory Council for Aeronautics Research in Europe (ACARE) established the Flightpath 2050 goals. The second chapter of PARE's report, entitled "Meeting Social and Market Needs" addresses Flightpath 2050's goals 1 to 5, which concern air traffic capacity, ground infrastructure, mobility, speed and punctuality, respectively.

AIR TRAFFIC CAPACITY

Currently, the European airline traffic is around 10 million flights per year of all types of vehicles, and is expected to rise to 25 million by 2050, including unmanned and autonomous vehicles. This forecasted growth of air transport puts increasing demand on air traffic capacity with undiminished safety, being this capacity concerned with runway, airways terminal area and en route capacity, and its evolution closely related to air traffic management (ATM). The accommodation of such a growth in flights will be determined by the most restrictive of these three capacity limits, being it the runway capacity.

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KEY FINDINGS

- In 2007, in Europe, there were about 45 main airports (large and medium hubs) and about 450 country and regional airports (commercial service airports). Three years later, the five major European airports hubs were at saturation – operating at full capacity;
- In 2016, the total numbers of passengers travelling by air in the EU could be established at 973 million, an increase of 5,9% compared to 2015;
- Over a European network of more than 2100 airports, 528 airports account for just 25% of airports, but 98% of the departures. Also, the 25 largest airports in Europe generate 44% of all flights and 90% of all traffic comes from the largest 250 airports;
- There is a geographical concentration of airports in the region London – Amsterdam – Munich – Milan, which creates dense air traffic, with large numbers of climbing and descending aircraft: a significant challenge for terminal area and en route capacity;
- The cities closest to Europe's busiest airports have between 4 and 46 airfields within 100 kilometers (km) from the city centre. For 8 of the 10 cities close to Europe's biggest airports, a single airport handles 80% or more of all the departures within 100 km;
- By 2030, it is expected that no fewer than 19 airports will be operating at full capacity eight hours a day, every day of the year, which means they will be highly congested and 50% of all flights will be affected by delays upon departure or arrival, or both.
- During the past years, it has been identified a growing gap between capacity and demand at a number of busy European Union (EU) hubs, being predictable that Europe will not be in position to meet a large part of the expected demand due to a shortage of airport capacity. In concrete terms, in 2050, it is estimated that 36% of flight demand will not be accommodated at European airports.

KEY ACTIONS

It is recommended that a broad and deep research effort is maintained concerning all aspects of ATM that can contribute to increase airspace capacity, which is the purpose of the 1st Flightpath 2050 goal, with equal or greater safety. Additionally, there are proposed projects and measures that could improve air traffic capacity:

1. Eurocontrol measures to mitigate the capacity challenges;
2. The SESAR project PJ02 (EARTH) - Increased Runway and Airport Throughput;
3. The Airport Collaborative Decision Making (ACDM) concept.

GROUND INFRASTRUCTURE AND MULTIMODAL TRANSPORT

Nowadays, new airports to serve major cities tend to be built farther requiring transport to reduce access time to the airport, which affect passenger convenience. Vertiports and heliports can be sited much closer to city centres, providing an alternative with faster access than airports, if noise and community issues can be resolved. By 2050, the air transport ground infrastructure should comprise major hubs, secondary airports, vertiports and heliports, all seamlessly connected within a multimodal transport system, and should include interfaces with other modes of transport.

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KEY FINDINGS

- In the U.S., from the existent 5,664 heliports in 2016, both for private and public use, most of them were essentially unused and have been declared, throughout the years, inactive and for emergency use only. In Europe, unconfirmed reports indicate less than 100 civilian type heliports;
- The most frequent distance between European airport pairs is related to approximately 1000 km, while there are only a few potential links above 3000 km. At smaller airports, departures most often travel less than 300 km, and at large and very large airports, the 400 km distance bracket Is the most common, even though they have the largest share of 3500 km flights;
- Very high – speed train point to point connections (travelling at 250 km / hour) can be more time efficient than air transport over a distance up to about 600 km, although load factors are lower than in aviation (85% on average);
- Over 50 city-pairs will be connected by new or improved links between 2019 and 2035, such as high – speed trains that can offer comparable transport times for distances up to 800km. Passengers opting for rail will reduce the demand for flights by a little over 0,5% (estimated 0,7%) in 2035;
- A network of small, traditional or electric aircraft that take off and land vertically, called Vertical Take – off and Landing (VTOL), would enable rapid, reliable transportation between suburbs and cities and, ultimately, within cities. On a different perspective, shifting short – haul flights to high speed - train would reduce, even slowly, the unaccommodated demand for flights, by reducing the demand for flights.

KEY ACTIONS

It is recommended that urban and land planning methodologies are developed to optimize, on a regional basis, the location of airports, vertiports and heliports to simultaneously provide convenient links to other transportation nodes and minimize environmental impacts and disturbance of populations. Some of the proposed measures mentioned before could also improve the connectivity of (or the mobility between) airports, which is the aim of the 2nd Flightpath 2050 goal, as well as the new initiative, named ONE Order, proposed by the International Air Transport Association (IATA).

CHOICE OF MOST EFFICIENT MOBILITY SOLUTIONS

The progress in mobile communications and availability of information should ensure that, in 2050, European citizens can make informed mobility choices among several available travel options and have affordable access to one another, taking into account economy, speed and level of service (that can be tailored to the individual customer). Additionally, continuous, secure and robust bandwidth communications should be provided for added value applications.

KEY FINDINGS

- In 2009, according to a survey conducted within ModAir project, no airport website provided enough information for the customer to be able to plan the entire trip. Customers needed to visit several websites to do that and still, websites didn't provide information about transit times between different travel modes nor real time information about delays in ground transportation;
- According to ModAir project, a clearly important requirement for passengers is to easily access reliable, impartial and real time information, both for pre – trip planning and to be kept informed of relevant developments during the journey;
- Passengers are mainly willing for better information related to intermodality, comprehensibility of the reservation systems (including better prices when booked air and rail are together), flexibility on their bookings and a secure framework with clear operators 'liability conditions;
- Automation will enable passengers to be informed about the current status of their journey and alternative options, periodically or on demand, using smart phones or interactive panels/screens situated along the intermodal transport network;
- Nowadays there are many sources of travel information and services with different objectives and priorities making the choice confusing and often non-comparable. Moreover, there is the necessity to develop and/or implement solutions to provide passengers with real time information during their entire journey.

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KEY ACTIONS

To achieve the 3rd Flightpath 2050 goal, it is recommended that a one-shop centralized travel information site is promoted where the EU citizen can readily find the alternative options for connecting any two locations, including costs and timetables, with links to reliable booking.

OVERALL GROUND PLUS AIR TRAVEL TIME

By 2050, the interfaces of the airport with other modes of transport must allow 90% of passengers within Europe to be able to complete their journey, door-to-door (D2D) within 4 hours. This D2D time comprises the origin airport access time, the time inside the origin airport to go through airport services, the air travel time, the time inside the destination airport and the time from the destination airport to the final destination place.

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KEY FINDINGS

- In 2016, the average departure delay per flight ranged from 8 to 16 minutes, with an annual average all – cause departure delay per flight of 11.3 minutes. The aircraft turnaround related processes have been the main factor that have induced delays in the air transport operation over the years;
- For almost 80% of the European cities, the nearest airport is situated at 20 km. Such a short distance reflects that the general accessibility of the European airports is high;
- Passengers spend on average, using Madrid as example, more than thirty minutes to get to the airport. Therefore, researching new ways to get to the airports (for example, the use of VLOTs) from the city centers would be the first key to actually reduce the travel duration;
- The second key to actually reduce travel duration would be the improvement of the current processes carrying at the airports or even the design of a new system regarding both passengers and luggage processes;
- Air travel times can vary significantly in Europe, from one hour in central Europe to four hours between extremities of the continent. Besides depending on flight distance, which can go up to 3000 km within the EU, travel times also depend on the aircraft engine type, being that an aircraft jet powered is faster than one propeller driven;
- Key enablers to reduce overall travel times are a reduction in airport access times, a higher predictability of times accessing the airport and process times inside the terminal. However, as the aviation factor cannot be responsible for what happens outside the aircraft and airports and cannot influence travel time to or from the airport, the 4th Flightpath 2050 goal should only consider travel times and process times inside the terminal

KEY ACTIONS

It is recommended that the 4th Flightpath 2050 goal is revised to take into account the distance and duration of flight and cover the time period from arrival at the departure airport to exit from the destination airport. The project DATASET2050 can support this revision process since it addresses the EU passenger mobility in the context of the D2D objectives defined in the Flightpath 2050 vision.

ATM AND WEATHER

In 2050, flights should arrive within 1 minute of the planned arrival time, regardless of weather conditions, thanks to a resilient transport system, capable of automatically and dynamically reconfiguring the journey within the network to meet the needs of the traveler if disruption occurs. Likewise, special mission flights should be able to be completed in the majority of weather, atmospheric conditions and operational environments.

This punctuality of air transport in adverse conditions depends on availability of meteorological data sufficiently in advance for efficient re-routing. Disruptive events and special flights that require reconfiguration of multiple flight paths can be made efficiently if supported by fast and reliable simulation tools.

KEY FINDINGS

- A flight is considered to be delayed when it is 15 minutes later than its scheduled time. In 2016, yearly airline arrival punctuality decreased, with 81% of flights arriving within this time, compared to 82% in 2015. Weather delays slightly increased, compared with 2015, to 0.57 minutes per flight;
- The basic issue is overall ATM capacity, not only at airports and in terminal areas, but also en route, with spare capacity to cope with special missions, disruptions and weather hazards (weather conditions such as icing, strong wind, low visibility, snow, etc.);

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- A high average weather-related airport arrival delay is usually the result of a notable capacity reduction in bad weather combined with a high level of demand;
- At U.S. airports, the higher frequency of instrument meteorological conditions (IMC) combined with scheduling closer to visual meteorological conditions (VMC) are key elements to reduce winter delays. Weather – dependent delays are more relevant during summer months;
- Both in U.S. and Europe, weather is the predominant element affecting the airport throughput and as consequence of ATM – related departure restrictions. In Europe weather – related constraints represent a smaller share of delays than in U.S., even though weather in Europe is less favorable;
- Runway throughput rates depend on visibility conditions and are reduced significantly when Low Visibility Procedures (LVPs) have to be adopted, since they require an increased spacing between aircraft;
- ATM performance depends on a number of factors and is affected by meteorological conditions, such as visibility, wind and convective weather, and can vary significantly in different airports, according to the airport equipment, runway configurations (wind conditions) and approved rules and procedures. Therefore, additional efforts are required to relate weather conditions on airport and ATM performance and to develop a more comprehensive assessment of weather impact.

KEY ACTIONS

It is recommended that a more comprehensive weather data is made available to ATM and airlines to assist achieving punctuality targets and that a rapid near real time simulation capability is developed for ATM to accommodate special emerging flights and adjust to major disruptive events.

For more information about these topics, you can access the full chapter here.