Developing Multimodal, Air-Rail Scenarios for Europe
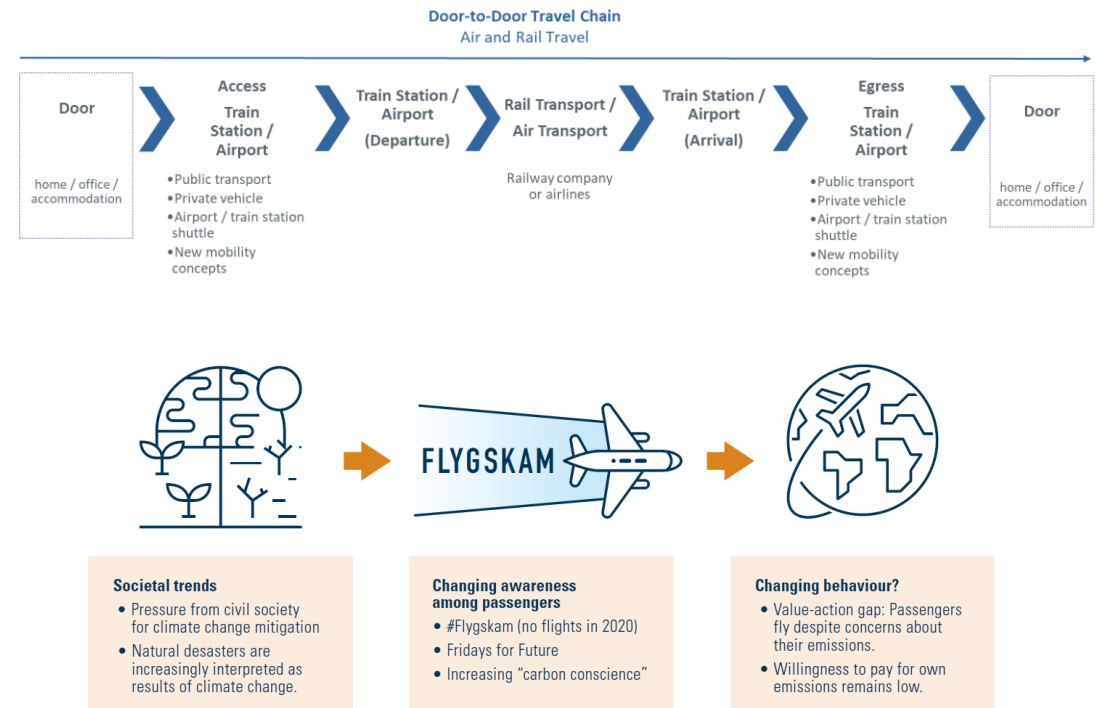
A. Paul[1], U. Schmalz[1], I. Laplace[2], A. Cook[3], T. Bolic[3], V. Perez[4], N. Pilon[5]

[1]Bauhaus Luftfahrt, [2]Ecole Nationale de l'Aviation Civile, [3]University of Westminster, [4]International Union of Railways, [5]EUROCONTROL

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Moving Towards a Multimodal European Transport System

- Manifold challenges ahead!
  - Enabling a **seamless passenger journey**, including multiple providers and information
  - Meeting **environmental goals** and facilitating a sustainable transport system
  - Identifying and developing **new business models** that enable multimodal transport
  - Tackling the long-term **implications resulting from COVID-19**
  - Rethinking the use of current **infrastructure** and future challenges

Door-to-Door Travel Chain
Air and Rail Travel

| Door | Access Train Station / Airport | Train Station / Airport (Departure) | Rail Transport / Air Transport | Train Station / Airport (Arrival) | Egress Train Station / Airport | Door |

home / office / accommodation

Access Train Station / Airport
- Public transport
- Private vehicle
- Airport / train station shuttle
- New mobility concepts

Railway company or airlines

Egress Train Station / Airport
- Public transport
- Private vehicle
- Airport / train station shuttle
- New mobility concepts

home / office / accommodation

FLYGSKAM

Societal trends
- Pressure from civil society for climate change mitigation
- Natural desasters are increasingly interpreted as results of climate change.

Changing awareness among passengers
- #Flygskam (no flights in 2020)
- Fridays for Future
- Increasing "carbon conscience"

Changing behaviour?
- Value-action gap: Passengers fly despite concerns about their emissions.
- Willingness to pay for own emissions remains low.

Source: Adapted from Schmalz et al. (2021) & Bauhaus Luftfahrt Yearbook (2019)

The Modus Project and Multimodality

- The overall performance of the (future) European transport system will strongly depend on the **alignment and optimization of multimodal transport**.

- Modus develops a **modelling approach for the assessment of seamless door-to-door multimodality and passenger experience** in Europe.

- Modelling **diverse passengers' modal choice decisions** and the impact on capacities, predictability and the environment.

Call: ATM Role in Intermodal Transport (H2020-SESAR-ER4-10-2019)
Grant no. 891166
Duration: June 2020 – November 2022

Objectives:

- Exploring the future landscape of air-rail multimodal travel, under a range of future scenarios and use cases.

- Assessment of seamless door-to-door multimodality and distinct passenger experience in Europe.

- Evaluate the impact of an improved, joint air-rail transport system on frequencies between various city pairs.

Analysing Future Multimodal Pathways

- Development of **future multimodal scenarios for European joint air-rail transport**

- Derived from **European high-level mobility objectives**, existing scenario studies as well as the work conducted within the Modus project

- Focus on particular aspects envisaged for the future, and that have the potential to significantly change the transport system

- Not mutually exclusive: different regions may develop features of several scenarios

- Four multimodal scenarios with a time horizon 2040+

European high-level mobility objectives (extract)

Mobility goals	Definition
Connectivity	Reduction of travel time; Connection of remote regions
Environmental impact	Reduced reliance on fossil fuel; Reduction of CO_2 emissions; Internalisation external costs
Integration and additional demand	Meeting increasing transport demand by adjusting and extending capacities; More efficient resource allocation within transport network
Technological innovation and (widespread) implementation	Develop more fuel-efficient, hydrogen-powered and (hybrid-)electric aircraft and bring these into operation through continued fleet renewal; Ensure that low and zero emission technology options are deployed, including through retrofitting and appropriate renewal schemes in all transport modes

Source: Modus Deliverable D3.2 (2021)

Future Supply and Demand Scenarios

Scenario 1: Pre-pandemic recovery (baseline)

- Network structures remain similar to todays

- Implementation of innovative technologies facilitates the reduction of emissions in air transport

Scenario 2: European short-haul shift

- High share of short-haul air traffic replaced by air-rail cooperation

- High quality of transport network with HSR services on short-haul distances

Scenario 3: Growth with strong technological support

- Higher growth rates of the transport sector until 2040 than the baseline

- Uptake of technological innovations to both reduce emissions and alleviate capacity shortages in air transport

Scenario 4: Decentralized, remote and digital mobility

- Population becomes more dispersed across rural and remote regions with increased options for remote working and virtual meetings

- More decentralized air transport network, additional railway stations

- Technological innovations for regional aircraft

Scenario 1:
Pre-Pandemic Recovery (Baseline)

- The European transport market recovers to pre-crisis levels; air transport and railway network structure remain similar to today's.

- The implementation of innovative technologies, SAF, as well as market-based measures facilitate the **reduction of emissions** in each transport sector.

This scenario serves as the **baseline** for the comparison with different future development paths.

Scenario 2:
European Short-Haul Shift

A high share of **short-haul air traffic is replaced by a cooperation between rail and air,** reduction in overall air traffic on short-haul routes in Europe:

- A high-quality transport network with high-speed rail services on short-haul distances is established, and with clean aviation services improving the coverage of long-haul routes.

- By 2030, **high-speed rail traffic will double** (this mainly concerns major links inter- and extra-EU), and that scheduled collective travel of **under 500 kilometers should be carbon neutral** within the EU. The relevance of rail increases significantly in the segment between 200 to 1,500 kilometers.

- Increased level of **cooperation** between air and rail to provide both door-to-door solutions as well as efficient connectivity of European regions.

Scenario 3:
Growth with Strong Technological Support

- Significantly **higher growth rates of the transport** sector until 2040 than in the baseline scenario.

- Uptake of **technological innovations** in the air transport sector to both reduce emissions and alleviate capacity shortages, exceeding levels envisaged by Destination2050, Flightpath2050, EU Smart and Sustainable Mobility Strategy, for example.

# Scenario 4: Decentralized, Remote & Digital Mobility

The European population becomes more dispersed across **rural and remote regions**, these become attractive due to increased options for remote working and virtual meetings.

In line with the EU Smart and Sustainable Mobility Strategy, remote and rural regions will be better connected to the European transport network:

- significantly increased role of **small and regional airports**,

- additional railway stations in the network,

- a more **decentralized** (air) transport network structure,

- widespread implementation of technological innovations for **regional aircraft**.

Outlook and Recommendations

- Towards future air-rail multimodal mobility:
  - Ensuring connectivity of regions,
  - A holistic assessment of investment in modal alternatives,
  - Enabling cross-border and cross-mode tickets,
  - Implementing a common regulatory framework that addresses passenger rights, data sharing, or the concept of single ticketing.

Inclusion

Data Availability

Connectivity

Data Sharing

Accessibility

Regulation
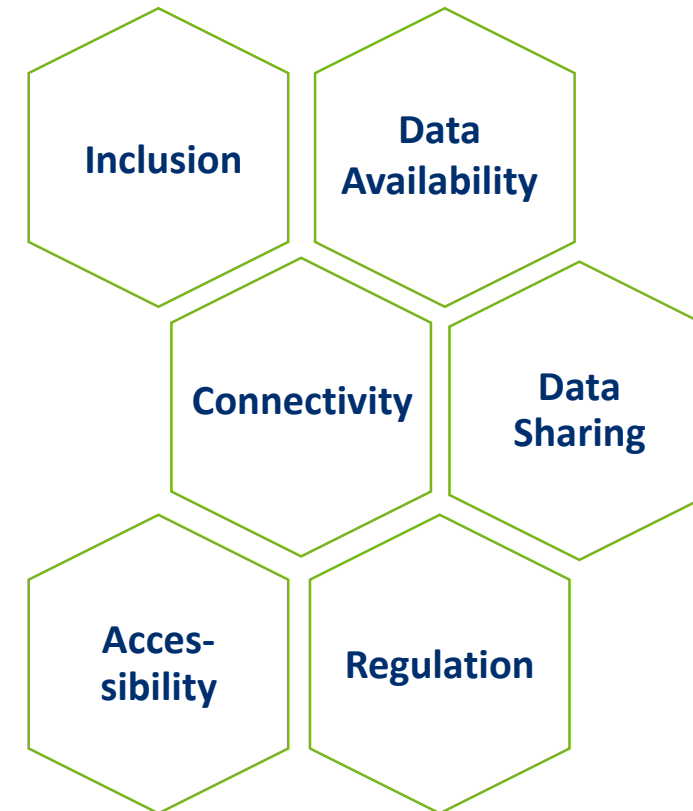
If you have any questions or like to learn more about Modus, contact us via:

Modus Website: https://modus-project.eu/

Modus Twitter: @Modus_project

Modus LinkedIn:
https://www.linkedin.com/company/moduseuproject/

Modus Coordinator: Bauhaus Luftfahrt

- Dr. Annika Paul, Annika.paul@bauhaus-luftfahrt.net
- Dr. Ulrike Schmalz, Ulrike.schmalz@bauhaus-luftfahrt.net

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Paris / online

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YOUR ATTENTION

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Back Up

SOCIO-ECONOMIC SCENARIO PARAMETERS

Scenario parameter	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Socio-economic category				
NUTS2 population	Aging and increasing | UN medium fertility variant			
NUTS2 GDP of departing and arriving airports/stations / NUTS2 average households' income	Current status	Moderate increase (++)	Strong increase (+++)	Moderate increase (++)
Environmental and political development category				
Environmental regulations	Low increase (+)	Strong increase (+++)	Strong increase (+++)	Moderate increase (++)
Mobility network category				
Air traffic demand (passengers per city pairs)	Current status	Decrease in growth in the short-haul market (-)	Strong growth (+++)	Moderate growth (++)
Rail traffic demand (average number of passengers)	Current status	Strong growth (+++)	Strong growth (+++)	Moderate growth (++)
Assumed air space improvement	Current status	Weak improvement (+)	Strong improvement (+++)	Moderate improvement (++)
Assumed rail network improvement	Low level of improvement (+)	High level of improvement (+++)	Moderate level of improvement (++)	High level of improvement (+++)
City archetypes	Continuation of status quo structure (recovered to pre-pandemic)	Stronger focus on existing hubs and large airports (long-haul traffic focus) and feeder rail connections	Uniform growth across air and rail networks, with little or no differentiation between route or node types	Decentralised air transport network
Number of busy airports (airport traffic)	Current status	Current status	Increase	Increase in small and regional airports
Number of HSR lines	Small increase (++)	Strong increase (+++)	Strong increase (+++)	Moderate increase (++)
Airport catchment area effects	Small increase in airport catchment areas (+)	Increase in airport catchment areas (++)	Increased airport catchment areas (++)	Airport catchment areas increase (++)

SUPPLY AND TECHNOLOGICAL DEVELOPMENT SCENARIO PARAMETERS

Scenario parameter	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Rail transport frequency	Low increase (+)	Strong increase (+++)	Strong increase (+++)	Moderate increase (++)
Air transport frequency	Low increase (+)	Decrease in short-haul frequencies (-)	Strong increase (+++)	Moderate increase (++)
Rail supplied capacity (maximum number of carried passengers)	Low increase (+)	Strong increase (+++)	Strong increase (+++)	Moderate increase (++)
Air supplied capacity (maximum number of carried passengers)	Low increase (+)	Decrease in short-haul traffic (-)	Strong increase (+++)	Moderate increase (++)
Type of train used	More HSR trains are employed, focus on specific high-demand routes (+)	The use of HSR services and trains increases significantly (+++)	The use of HSR services and trains increases significantly (+++)	More HSR trains are employed (++)
Travel time (air or rail segment)	Current status	Reduced travel times in both the air and rail sector	Current status	Reduced travel time in the air transport sector
Share of train leaving (or arriving) on time	Current status	Strong increase (+++)	Moderate increase (++)	Moderate increase (++)
Share of aircraft leaving (or arriving) on time	Current status	Increase (+)	Decrease (-)	Moderate increase (++)
Monthly price index for rail transport	Current status	Weak increase (+)	Moderate increase (++)	Moderate increase (++)
Monthly price index for air transport	Current status	Strong increase (+++)	Moderate increase (++)	Moderate increase (++)
Level of air-rail integration and cooperation	Low degree	High degree	Medium/low degree	High degree
Implementation degree of new aviation technologies	Current status	Moderate degree (++)	High degree (+++)	Moderate degree (++)
Implementation degree of new rail technologies	Current status	High degree (+++)	Moderate degree (++)	Moderate degree (++)