

# Modus: Modelling and Assessing the Role of Air Transport in an Integrated, Intermodal System

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**Abstract** - In the context of increasing environmental awareness, regulatory measures, capacity shortages across different modes, and the need for a more seamless and hassle-free passenger journey, the future evolution of European travellers' demand for mobility and its potential impacts on the European transport system is still unknown. The optimization and alignment of intermodal transport is therefore of utmost importance for the overall performance of the (future) European transport system, especially in regard to providing an improved passenger journey as well as mitigating mobility capacity constraints. The main objective of the Modus<sup>1</sup> project therefore is the analysis of the performance of the overall transport system by considering the entire door-to-door journey holistically and assessing the role of air transport within an integrated, intermodal approach. For this purpose, Modus identifies and assesses (future) drivers for passenger demand for and supply of mobility in terms of their impact on passenger mode choices. This enables the development of multiple scenarios of future mobility paths, taking into account aspects such as new regulatory contexts meeting new environmental standards, or new transport operators' business models, covering a time horizon of 2040+.

**Keywords** - air transport, intermodal transport, capacity, performance, Europe, modeling

## I. INTRODUCTION

Travellers have never had so many mobility options to choose from for getting from A to B: Planes, trains and automobiles, not to mention micro-mobility options like bikes and scooters. But what combination of these offers the quickest, most affordable, reliable and greenest option for getting from door to door, especially for journeys that involve air travel? That is the challenge that researchers in the recently launched Modus project have set themselves.

With this in mind, the main objective of the project is the performance analysis of the overall transport system by considering the entire door-to-door journey and assessing the role of air transport within an integrated, intermodal approach. Modus identifies and assesses (future) drivers for passenger demand for, and supply of, mobility, and how these impact passengers' modal choices. This enables the development of

multiple scenarios of future mobility pathways, taking into account new regulatory contexts, meeting new environmental standards, or new business models, and covering a time horizon of 2030 and further beyond.

The Modus consortium (Bauhaus Luftfahrt (coordinator), University of Westminster, Innaxis, EUROCONTROL, Skymantics, International Union of Railways, and Ecole Nationale de l'Aviation Civile) combines intermodal expertise and experience to meet these objectives.

## II. CONCEPT AND APPROACH

The Modus project is structured into three main pillars that build upon each other - (1) Future supply and demand scenarios, (2) Passenger mobility modelling, and (3) Identification of gaps and barriers - and provide an assessment of the overall performance of the European transport system and the role aviation plays in an integrated, intermodal passenger door-to-door journey. Following these objectives and approach, Modus explores demand and supply drivers, and how these affect mode choices, by conducting expert and passenger surveys, a detailed literature review of the research landscape, and by applying passenger mode choice modelling. Furthermore, Modus applies and further advances existing models to determine the demand allocation across different transport modes, especially air and rail, and the effects on the overall capacity of these modes. Based on these analyses, a set of performance and connectivity indicators will be developed and assessed within the project. These facilitate the identification of gaps and barriers in meeting high-level European (air) transport goals, and solutions to gaps can be addressed.

Across these pillars, a data-driven approach is pursued in order to ensure a thorough assessment of the current and future European transport system, and advance the data availability in this area. The goal of the research is to provide a holistic modelling approach that covers door-to-door travel and illustrates the impact on (air) transport capacity - in particular at airports - and passenger flows. For this purpose, the Modus consortium makes use of various data sources to model the

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More information can be found here: <https://modus-project.eu/>

interaction between different transport modes including, for example, Eurostat database, World Bank database, or national statistical databases providing transport statistics, drawing on the consortium's experience in other EU-projects such as DATASET2050 or Domino.

The modelling approach builds on the already well-developed (air) mobility model, 'Mercury', developed by the University of Westminster and Innaxis over the past years, mostly focused on the gate-to-gate segment of passenger travel itineraries, providing both advanced and classical passenger and flight metrics. This will be extended within Modus to a broader, much more comprehensive door-to-door context. It will also be complemented by RNEST, the research version of an ATM simulation tool used by EUROCONTROL, which allows the modelling of air traffic, including flight trajectories and ATM processes.

### III. EXPECTED IMPACT AND RESULTS

In terms of expected impact, Modus aims to provide important insights into the passenger experience by significantly

improving the knowledge of travellers' preferences and expectations, and on how different factors influence the demand for air and rail transport. This includes the detailed analysis of passengers' preferences with regard to modal choice, going beyond the mere travel time and price parameters, and taking into account aspects such as environmental considerations, or comfort during the journey.

Furthermore, the project provides an integrated modelling approach towards the European transport system, including both air and rail transport, to enable a thorough assessment of the gaps and potential solutions required to meet European high-level objectives in these areas.

The project thus also provides tools and insights for decision-makers in moving towards the future vision of the European transport system, also strongly supported by the inclusion of an intermodal Industry Board, as well as experts from relevant areas on the industry side