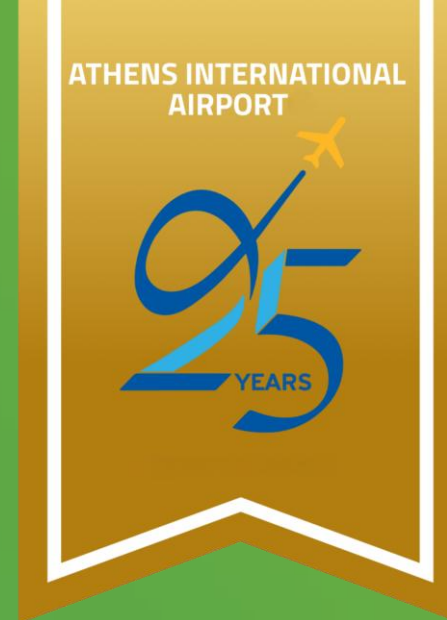




PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY

Athens International Airport, Greece
24 February 2026



Passenger centric digital airport and multimodality

Jérôme Delmeulle

Programme Manager, SESAR 3 JU

Multimodality and Passenger experience & Airport operations

Engage 2 - Athens Airport, 24 February 2026



Co-funded by the
European Union

Airside (Runway & Surface)

Focuses on maximizing the efficiency, safety, and throughput of aircraft movements from final approach to the gate through optimized spacing, automated guidance, and real-time safety alerts.

- Runway Throughput & Efficiency
 - Time-Based Separation (TBS): Optimizes aircraft spacing based on real-time wind conditions.
 - RECAT-EU: Optimized wake turbulence categories for arrival and departure spacing.
 - Runway Occupancy Time (ROT) Prediction: Predicts runway vacation for tighter spacing.
 - Integrated AMAN/DMAN: Synchronizes arrival and departure sequences for better flow.
- Surface Management & Navigation
 - Follow the Greens: Automated taxiway lighting guidance for pilots.
 - Routing & Planning Services: Automated taxi routing and conflict detection for controllers.
 - Enhanced Flight Vision Systems (EFVS): Improved landing capabilities in low-visibility.
- Safety Nets & Monitoring
 - Conformance Monitoring Alerts (CMAC): Controller alerts for aircraft deviating from taxi routes.
 - Conflicting ATC Clearances (CATC): Controller alerts for conflicting instructions.
 - Traffic Alerts for Pilots (SURF-ITA+): Direct cockpit alerts regarding surface collision risks.
 - Runway Excursion Prevention: Ground-air data synchronization to monitor braking risks.
- Remote Tower Operations
 - Remote Tower Services: Remote ATC services for single airports.
 - Multiple Remote Tower Module (MTRM): Single controller service for multiple airports simultaneously.

Landside & Operational Planning

Aims to synchronize airport resources with air traffic demand by integrating terminal, baggage, and passenger data into a rolling, collaborative plan.

- Collaborative Planning (AOP/APOC)
 - Basic Airport Operations Plan (AOP): Real-time airside data sharing with the network.
 - Extended AOP (eAOP): Full integration of terminal, airside, and landside data.
 - Airport Operations Centre (APOC): Physical or virtual facility for real-time stakeholder management.
- Performance & Decision Making
 - Airport Collaborative Decision Making (A-CDM): Data sharing between airlines, handlers, and ATC to improve turnarounds and predictability.
 - Total Airport Management (TAM): Collaborative tools for holistic airport-wide operations.
 - Airside/Landside Integration: "Digital Smart Airport" performance dashboards.



Multimodality & Passenger Experience

Extends the airport's reach into the wider transport network, enabling seamless air-rail integration and AI-driven tools to reduce passenger stress.

- Intermodal Coordination & Governance
 - Intermodal Information Sharing (TRANSIT): Real-time data exchange between air and rail.
 - Intermodal Mobility Modelling (MODUS): Tools for assessing air/rail substitution impacts.
 - Multimodal Airport Operations (IMHOTEP): Shared data frameworks for ground transport stakeholders.
 - Smart Contracts & Data Sharing (SIGN-AIR): Framework for automated agreements and data sharing between transport service providers.
- Journey Optimization & Access
 - Integrated Air-Rail optimisation (MultiModX): Coordinated flight and train timetables.
 - Door-to-Door Connectivity (X-TEAM D2D): Integration of ATM with vertical and urban transport.
 - Intelligent Airport Access (MAIA): AI modeling for passenger arrival behavior.
 - Regional Intermodal Integration (PRIAM): Regional network data sharing and management.
- Passenger Services
 - Virtual Queuing (PJ.04-W2-29): Pre-booked security and boarding time slots.
 - Intermodal Orchestration (Travel Wise): Shift from siloed management to cross-modal situational awareness and collaborative decision-making, specifically for disruption-proof travel.

Airport operations by 2030+

A fully integrated multimodal hub within the network for a seamless passenger experience.

- **Intermodal transport system** and **Information sharing** among actors of different modes of transport.
- **CDM tools and procedures** to plan operations, optimize overall system performance, and manage crises.
- **Impact of landside activities (passengers and baggage)** on information sharing and airside collaborative decision-making.
- **Artificial intelligence and business intelligence** supporting collaborative decision-making processes
- **Vertiport operations** integrated into airside airport operations and with the ground transportation network.



Thank you!



Oznur Uygur

Programme Manager at SESAR JU
Optimised ATM network services projects &...



Jerome Delmeulle

Programme Manager at the SESAR Joint
Undertaking



Co-funded by the
European Union

Engage 2

Engage 2

Welcome and Introduction

Marilea Laviola – Deep Blue
PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY
Athens, 24 February 2026

Engage 2

is the **bridge** between academia and industry in the ATM domain.

Its **mission** is to empower the next generation aviation workforce in the ever-evolving digital economy.

Its **main targets** are:

STUDENTS



POLICY MAKERS



ACADEMIA



ATM INDUSTRY



Engage 2



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Engage 2

Thematic Workshops & Events

THEMATIC WORKSHOPS:

to convene stakeholders and delve into the following 4 thematic challenges identified by the project:

- Climate impact analysis and mitigation for ATM-related non CO2-emissions
- Passenger-centric digital airport
- Disruptive ATM system modernization
- Integration of new entrants

CROSS-FERTILISATION WORKSHOPS:

to foster coordination with other domains related to ATM and facilitate cross-domain discussions.

FLAGSHIP EVENTS:

to boost alignment and collaboration across each SESAR flagship.

Engage 2 PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY | Topics



Passenger Experience

How passengers perceive their entire journey across the aviation and multimodal ecosystem.

Key dimensions:

- Reliability
- Travel Quality
- Trust and Satisfaction



Operator Experience

How operators and staff experience solutions, procedures, and technologies in their daily work.

Key dimensions:

- Usability and HMI design
- Workload and Awareness
- Training and Adoption
- Reliability and Efficiency

Engage 2

PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY | Agenda

TIME	ACTIVITY
09:00 – 09:30	Registration
09:30 – 09:40	Welcome and Introduction with AIA
09:40 – 09:50	Welcome and Introduction with SJU
09:50 – 10:00	Welcome and Introduction with Engage 2
10:00 – 11:00	Presentation from 5 projects (12 min each): ASTAIR - FASTNet - HERON - JARVIS - MAIA
11:00 – 11:15	Break
11:15 – 12:30	Presentation from 6 projects (12 min each): MultiModX - ORCI - PEACOCK - PRIAM - SIGN-AIR - TravelWise
12:30 – 13:30	Lunch

TIME	ACTIVITY
13:30 – 13:45	Clustering Participants for Round table discussion
13:45 – 15:00	Round table discussions: Participants are divided into four groups, each led by a dedicated moderator. Each group will take part in round-table discussions on one topic, then rotate to a different table for the second topic. 35 minutes are allocated per topic, with a 5-minute transition between sessions for table changes and setup. TOPICS: 1. Passenger experience 2. Operator experience
15:00 – 15:25	Networking Break
*15:15 – 15:25	Synthesis of key findings from all table discussions for each topic
15:25 – 15:35	Results of topic 1 with Q&A
15:35 – 15:45	Results of topic 2 with Q&A
15:45 – 16:00	Wrap Up and closing remarks

Engage 2 PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY | Objectives

- Establish exchange of results and “best practices”
- Try to identify benefits and synergies by combining results of several projects
- Identify open questions and remaining gaps after the completion of the airport/multimodal related projects present today

Engage 2

How can you stay tuned about Engage 2?



Engage 2 Wiki



LinkedIn



Newsletter



Engage 2



THANK YOU FOR
YOUR ATTENTION

ASTAIR

Towards more automated airport ground operations within the ASTAIR project

Giusy Portolan

Passenger-centric, Digital Airport and Multimodality

24-25 February 2026, Athens

ASTAIR Auto-Steer Taxi at AIRport



ASTAIR is a S3JU funded **Exploratory Research project** under the flagship of «Connected and Automated ATM»

Duration of the project: 01/09/2023 – 28/02/2026



Co-funded by
the European Union

Single European Sky ATM Research



ACKNOWLEDGMENT

This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon Europe research and innovation programme under grant agreement No 101114635. The authors would like to thank all SEC- AIRSPACE consortium members that contributed to this paper through stimulating discussions around the concepts presented.

ASTAIR

What's the focus?

Auto-Steer Taxi operations to improve ground operations at congested airports (e.g. Paris CDG)

Problem statement

Departure and reactionary delays in Europe shows a critical need to improve efficiency of ground operations

Expected Benefits

- Capacity
- Predictability
- Environmental Impact
- Safety



ASTAIR The solution



The solution □ introducing AI-powered support tool that automatizes the supervision of ground operations by pre-calculating trajectories and sending digital speed profiles to aircraft

- **Conflict-Free AI Planning:** AI pre-calculates deconflicted trajectories for aircraft and tugs 20 minutes ahead.
- **Precision Guidance:** Digital speed profile clearances are sent via datalink to minimize variability and improve safety.
- **Supervisory Control:** ATCOs shift from active directing to high-level supervision, intervening only in case of non-nominal events.

ASTAIR HMI and Algorithms

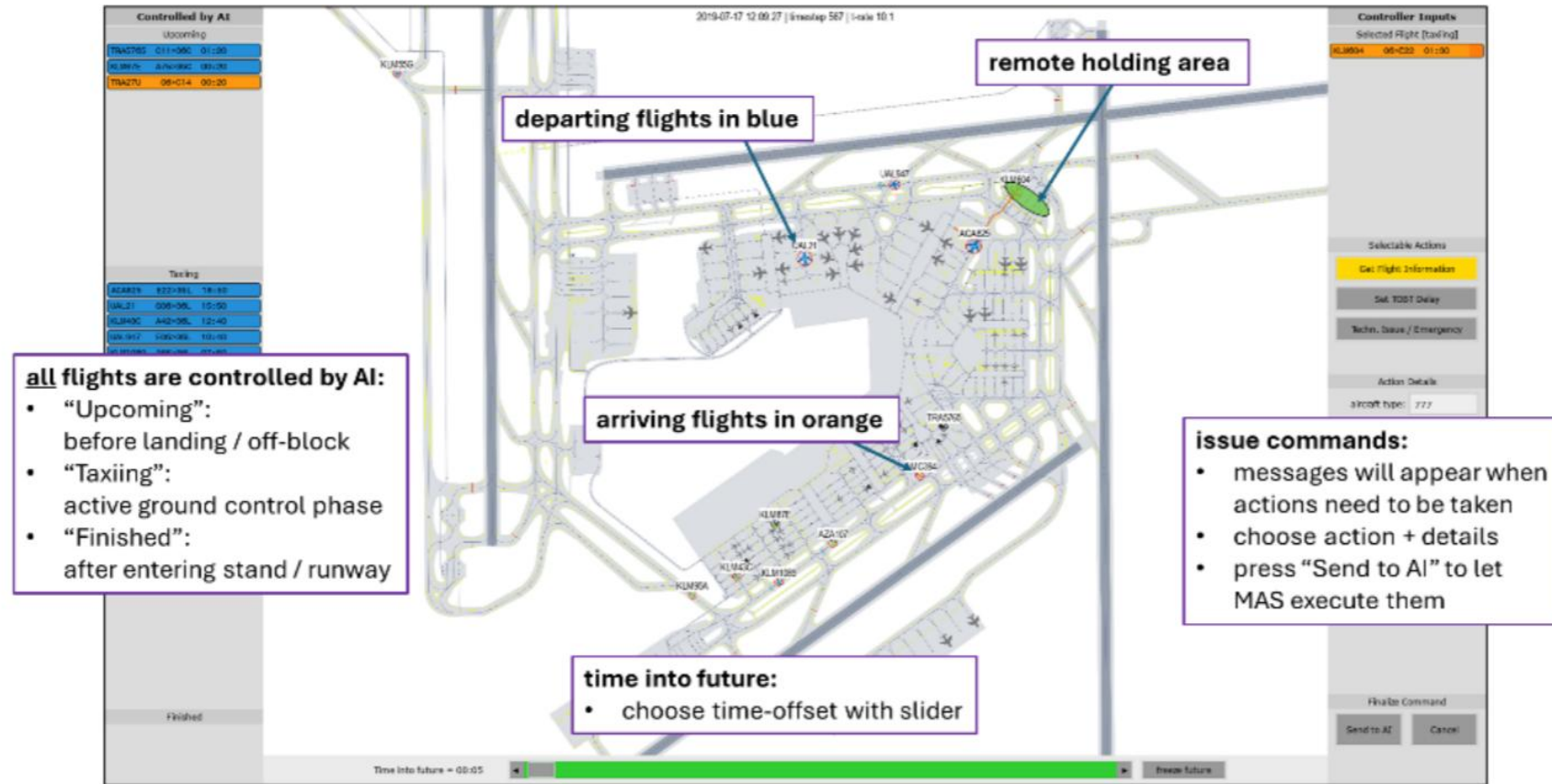


Main components:

- Global Traffic Supervision
- Inspection Interface
- A-SMGCS Integration

The **ASTAIR** HMI, developed by ENAC

ASTAIR HMI and Algorithms



Main components:

- Multiagent Motion Planning Algorithm
- One-screen with radar image with AI-decision support Inspection interface overlay

Fast time-simulation algorithms, developed by TUDelft

ASTAIR validation

Methods:

- Workshops with stakeholders
- Real-Time simulations
- Fast-Time simulations
- Questionnaires (SUS, SART, SAGAT, UES, Bedford)
- Liability Tool



Validation objectives:

- Operational Feasibility
- Human-machine collaboration and Human Performance
- Usability of HMI
- Effectiveness of Planning Algorithms, including sustainability and capacity
- Legal Liability



Stakeholders involved:

Air Traffic Controllers
Airport Managers
Pilot Representatives
Ground Operators
Apron Operators



ASTAIR HP related Results

- **Human-AI teaming**

The system effectively supports teamwork and integrates well into existing workflows. Participants trusted the AI system to manage traffic, especially for routine tasks. Need for AI rationale was noted.

- **Liability Impact**

The ASTAIR concept carries moderate liability risks. Key recommendations include improving AI transparency, clarifying roles, and strengthening procedures and training

- **Engagement with the automation**

High level of engagement, specially during RTS, but noticed role shifting from active to passive (impact on job satisfaction). Workload remain manageable. Limited customization options.

- **HMI Usability**

The system was quickly understood with minimal training. Usability was assessed (SUS=62.5). Participants showed good situational awareness. Improvement areas have been identified.

- **Operational Feasibility**

Tools were well-received by all participants (challenges: visual attention spread) and missing pilots in the loop (only pilots representatives during Final Workshop).

ASTAIR

THANK YOU FOR
YOUR ATTENTION

FASTNet

FASTNet Project

24/02/2026

Project Coordinator - Juan Francisco García López

SUPPORTED BY
sesar
JOINT UNDERTAKING



Co-funded by the
European Union

This project that has received funding from the SESAR 3 Joint Undertaking under grant agreement No 101114718 under European Union's Horizon Europe research and innovation programme

Project overview

FASTNet aims to **provide future data services and applications for airports and network**, in order to contribute to the **dynamic reconfiguration of resources**, both at local and network level, and **new capacity-on-demand services** to maintain safe, resilient, smooth and efficient air transport operations while allowing for the optimization of trajectories even at busy periods.

- **Solution 0346: Enhanced AOPs-NOP Tactical planning**, with the inclusion of an “airport-to-airport(s)” AOP to AOP collaborative planning process and use of artificial intelligence (AI)/ machine learning (ML).
- **Solution 0347: AOP-NOP data enhancement to the strategic (from months in advance until D-7) and pre-tactical (D-7; D-1) planning phases.**

D-180

D-7

D-1 Day D

Strategic

Pretactical

Tactical



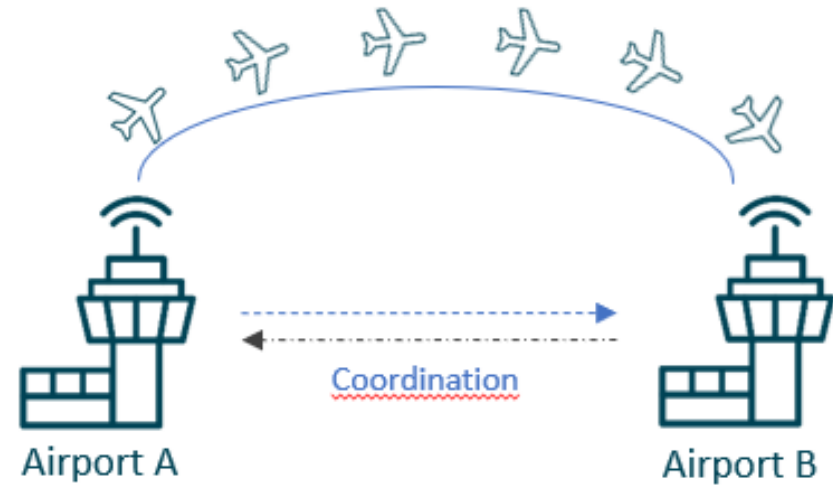
Solution 0346 - Enhanced AOPs-NOP Tactical planning

- **Feature 1:** Direct AOP-AOP coordination

Capacity imbalance is solved by NM regulations



Airport-to-Airport collaborative planning process
before proposing the agreed solution to NM



- Improve the accuracy of the time of arrival (EIBT) for every aircraft to parking positions to optimize the use of ground handling resources
- Improve the use of the runway through a better estimation of take off (TTOT)

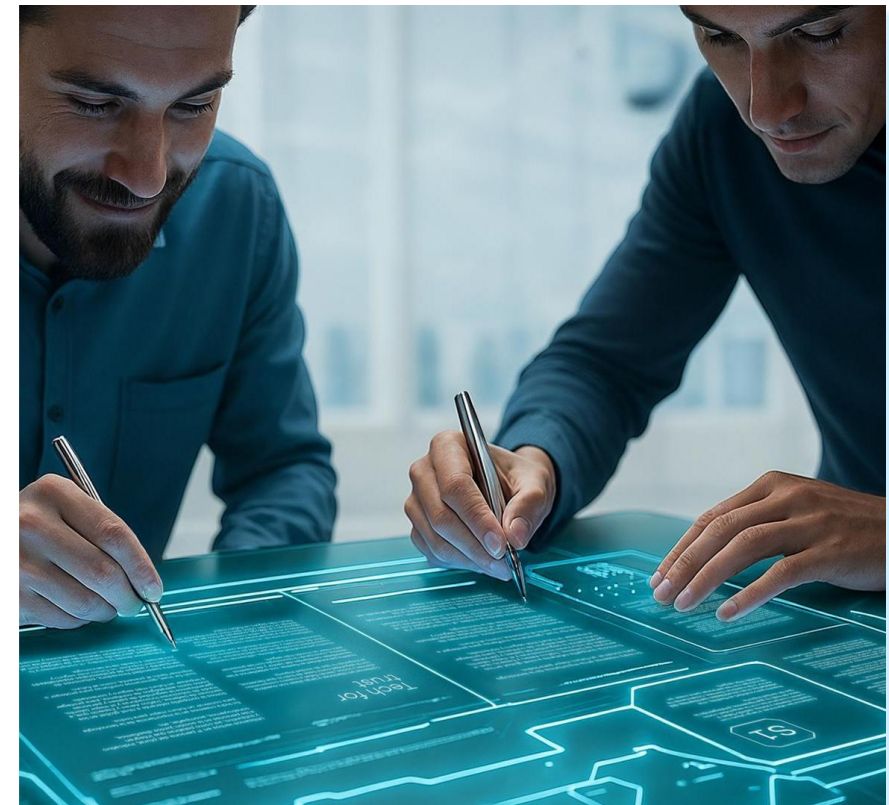


Solution 0347 - AOP-NOP data enhancement to the strategic (from months in advance until D-7) and pre-tactical (D-7; D-1) planning phases

The strategic and pre-tactical phases are critical due to many errors and approximations in airport planning during these times.



Digital process supported by AI



Solution 0347 - AOP-NOP data enhancement to the strategic (from months in advance until D-7) and pre-tactical (D-7; D-1) planning phases

- **Prediction models in strategic and pre-tactical phases:**

The development of AI/ML models is envisaged at different time horizons - typically D-1, D-7, D-20, D-45, M-2, Y-1 depending on the needs

- **Feature 1:** Passenger Predictions
- **Feature 2:** Baggage Predictions
- **Coordination with NM:**
 - **Feature 3:** AOP-NOP communication in pre-tactical phase to share changes in flight schedules

Strategic phase (before D-7):

- Passenger Booking counts in the AOP (automated update)
- Baggage reservation counts in the AOP (automated update)
- Up to date Flight schedule information in the AOP (automated update)
- Airport capacity information (for check-in, border, security)
- Network Passenger demand forecast and load factor per flight in the AOP
- Passenger predictions (per flight, at check-in, security and border controls) using new data and models (AI/ML)
- Baggage predictions per flight using new data and ML models

Pre-tactical phase (D-7 to D-1):

- Passenger Booking counts in the AOP (automated update)
- Baggage reservation counts in the AOP (automated update)
- Up to date Flight schedule information in the AOP (automated update)
- Airport capacity information (at check-in, security, border)
- Network Passenger demand forecast per flight
- Regulation outlook : list of captured departing flights captured by regulation at the airport
- Passenger predictions using new data and ML models
- Baggage prediction per flight using new data and ML models
- P-DPI and C-DPI messages from AOP to Network up to D-6 ahead (without flight plan)

Partnership expertise

	Airlines	Airports	Industry	Network	ANSPs
Members	AIRFRANCE transavia AEGEAN	ATHENS INTERNATIONAL AIRPORT ELEFTHERIOS VENIZELOS Fraport Greece brussels airport the heart of Europe CPH GROUPE ADP Schiphol	INDRA	EUROCONTROL	CIVIL AVIATION AUTHORITY
Advisory Board		ACT EUROPE			dgac DSNA

* Not a member of the consortia but collaborating in solution 0346

FASTNet

Thank you!

PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY

HERON PROJECT PRESENTATION

Athens, 24 February 2026

HERON



1 Nov 2022 – 31 Dec 2025



A large Pan European Consortium of 24 members, gathering :

- 5 airlines
- 5 Airports
- 7 ANSPs,
- And many industrials

Followup to several earlier VLD or R&D projects:

- ADSCENSIO
- ALBATROSS
- DREAMS
- PJ.02-W2, EARTH, AART, SORT
- PJ.04-W2

Project Coordinator: Airbus

HERON

23 Demonstrations, in four "Themes"



SHARING OF THE 4D-TRAJECTORY VIA ADS-C/EPP

- Operational usage of the aircraft shared trajectory
- "Initial implementation" of TBO use-cases, focused on CO2-reduction benefits
- Deployment of a key technology enabler for a/c trajectory sharing (TRL8)



GREEN SURFACE OPERATIONS MANAGEMENT

- 4 SESAR Solutions at TRL7 / TRL8
- Multiple innovations in Apron operations
- Real-world usage of TaxiBot at Schiphol
- Major AU fleets "best equipped" for TaxiBot or for Single-Engine Taxiing



OPTIMISED APPROACH PROFILES AND SPACING

- 3 SESAR Solutions for Apch / Rwy optimization (TRL7 / TRL8)
- Many operational implementations of concepts for optimized descent deployed in 5 airports, 2 TMAs, 2 AU fleets



IMPROVED TRAJECTORY PLANNING

- Dynamic RAD activated in the highly sensitive Polish airspace
- Improved support in NM systems for planning of improved trajectories (AUs and ANSPs)

HERON

Environmental impact and the other Performance Areas

- **Primary focus of HERON was CO2 and noise**
 - Other Performance Areas, including on-time performance and human performance, were also considered:
❓ *does decarbonation have any link or impact (whether positive or negative) on other performance areas*
- **As a general statement :**
 - **CO2 emissions** are proportional to fuel-burn; their reduction very often result from
 - optimization of the flight trajectory (eg. more direct, closer to the aircraft optimum)
 - optimization of the network (eg. flexible "constraints", tailored to the strict necessary)
 - **Therefore, in general, reducing CO2 footprint also improves on-time performance**
 - On the other hand, "**non-CO2 effects**" (e.g. as condensation trails) and sometimes noise emissions:
 - are not proportional to the "shortest, most efficient flight"; may in fact require *flying around an area of susceptibility/sensitivity*
 - There is a **more complex tradeoff** environment / on-time performance.
 - "How much additional time/distance/CO2 is justified, in order to avoid the adverse effect ?"
 - (NB: non-CO2 effects were NOT covered in HERON, and are in fact still at a much lower maturity level. Other projects are working on this subject.)
- **Human performance** (i.e. "Operator Experience")
 - Obviously always taken in consideration at TRL >6 , for feasibility and safety of the Solutions.

(also applies to other emissions proportional to fuel-burn)

Exercises list:

1. AI on aircraft stand at Paris Orly airport, ***Part of Solution 0358***
1. Automating aircraft parking operations at Paris Orly airport, ***Part of Solution 0358***
1. Engine-off taxiing with Taxitow at AMS, ***Solution 0356***
1. Optimizing Single Engine Taxiing practice at Paris Orly airport, ***Part of Solution 0357***
1. Optimizing Single Engine Taxiing: Advanced AMM, ***Part of Solution 0357***

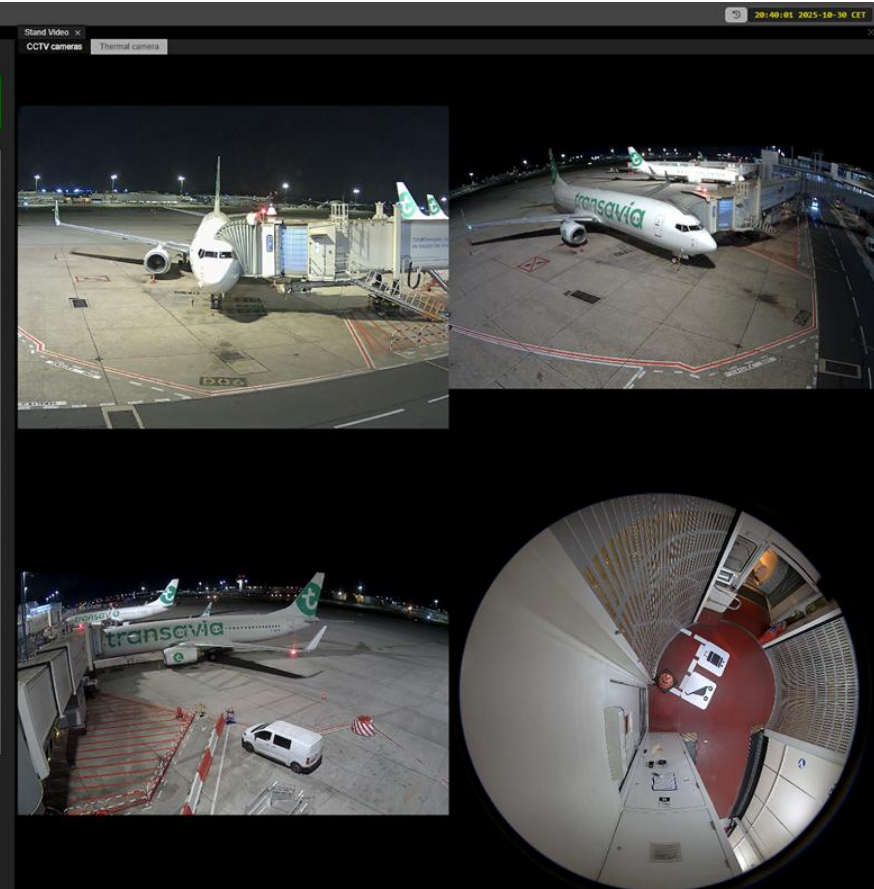
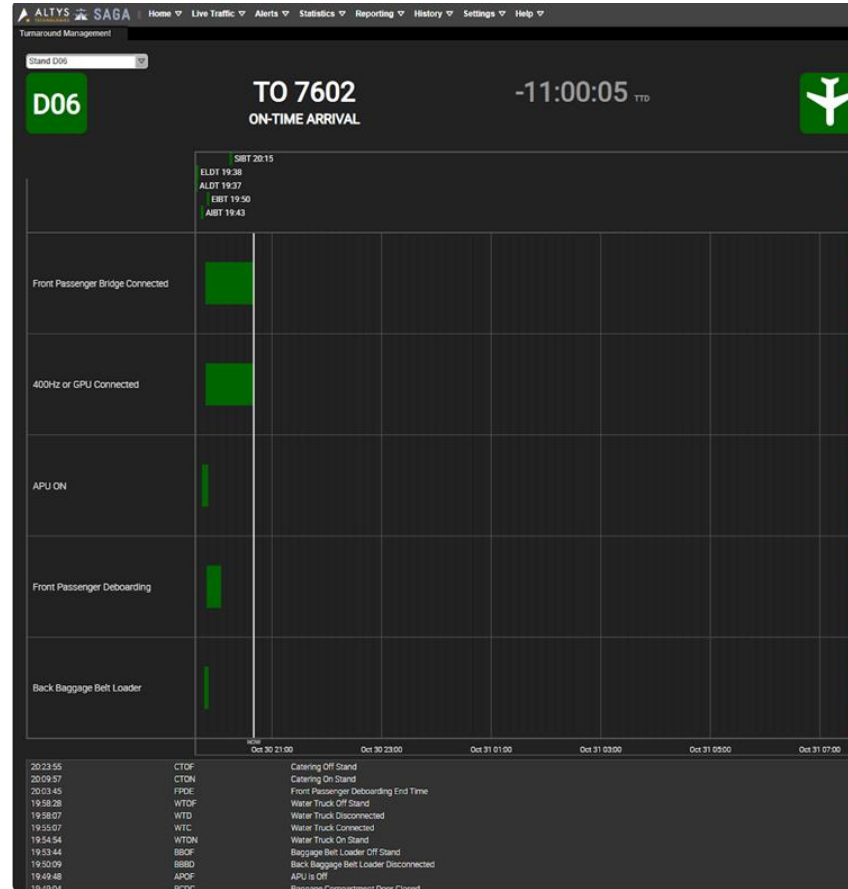
AI on aircraft stand at Paris Orly airport,

Part of Solution 0358

HERON

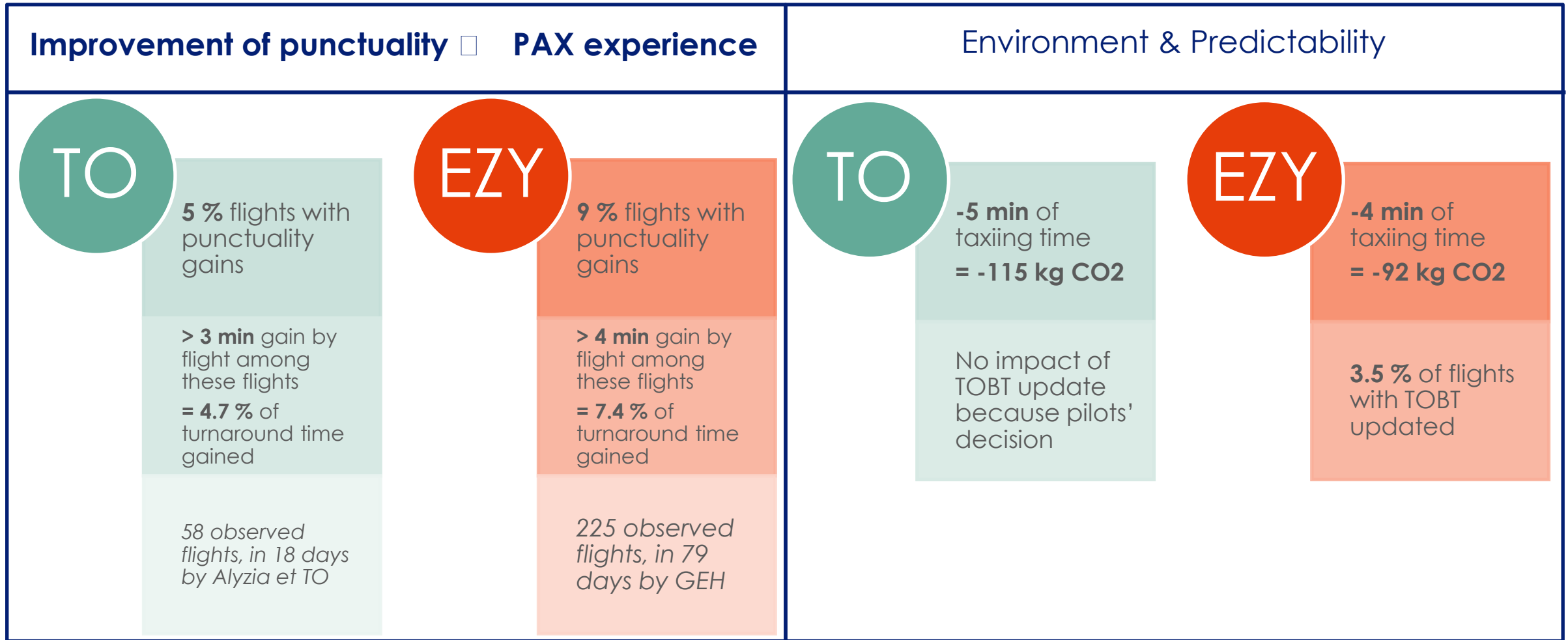
AI on aircraft stand

- Monitoring aircraft turnarounds
- Using **Artificial Intelligence** applied to data obtained from **CCTV cameras** and **thermal cameras**
- **Detect automatically all the turnaround milestones and the APU usage.**
- **Object detection** applied to detect key elements (aircraft, chocks, vehicles, pushback, etc.)
- 3 aircraft stands
- **Objectives:** improve punctuality, reduce CO2 emissions



- Detections integrated in an **interface sending alerts** in case of:
 - **delays**
 - **non-compliant APU usage.**
- Provide a clearer view of the situations on the ground, on **live** and for **post-operational analysis** to
 - the **airport**,
 - the **airlines**,
 - the **ground handlers**.

Current operating method	New operating method
Some turnaround milestones are collected manually by the ground handler.	More turnaround milestones are collected automatically by the system and is available for all stakeholders (airlines, ground handlers and airport operator). Alerts are configured by stakeholder when some critical milestones are delayed. The airlines, ground handlers and airport operator can react when an alert is emitted and, in some cases, calling the concerned stakeholders.
The TOBT is updated by the airlines or ground handlers based on the information they have and, on their willingness to update it.	The TOBT can be updated by the airlines or ground handlers based on a higher level of information .

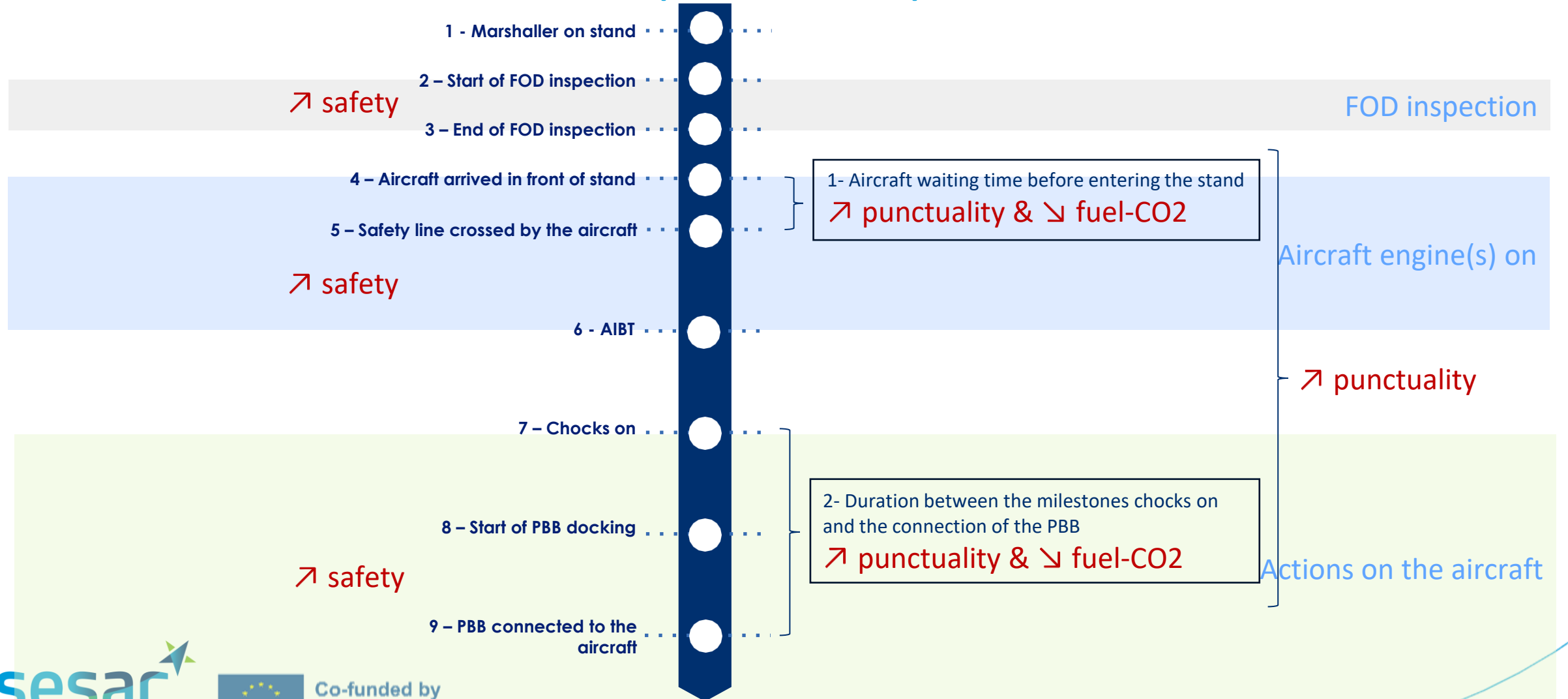


Automating aircraft parking operations at Paris Orly airport,

Part of Solution 0358

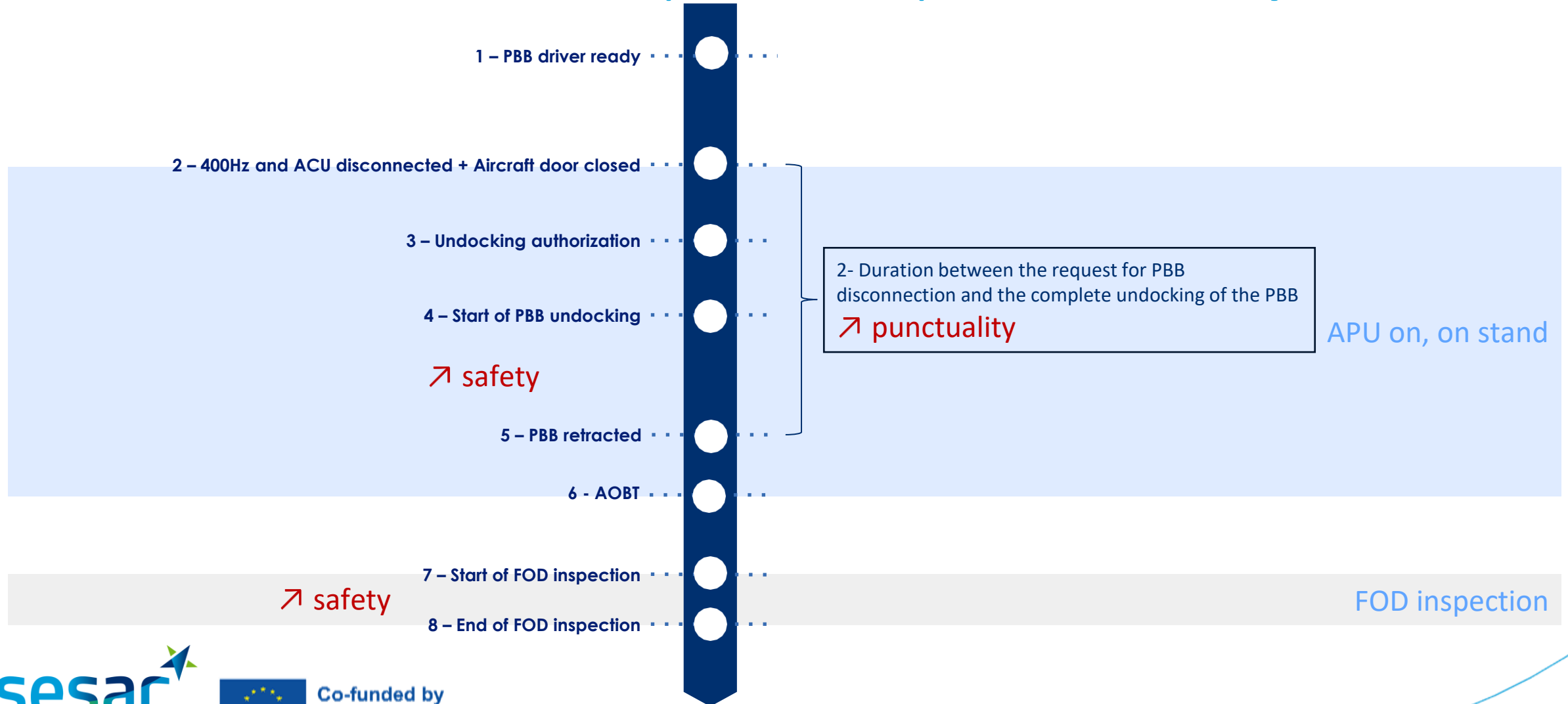
HERON Aircraft parking Operations

Theoretical sequence of operations of Arrival



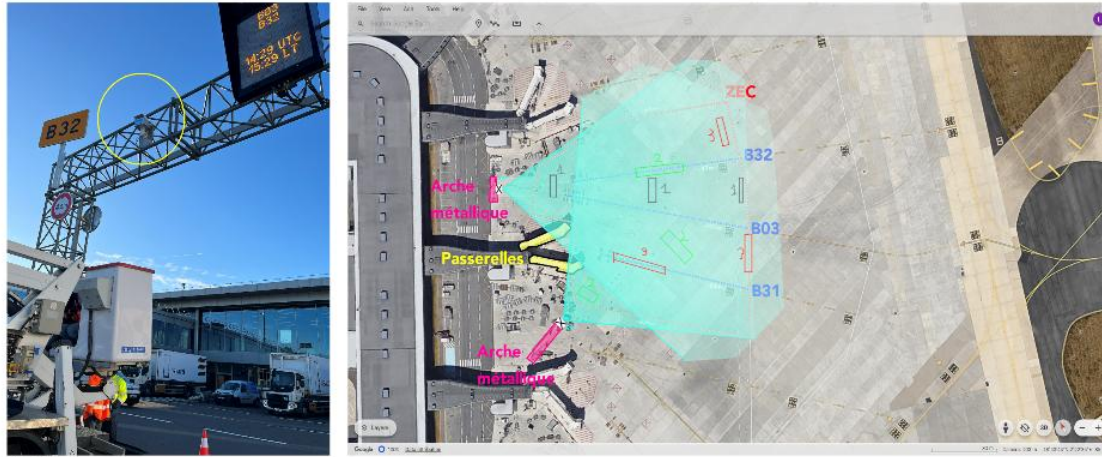
HERON Aircraft parking Operations

Theoretical sequence of operations of Departure



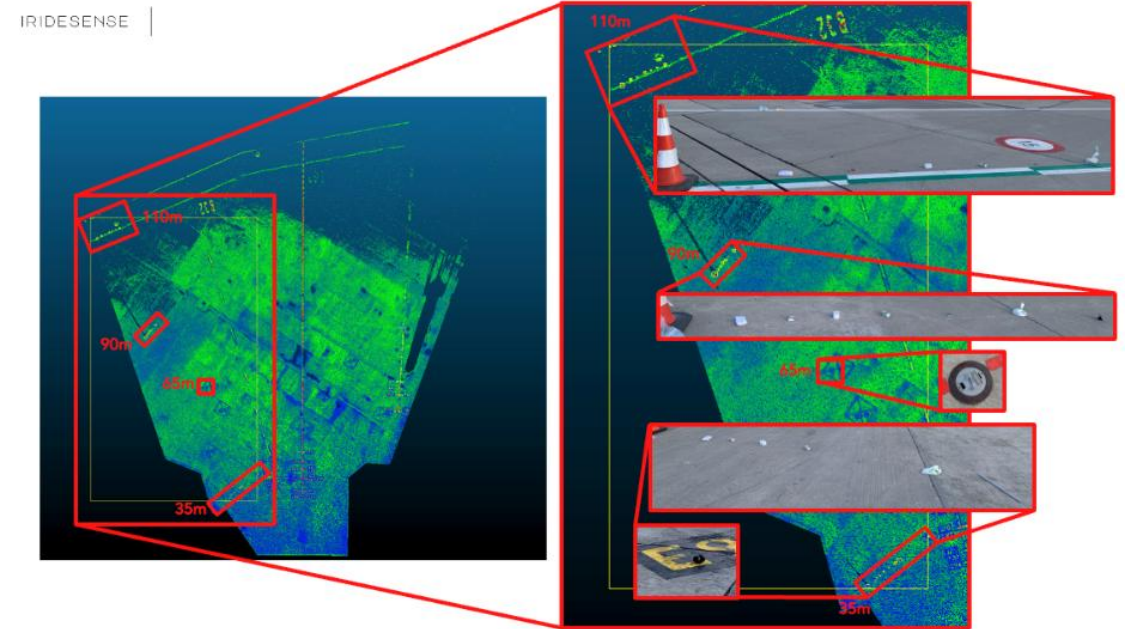
HERON Automated stand inspection

2 Iridesense LiDARs installed to monitor 1 MARS stand (= 3 aircraft stands, one wide-body, two narrow-body)



93% of all FODs are detected (true positive),
with a minimal size for FOD of 5 cm

0.6 false positive are created per inspection



HERON Automated launch of Visual Docking Guidance System

Before / Out of HERON
Semi-automatic mode:

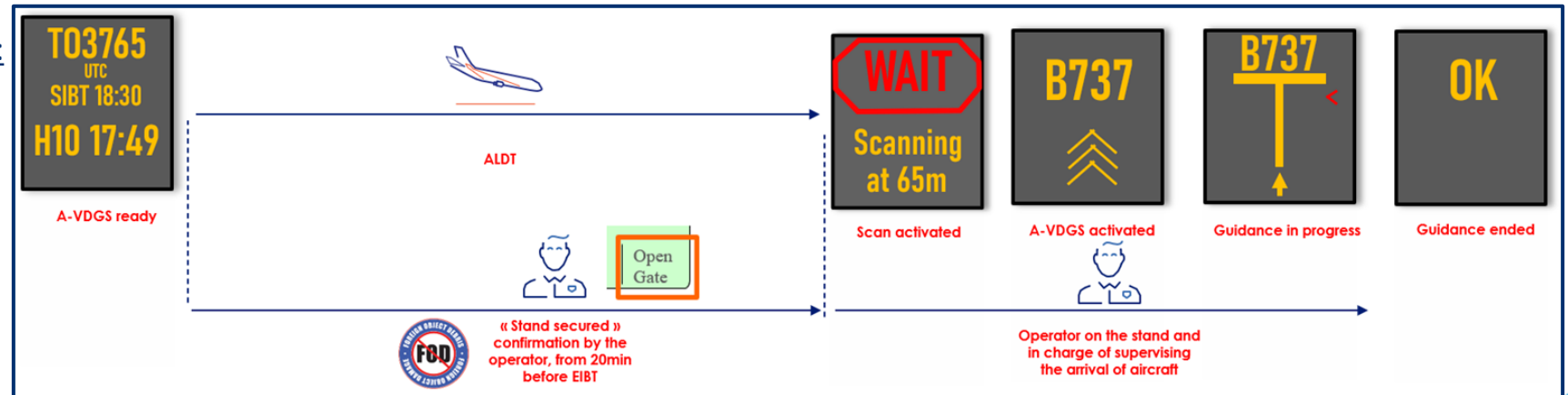


Actions implemented
Continuation of A-VDGS Scenario 0:



Regulation constraint:
The entrance of the aircraft is possible only when the marshaller is present

Demonstration of A-VDGS Scenario 1:



HERON

Automated Passenger Boarding Bridge docking / undocking



Functionalities



Automatic driving function

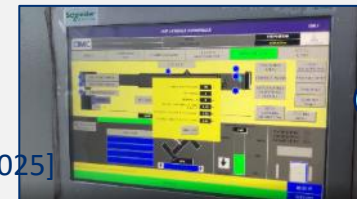
- ❑ Trajectory calculation based on aircraft position (AODB, VDGS)
- ❑ Door recognition : camera (01)

Operational functions

- ❑ On ground supervision (02)
- ❑ Door opening authorized: LED strip (03)
- ❑ Door closed detection (04)
- ❑ Docking status display (05)

Safety functions

- ❑ Human PBB entrance detection (06-09) + No entrance display (10)
- ❑ Objects on external head detection (11)
- ❑ Aircraft anti-collision: radar (12)
- ❑ Objects on ground detection: sonar (13)
- ❑ Stairs anti-collision (14)
- ❑ Emergency button (15)



HERON

Automated Passenger Boarding Bridge docking / undocking



- 3 Tests of the automated PBB on an empty aircraft
- 202 Tests of the automated PBB on a mock-up

Engine-off taxiing with Taxitow at AMS,

Solution 0356

HERON: WP 2.2 Green Surface Operations & Taxitow

Why Taxitow?

Why Taxitow aircraft at Amsterdam Airport Schiphol?

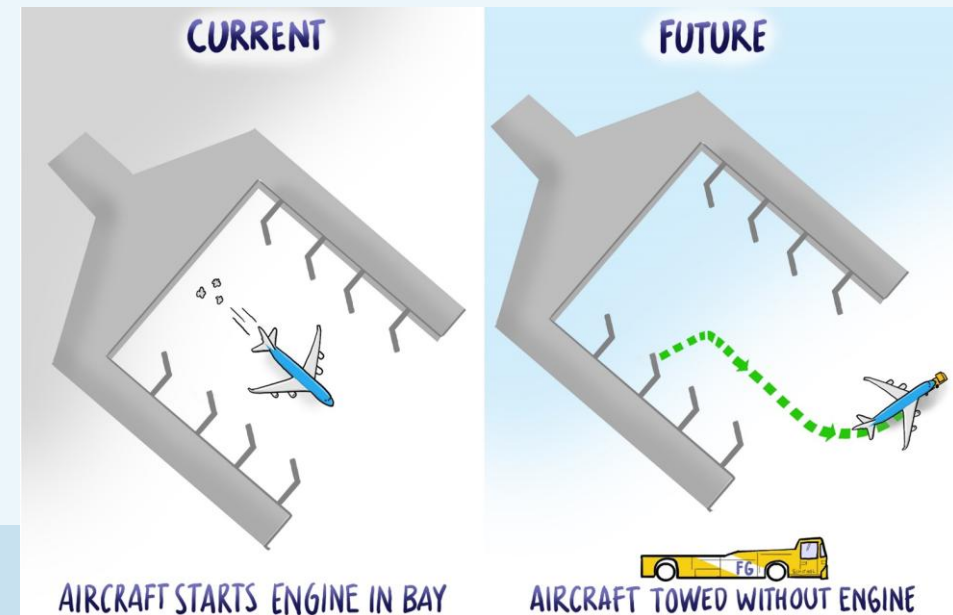
Workers on the apron are exposed to emissions from Diesel engines and Aircraft engines, including exhaust gasses and Ultra Fine Particles (UFP).

Part of the VDME Program (Program to reduce Diesel and Aircraft Engine Emissions)

- Aims to drastically reduce emissions from diesel and aircraft engines.
- Reduces exposure of workers to the emissions from diesel and aircraft engines.
- Taxitow allows for engine startup to happen near the runway.

Effects:

- Approximately ~90 missions completed – currently very weather dependent (wind direction & runway use).
- Reduces Kerosine & fuel use by ~53% for taxiing (the APU is still running).
- Reduces emissions & exposure of handling staff.
- Taxi times are currently slightly longer with Taxitow. However:
 - Starting engines during Taxitow may reduce this effect significantly.
 - Other, smaller optimisations include faster corner speeds, improved acceleration after braking etc.



Optimizing Single Engine Taxiing practice:

- at Paris Orly airport
- at AF with Advanced AMM

Solution 0357

HERON Single Engine Taxi ?



Prerequisite: SET is only applied when neutral on taxiing timing and behavior

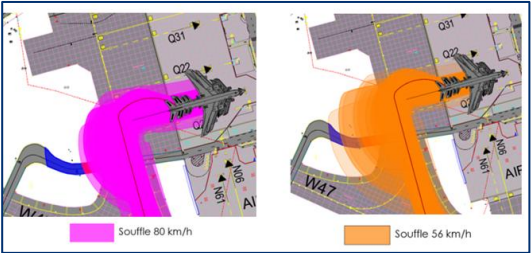
- ❑ no impact on **on-time-performance**

- ❑ no impact on **traffic management**

Known procedure for the **pilots**.

HERON

Increasing SET Practice

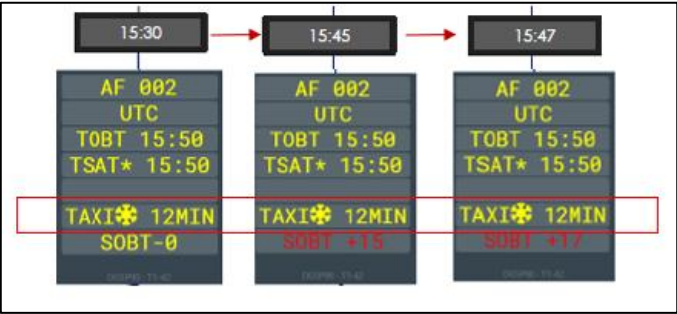


Jet blast hazard mitigation

21.6 REDUCED ENGINE TAXI PROCEDURE
In order to reduce CO2 and nanoparticle emissions from aircraft on Paris-Orly airport, pilots are invited to practice single engine taxi on arrivals and departures.
Operators are requested to assess jet blast hazards associated with this procedure before application, particularly on WT taxiway.

Recommendation in the AIP

ORY MEASURES



Estimated Taxi Time Display



Publication of knowledge and data for airlines

- A quick-win decarbonation solution : the AMM, basically a "safety" tool, has proven to be useful also in bringing environmental benefits
- **AMMs with "Advanced features" contribute to a higher "rate of application" of SET at Departure**
 - The added situational awareness from this tool, in particular with the two advanced features described below, contributes to crews being more incline to performing SET at departure, hence a higher rate of application

"SET" = Single-Engine Taxiing

"EFB" = Electronic Flight Bag

1. In the frontal field of vision



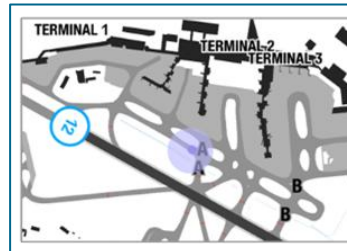
2. Aircraft position from the avionics (not only GNSS)

- higher positional precision than the EFB built-in receiver
- maintains orientation even when a/c not moving

Aircraft AMM



EFB AMM



Airport Moving Map ("AMM") = Computer-generated map that shows an aircraft's position relative to the airport surface. The displayed map is dynamically moved/recentered so that the aircraft position always remains visible, or is at the center. (Very similar to automotive navigation system used when driving a car...)

□ **20% improvement** attributed (conservatively) to the advanced AMM in the nb. of departures taxiing with one engine off

THANK YOU FOR YOUR ATTENTION

HERON

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<https://research.dblue.it/heron>



HERON Project



@heron_sju

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MAIA

Passenger-centric Digital Airport and Multimodality Workshop

Juan Blasco
Nommon

The MAIA project

MAIA - Multimodal Access for Intelligent Airports

- **Call:** HORIZON-SESAR-2022-DES-ER-01
- **SESAR Topic:** WA1-5 'Fundamental science and outreach for multimodality and passenger experience'
- **Level of maturity:** from Pre-TRL 1 to **TRL 1**
- **Start date:** 01/06/2023 | **End date:** 30/11/2025
- **Duration:** 24 months + 6 months for communication, dissemination and exploitation activities
- **Project partners:**



Background and motivation



European policy goal

The provision of seamless multimodal door-to-door travel is a priority for the European transport policy



Airport access

Air travel inherently relies on multiple transport modes

A multimodal approach is required to ensure aviation competitiveness by enhancing passenger experience and optimising capacity, but also to reduce aviation's ecological footprint



Need for multimodal strategies

Multimodality strategies must take into account that airport access is an ever-changing context permeable to mobility innovations.



Smart Mobility Solutions

Opportunities:

- Enhance airport accessibility
- Improve resilience
- Expand catchment areas
- Reduce emissions

Uncertainties

- Complementary existing modes
- Infrastructure needs
- Suitability for different airport contexts



The goal of **MAIA** is to develop a set of data analytics and modelling tools to support the evidence-based design and implementation of multimodal airport access solutions based on two passenger mobility innovations: shared autonomous vehicles (SAV) and unmanned aerial vehicles (UAV)

Project objectives

Problem definition	Identify the opportunities and risks associated with passenger mobility innovations in a multimodal airport access context		
Development of SESAR Solutions	Solution 1: MAIA-Engine	Solution 2: MAIA-CCAM	Solution 3: MAIA-UAM
	A toolset for a passenger-centric design and implementation of innovative multimodal airport access services, which includes new methods and tools for predicting passenger behaviour.	A vehicle dispatching tool to support the operation of Shared Autonomous Vehicle (SAV) fleets in the airport access, able to mitigate multimodal disruption impacts.	A vertiport site selection framework to support the implementation of Unmanned Vehicles (UAV) services in the airport access, able to balance passenger experience criteria and UAM operational constraints.
Case Studies	Evaluate the capabilities of MAIA-Engine, MAIA-CCAM and MAIA-UAM through their application to a set of case studies (Brussels and Madrid)		

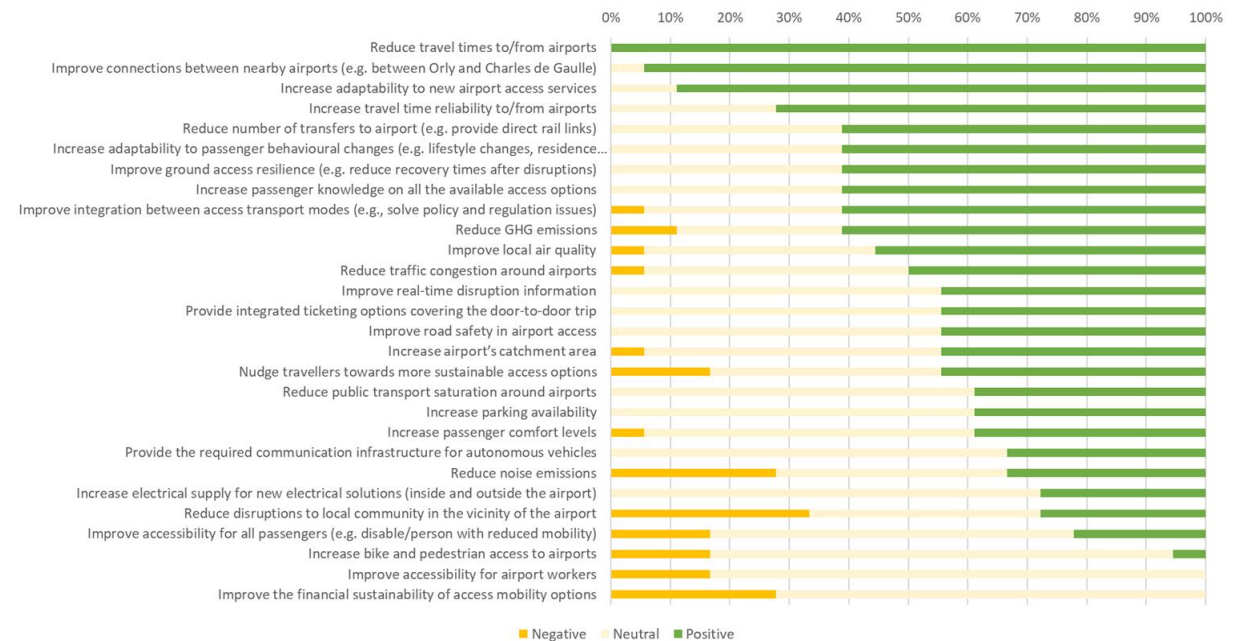
Problem definition

Identify the **main challenges airport accessibility** and the opportunities and risks associated with passenger mobility innovations in a multimodal airport access context.

Main challenges

Challenge	1st round		2nd round	
	Average	Std. Dev.	Average	Std. Dev.
Increase travel time reliability to/from airports	N/A	N/A	4,76	0,60
Reduce travel times to/from airports	4,52	0,75	4,59	0,70
Reduce GHG emissions	4,33	1,05	4,29	0,92
Reduce disruptions to local community in the vicinity of the airport	3,91	1,04	4,12	1,02
Reduce number of transfers to airport (e.g. provide direct rail links)	4,45	0,96	4,12	0,83
Improve real-time disruption information	4,27	1,04	4,06	1,22
Improve accessibility for all passengers (e.g. disable/person with reduced mobility)	4,06	1,06	4,00	1,19
Improve local air quality	4,15	0,99	4,00	1,25
Improve connections between nearby airports (e.g. between Orly and Charles de Gaulle)	3,39	1,23	3,94	0,93
Improve ground access resilience (e.g. reduce recovery times after disruptions)	4,12	0,89	3,94	1,41
Improve integration between access transport modes (e.g., solve policy and regulation issues)	4,30	0,82	3,94	1,28
Reduce noise emissions	4,15	0,99	3,88	0,96
Reduce traffic congestion around airports	3,73	1,15	3,88	1,11
Increase passenger knowledge on all the available access options	N/A	N/A	3,76	1,01
Reduce public transport saturation around airports	3,82	1,12	3,76	1,16
Nudge travellers towards more sustainable access options	4,09	0,96	3,71	1,03
Increase adaptability to new airport access services	3,55	0,86	3,53	0,90
Increase airport's catchment area	3,39	0,95	3,47	0,98
Improve road safety in airport access	3,61	1,17	3,47	1,20
Increase adaptability to passenger behavioural changes	3,55	1,17	3,41	0,97
Increase electrical supply for new electrical solutions (inside and outside the airport)	3,42	1,03	3,35	1,04
Provide integrated ticketing options covering the door-to-door trip	N/A	N/A	3,35	1,38
Increase passenger comfort levels	3,42	0,99	3,24	1,24
Improve accessibility for airport workers	3,61	0,94	3,18	1,10
Improve the financial sustainability of access mobility options	3,58	1,03	3,18	1,14
Provide the required communication infrastructure for autonomous vehicles	N/A	N/A	3,18	1,40
Reduce travel cost (e.g. public transport ticket prices)	3,30	1,12	3,06	1,35
Increase parking availability	2,79	1,19	2,88	1,11
Increase bike and pedestrian access to airports	N/A	N/A	2,35	1,15

UAM and CCAM opportunities

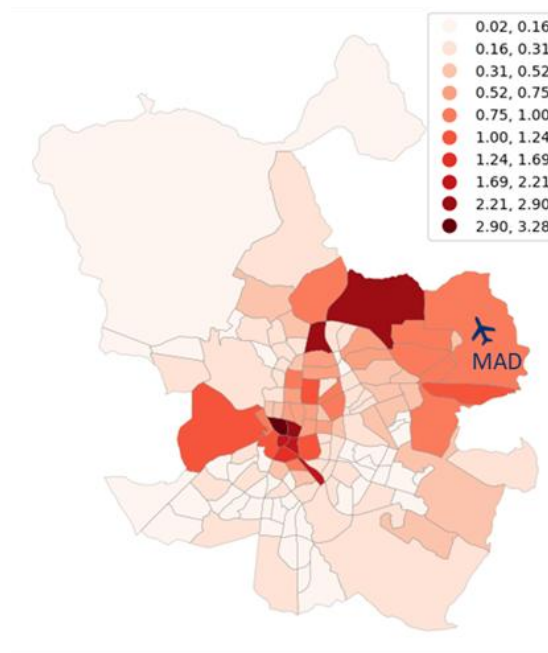


D2.1 Challenges and Opportunities of Mobility Innovations for Airport Access

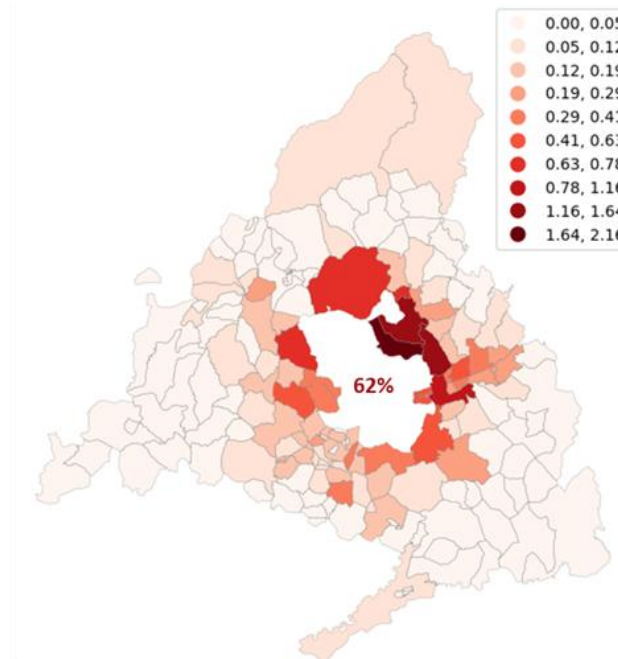
<https://maiasesarproject.eu/resource/deliverable-d2-1/>

A toolset for a passenger-centric design and implementation of innovative multimodal airport access services, which includes **new methods and tools for predicting passenger behaviour**.

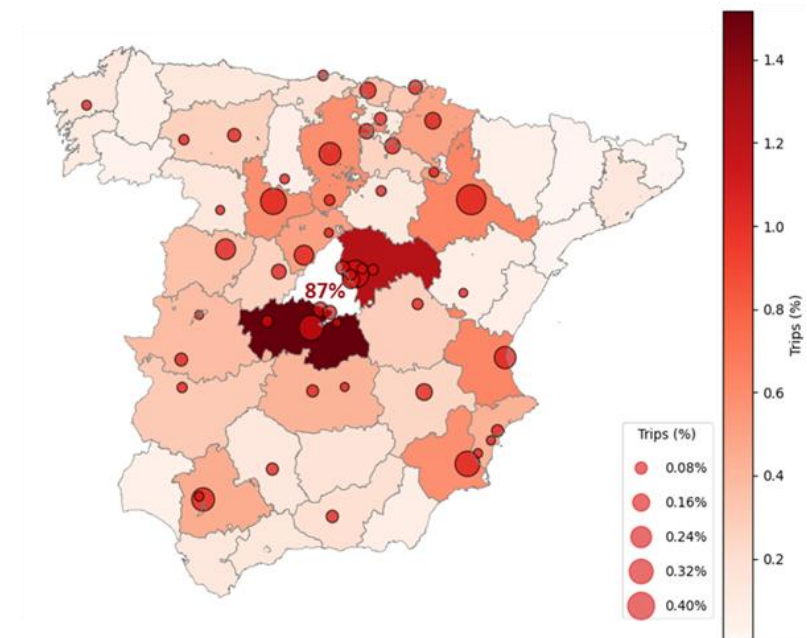
Tools for monitoring airport demand



Madrid

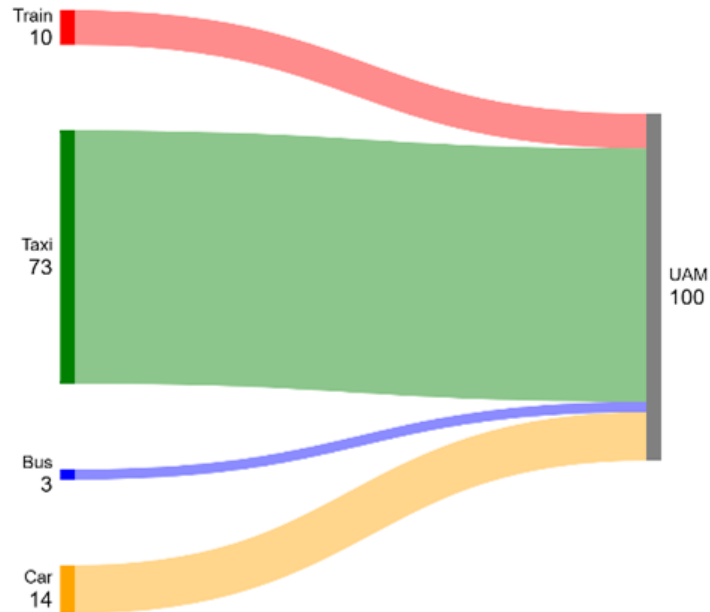


Community of Madrid (Province)



Spain

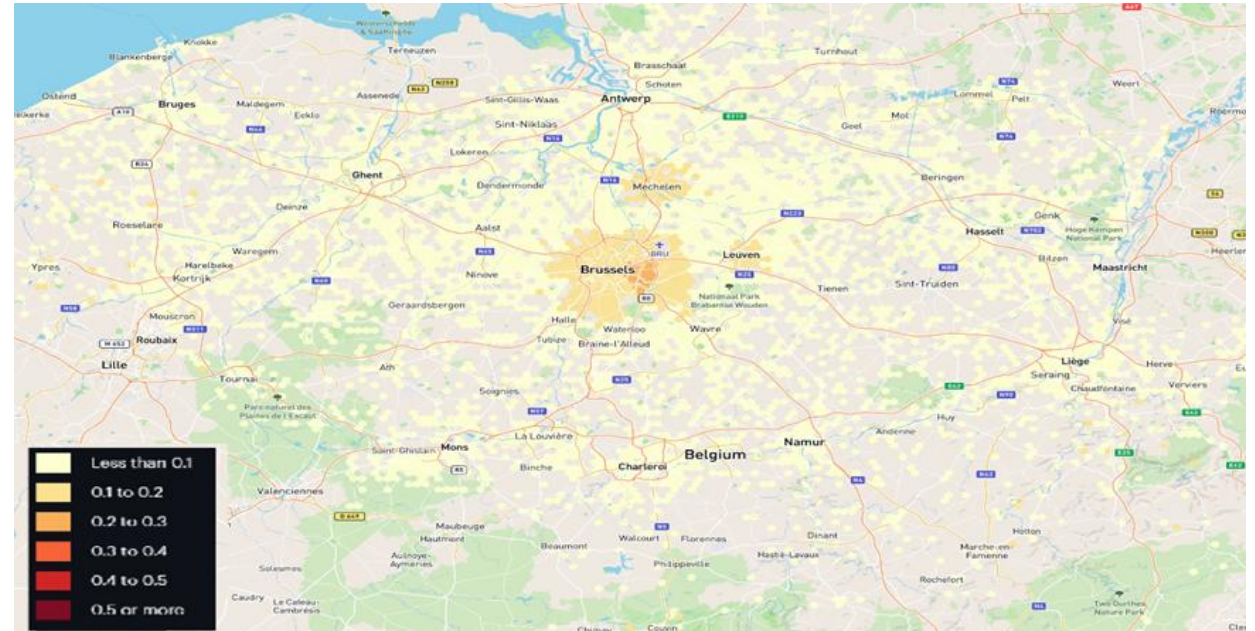
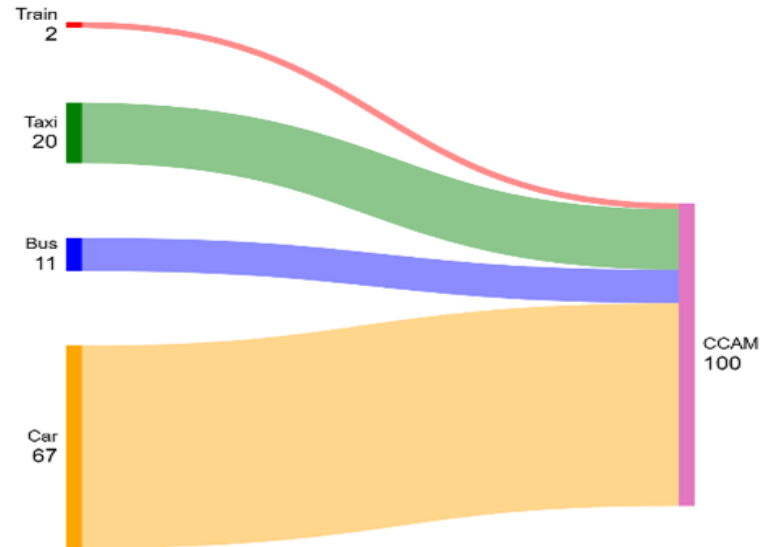
Tools for estimating UAM and CCAM demand



UAM adoption patterns

- Most UAM users come from taxi
- More likely in longer distances, as time-saving become more evident
- UAM appeals to time-sensitive, high-income travellers
- Similar attributes to taxis. Perceived as an “air taxi” alternative: direct, fast, congestion-free

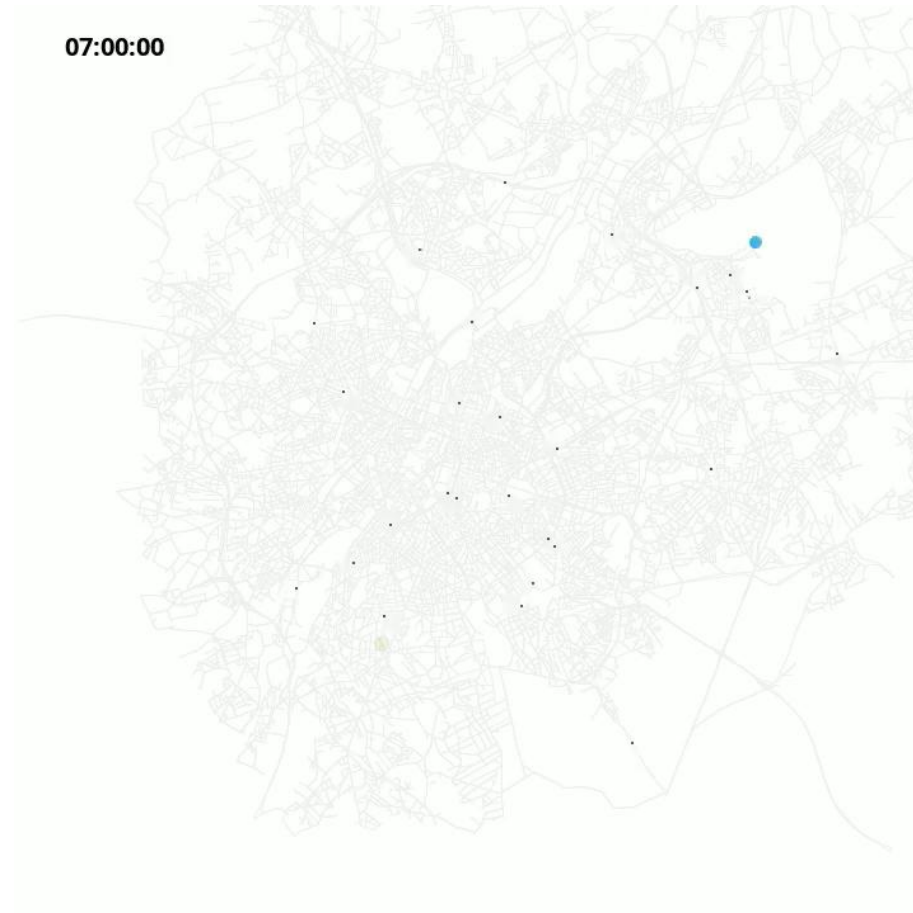
Tools for estimating UAM and CCAM demand



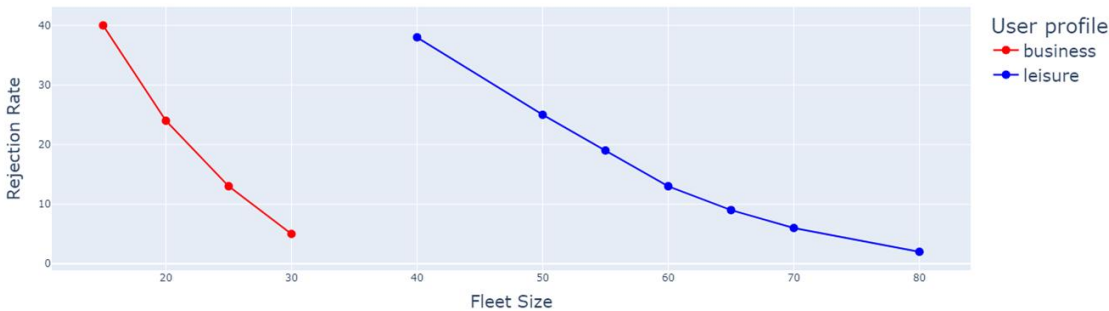
CCAM adoption patterns

- Most CCAM users come from car
- Cheaper than taxi but more expensive than bus/train
- Higher travel times than taxi but more convenient than bus/train

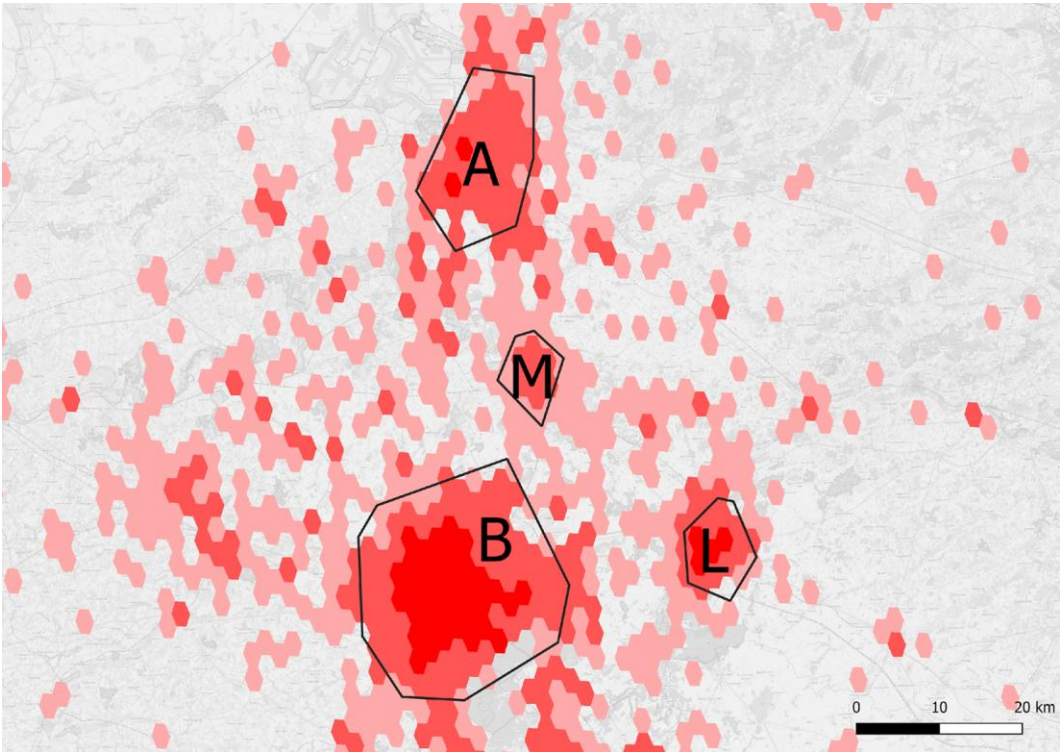
A simulation-based assessment toolkit that allows stakeholders to evaluate the **impact of management decisions** and derive key indicators for different deployment scenarios of a **CCAM fleet** for airport access.



Application to Brussels

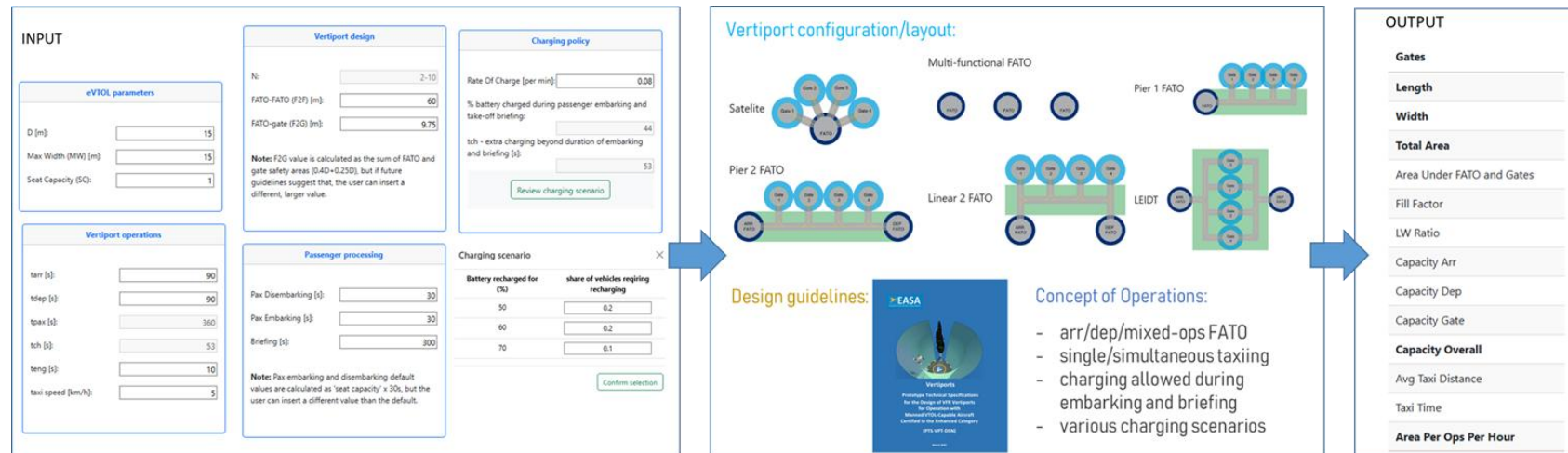


Areas				Requests		Rejections [%]		Distance ratio	
B	A	M	L	Leis.	Busi.	Leis.	Busi.	Leis.	Busi.
•				3,246	736	6	4	1.54	0.59
•	•			3,375	760	8	5	1.63	0.63
•	•	•		3,412	765	8	5	1.64	0.63
•		•		3,288	742	6	4	1.55	0.60
•			•	3,307	763	7	5	1.54	0.60
•		•	•	3,344	768	7	5	1.56	0.61
•	•		•	3,431	786	9	6	1.65	0.64
•	•	•	•	3,468	791	9	8	1.67	0.64



A **vertiport site selection framework** to support the implementation of **electrical Vertical Take-off and Landing (eVTOL)** aircraft services in the airport access, able to balance passenger experience criteria and UAM operational constraints.

Vertiport sizing and capacity tool

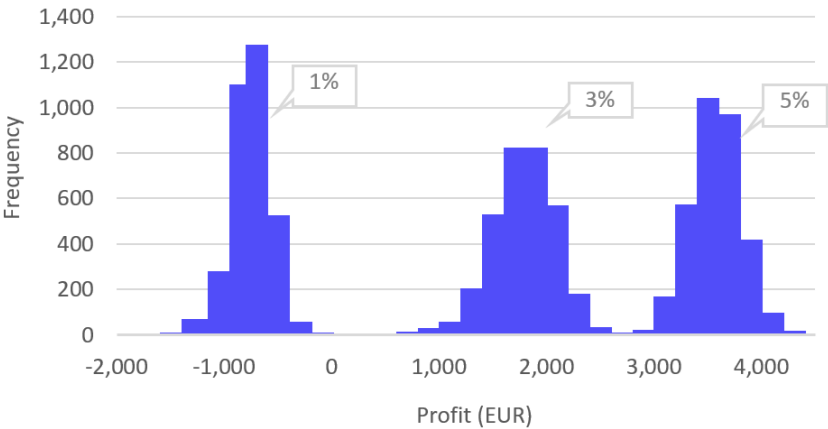
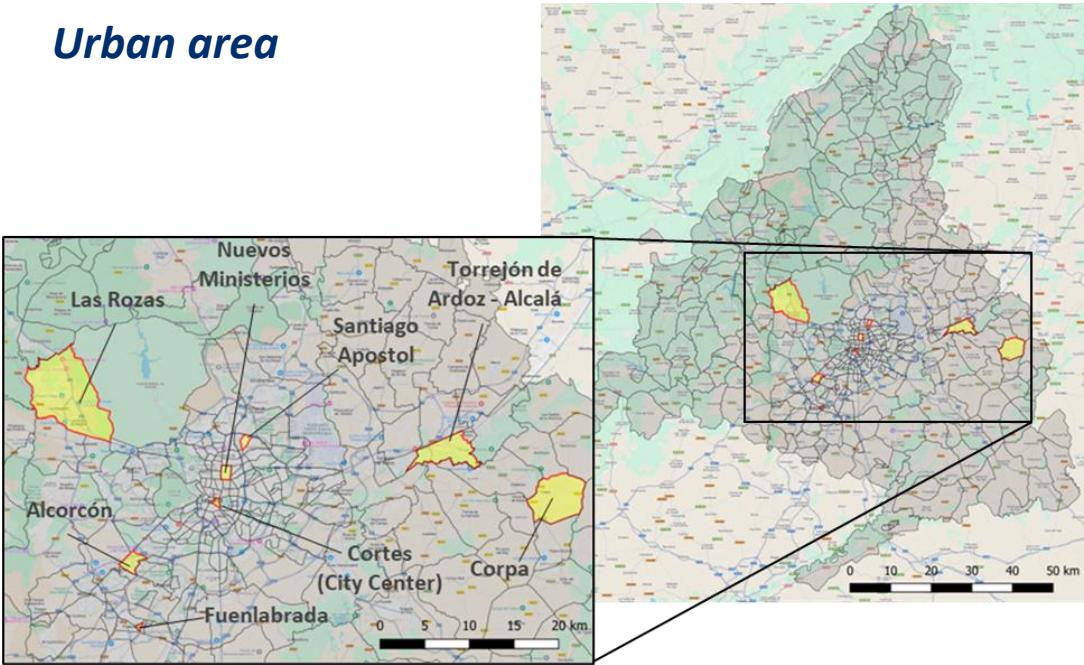


<https://vsctool.sf.bg.ac.rs/>

Airport site



Urban area



MAIA

<https://www.maiasesarproject.eu/>

 [@maiasesarproject](https://www.linkedin.com/company/maiasesarproject)

Thank you!

NOMMON

System^x
INSTITUT DE RECHERCHE
TECHNOLOGIQUE

TM **TRANSPORT
& MOBILITY
LEUVEN**

 **UNIVERSITY OF BELGRADE
FACULTY OF TRANSPORT
AND TRAFFIC ENGINEERING**

POLIS
CITIES AND REGIONS FOR TRANSPORT INNOVATION

 **brussels
airport**
the heart of Europe

JARVIS

JARVIS Airport Digital Assistant (AP-DA) SESAR Sol 0554 to 0557

Nikolaos Iosif, Manager Operational Compliance & Transformation,
Athens Intl. Airport (AIA)

*Passenger Centric Digital Airport & Multimodality Event,
Athens, 24-25 February 2026*



JARVIS ambition is to deliver three AI-based ATM solutions (digital assistants) to support pilots, ATC operators and airport operators and ensure safer and more efficient operations in complex scenarios.

JARVIS

in numbers



June 2023
May 2026



17
Organizations



9
Countries



36
Months



3
Digital Assistants



€ 10,8
Millions

Consortium

JARVIS



JARVIS

ACI Europe

AENA

Civil Aviation Authority

IATA

Swiss International Air Lines

Easyjet

German Pilots Union

Airbus Unmanned
Traffic Management

WISK

NASA

Embraer

Bombardier

AirNav Ireland

International Federation of Air Traffic
Controllers' Associations (IFACTA)

Irish Air Corps

Italian Professional Association of Air Traffic
Controllers (ANACNA)

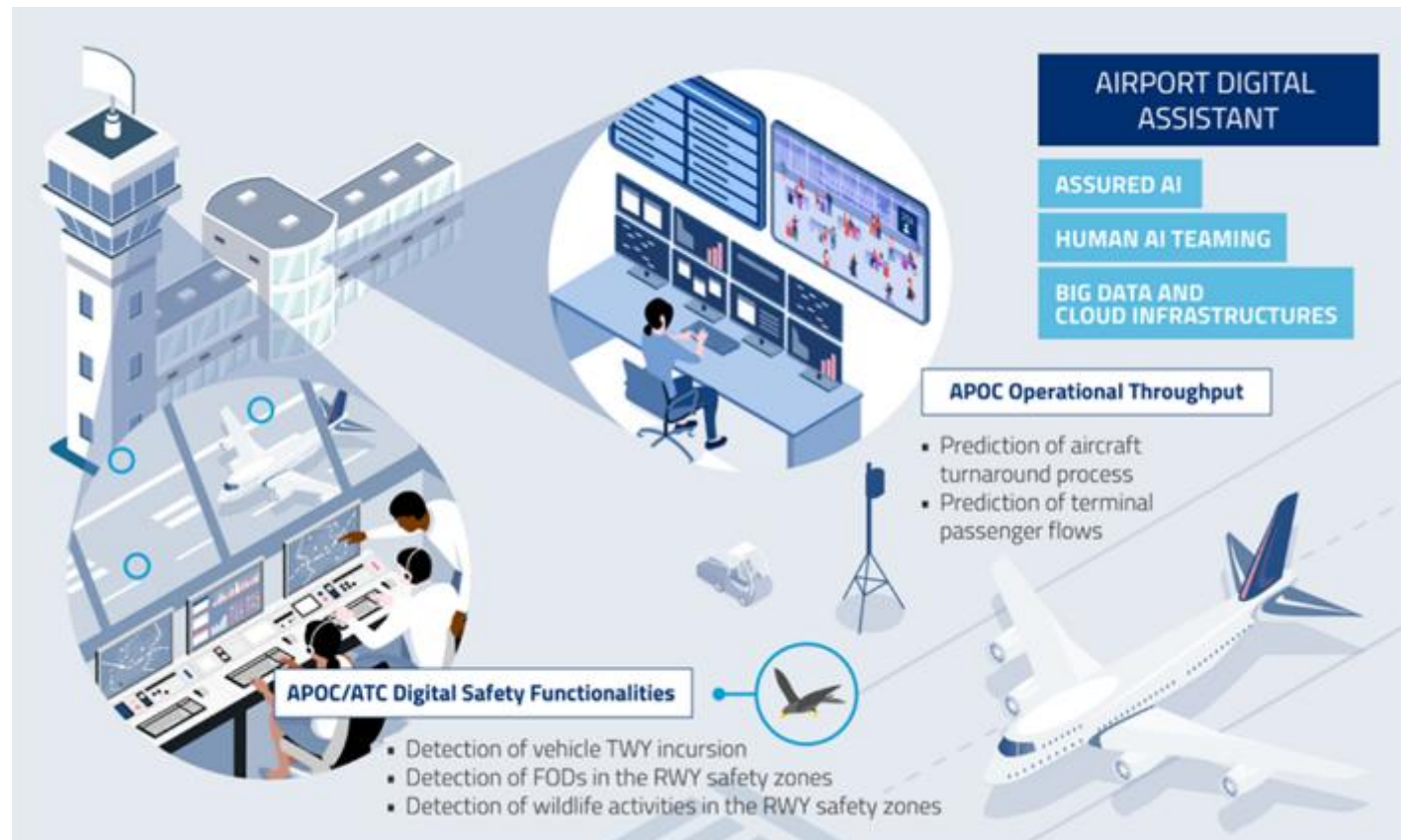
Luftfartsverket (LFV)

DSNA

DFS Aviation Services)

Airport Digital Assistant: The Vision & Context

The objective of the “*Airport Digital Assistant*” is to demonstrate the **AI technology capabilities** across the whole spectrum of airport operations, in a balanced way, touching on both **digital safety functionalities** and **operational throughput**, airside and landside.



‘JARVIS Airport Digital Assistant’

JARVIS Airport Digital Assistant	
Solutions IDs	0554 to 0557
Solutions title	Solution 0554 Improving detection of taxiway incursion by vehicles using AI Solution 0555 Improving detection of FODs and wildlife activities in the runway environment using AI Solution 0556 TOBT monitoring via AI-based prediction of aircraft turnaround times Solution 0557 Monitoring and AI-based Prediction of passenger terminal flows
Solutions nature	Industrial Research ATM Solution
Solutions TRL	Initial: TRL4 Target (proposal / grant agreement): TRL6
Solutions leader and contributors	Leader: Athens International Airport (AIA) Contributors: INDRA, EUROCONTROL, SWEDAVIA

Airport Digital Assistant (AP-DA)

Partners:
AIA, INDRA, Swedavia,
Eurocontrol



Solution definition

Airport Digital Assistant (AP-DA) increases the level of automation and adopts Artificial Intelligence (AI)-based solutions that directly impacts on safety performance and operational throughput at airports.

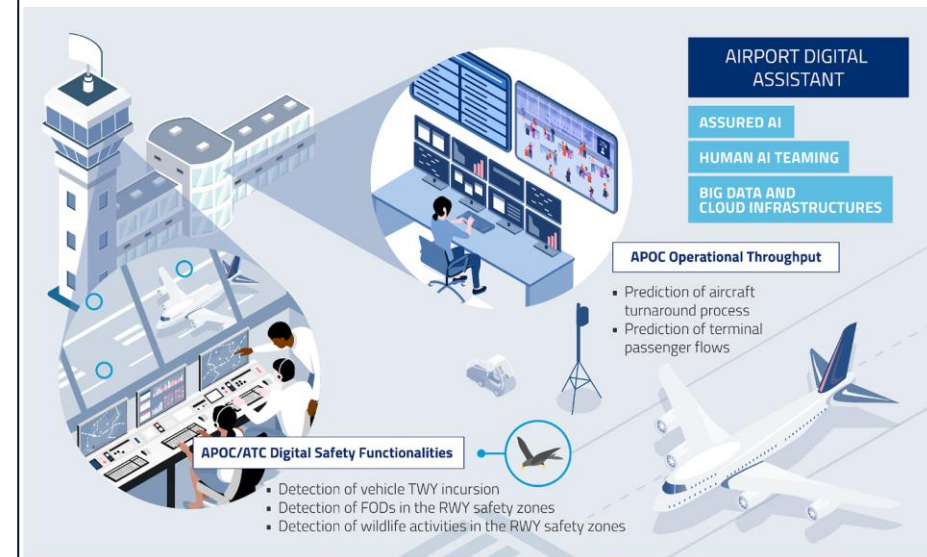
AP-DA consists of the following 4 Solutions:

- **Solution 0554** Improving detection of vehicle incursion on the taxiways using AI
- **Solution 0555** Improving detection of FODs and wildlife activities in the runway environment using AI
- **Solution 0556** TOBT monitoring via AI-based prediction of aircraft turnaround times
- **Solution 0557** Monitoring and AI-based Prediction of passenger terminal flows

AI-enabled AP-DA will provide an alert system, for promptly taking the appropriate related mitigation actions and achieve a more predictable airport operations plan (AOP), aiming at the safer and more efficient end-to-end airport operational performance.

Supporting Solution Exercises and dates

- TVAL.08.1-JARVIS-0554-TRL6: Detection of vehicle TWY incursion
- TVAL.09.1-JARVIS-0555-TRL6: Detection of FODs in the RWY environment
- TVAL.10.1-JARVIS-0555-TRL6: Detection of wildlife activities in the RWY environment
- TVAL.11.1-JARVIS-0556-TRL6: Predictions of aircraft turnaround process and their impact on the TOBT
- TVAL.12.1-JARVIS-0557-TRL6: Predictions of terminal passenger flows and their impact on the airport operations



JARVIS Concept Image

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Funded by
the European Union

'Airport Digital Assistant (AP-DA)'

Solutions 0554 to 0557



WHY?

- Improve end-to-end airport operational performance
- Improve Airport Safety
- Improve Operational Throughput and enhance Passenger Experience



WHAT?

- Airport digital assistant
- Detection:
 - Vehicle TWY incursions
 - Wildlife & FOD in RWY
- Prediction:
 - Aircraft turnaround
 - Passenger flows

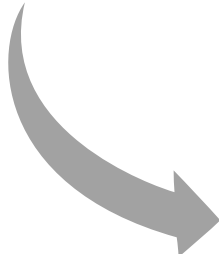


HOW?

- AI based technologies combined with ML
- Human AI teaming and Assured AI design framework

Solutions 0554 to 0557 – Expected Performance Contribution

SOL. CODE	SAF	FEFF1	TEFF1	CAP1	CAP2	PRD1	PUN1	CEF2	CEF3	SEC	HP	DIGI
(ID 0364) JARVIS-SOL1-AIR-DA	DSI	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
(ID 0365) JARVIS-SOL2-ATC-DA	DSI	YES	YES	YES	YES	YES	NO	YES	NO	YES	YES	YES
(ID 0366) JARVIS-SOL3-AP-DA	DSI	NO	YES	NO	NO	YES	NO	NO	NO	YES	YES	YES



SOL. CODE	SAF	FEFF1	TEFF1	CAP1	CAP2	PRD1	PUN1	CEF2	CEF3	SEC	HP	DIGI
Solution 0554	DSI	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
Solution 0555	DSI	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
Solution 0556	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO
Solution 0557	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO

In addition, Solution 0557 will bring benefits to the passenger experience aiming to bring visibility and reduce queuing times

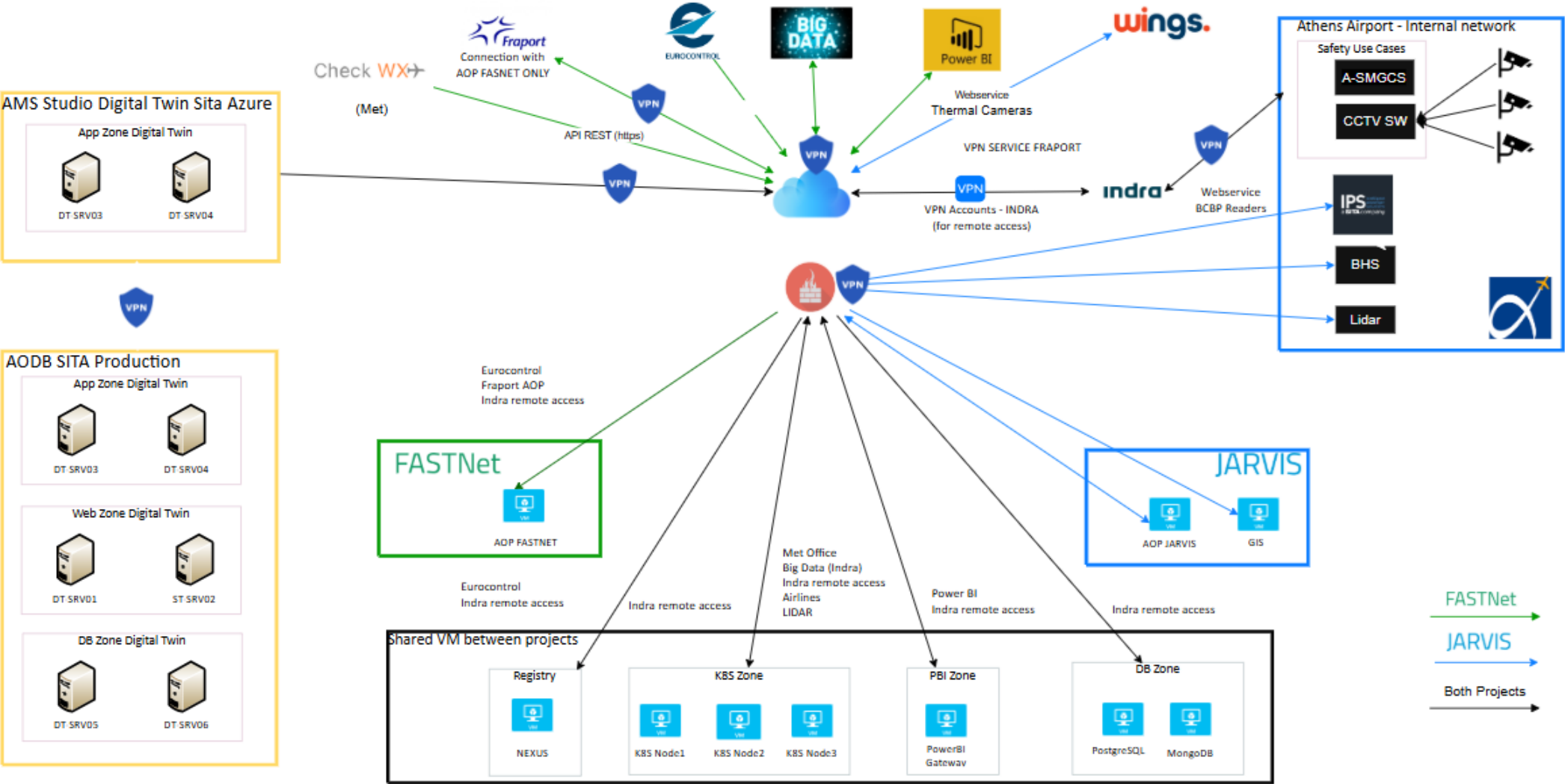
Challenges

AI design: Develop and assess a trustworthy system in terms of safety and security

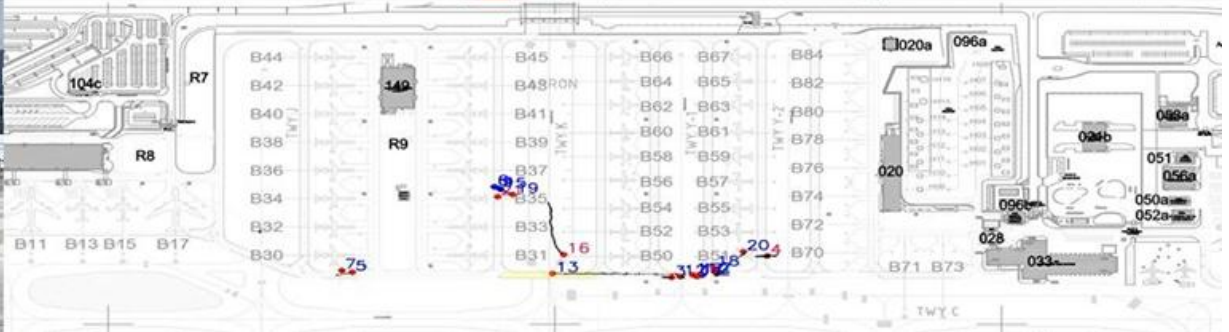
Human AI teaming: Create a positive machine/human synergy and deliver human centered solutions following ergonomics principles

Big data and cloud infrastructures: Investigate structures to collect the large amounts of data required for the project and develop ways to exploit data to generate knowledge

Solutions 554 to 557 – ‘Airport Digital Assistant’ Technical Architecture



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Solutions 0555 - Detection of FODs in the RWY environment



Solutions 0555 - Detection of wildlife activities in the RWY environment



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Solution 0556 - TOBT monitoring via AI-based prediction of aircraft turnaround times



- Predictive AI algorithms based on historical data
- Objective: Identify deviations on nominal turnaround times before the start of aircraft turnaround and contributes to improved operational efficiency.

Solution 0557 - Monitoring and AI-based Prediction of passenger terminal flows

Results



- Predictive AI models, for real-time passenger monitoring data in the calculation of operational timestamps.
- Objectives:
 - Predict passenger showing up at check in and security control
 - Calculation of passenger flow related operational timestamps
 - Triggering alerts to APOC when predictions exceed predefined thresholds



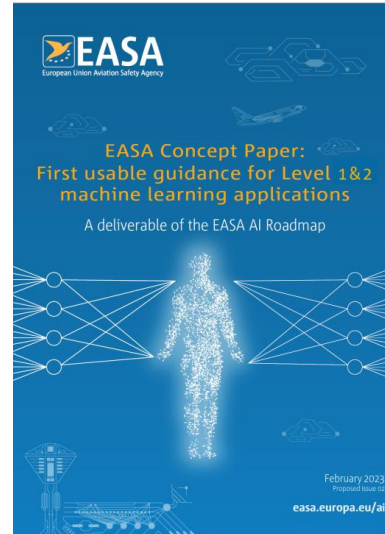
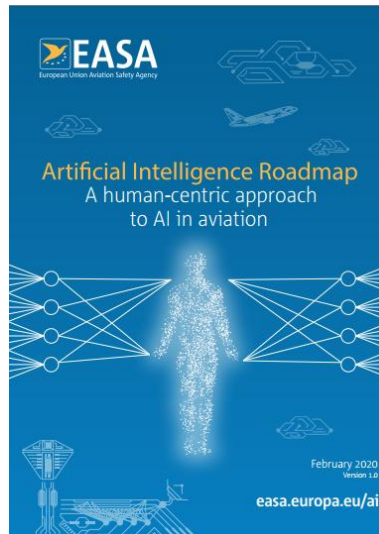
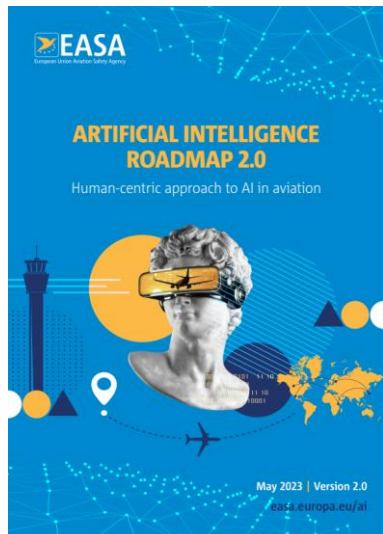
This collaboration is driven by EASA's interest in **validation of their recent AI guidance, as well as in extending it with new elements** aligned with its AI roadmap

Cooperate with EASA on **AI assurance for AI technologies different from supervised ML (i.e., Hybrid AI)**, for: **i)** early feedback from EASA on means of compliance, and **ii)** support EASA in shaping the emerging AI certification guidance

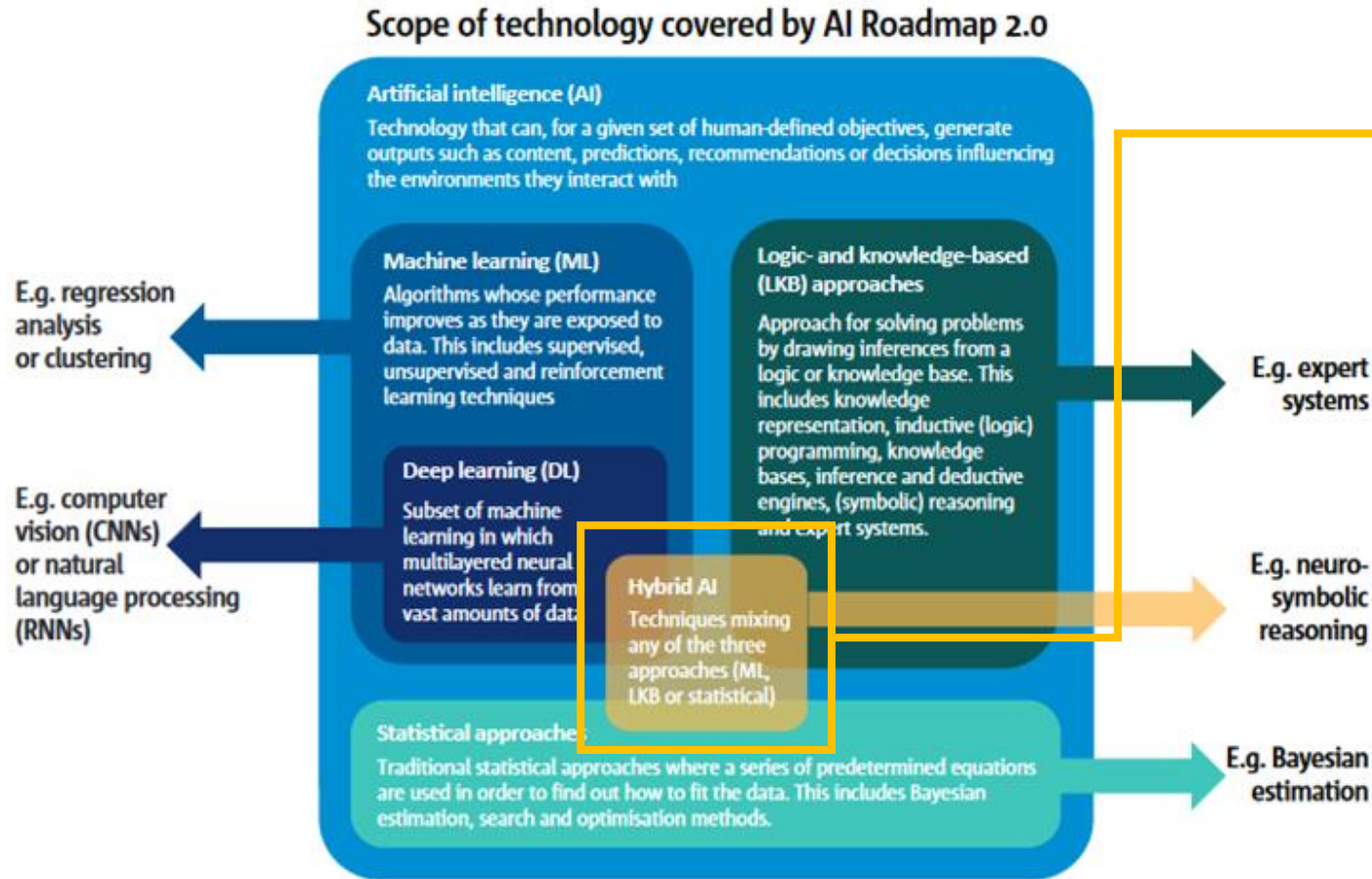
Three **(3)** sources of “rules” when considering the development of systems for aviation;

- **CS25.1302**, HF standard for aircraft
- SESAR Human Performance Reference Material (**HPRM**), guidance for ground based systems
- EASA first usable guidance for **all aviation AI based systems**, ground and air

Within the EASA guidance, it is possible to determine **which entry point into the classification scheme your system falls**, therefore, identifying which guidelines are to be applied to it.



AI Taxonomy – “FOD Detection” mapping



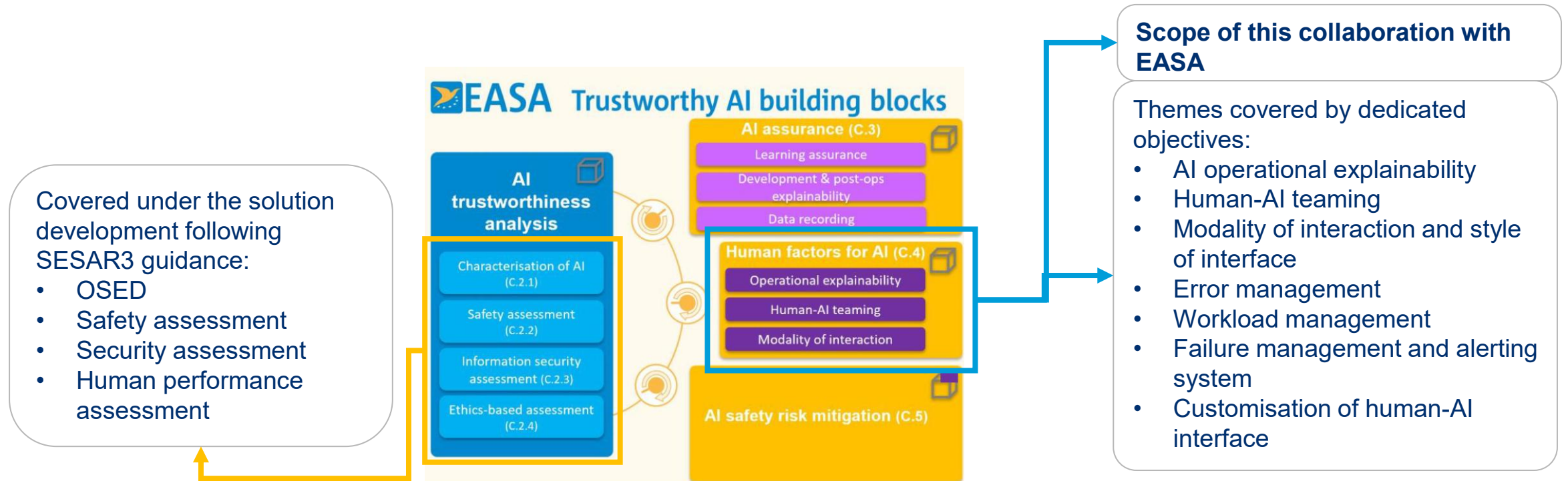
UC 2 - Detection of FODs in the RWY safety zones

- 1b EASA AI level: Supports information acquisition and processing (FOD detection), support for decision making (raising an alert), no automatic implementation of actions (alert only).
- The use case combines deep learning techniques to compute the detection with logic and rule-based reasoning to generate an alert associated with the detection.
- Along with the alert, the video detection is enriched with metadata, such as datetime, position, type of detection, which are combined as well with operational data to develop the logic of the alert.

JARVIS

“FOD Detection” AI Assurance: Development as per EASA’s guidelines

Initial set of design principles provided for Level 1B



- SESAR Joint Undertaking | JARVIS- Just a rather very intelligent system
- SESAR Joint Undertaking | JARVIS: Increasing the trustworthiness of AI in aviation
- <https://www.sesarju.eu/news/tangible-ai-solutions-atm-focus-fly-ai-forum>

Smart airports and innovations in multimodality | A Projects Info Pack by CORDIS

8

"Our digital assistants don't replace humans but collaborate with them, benefiting passengers and industry."
Stefano Rivero, JARVIS project coordinator



PROJECT ID CARD

Full name:	Just a rather very intelligent system
Project dates:	1 June 2023 – 31 May 2026
Coordinated by:	Collins Aerospace in Ireland
Funded under:	Horizon Europe – Climate, Energy and Mobility
CORDIS factsheet:	cordis.europa.eu/project/id/101114692
Project website:	research.dbi.eu/jarvis
Total budget:	EUR 15 762 360
EU contribution:	EUR 10 847 806

JARVIS

Thank you!

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European Union

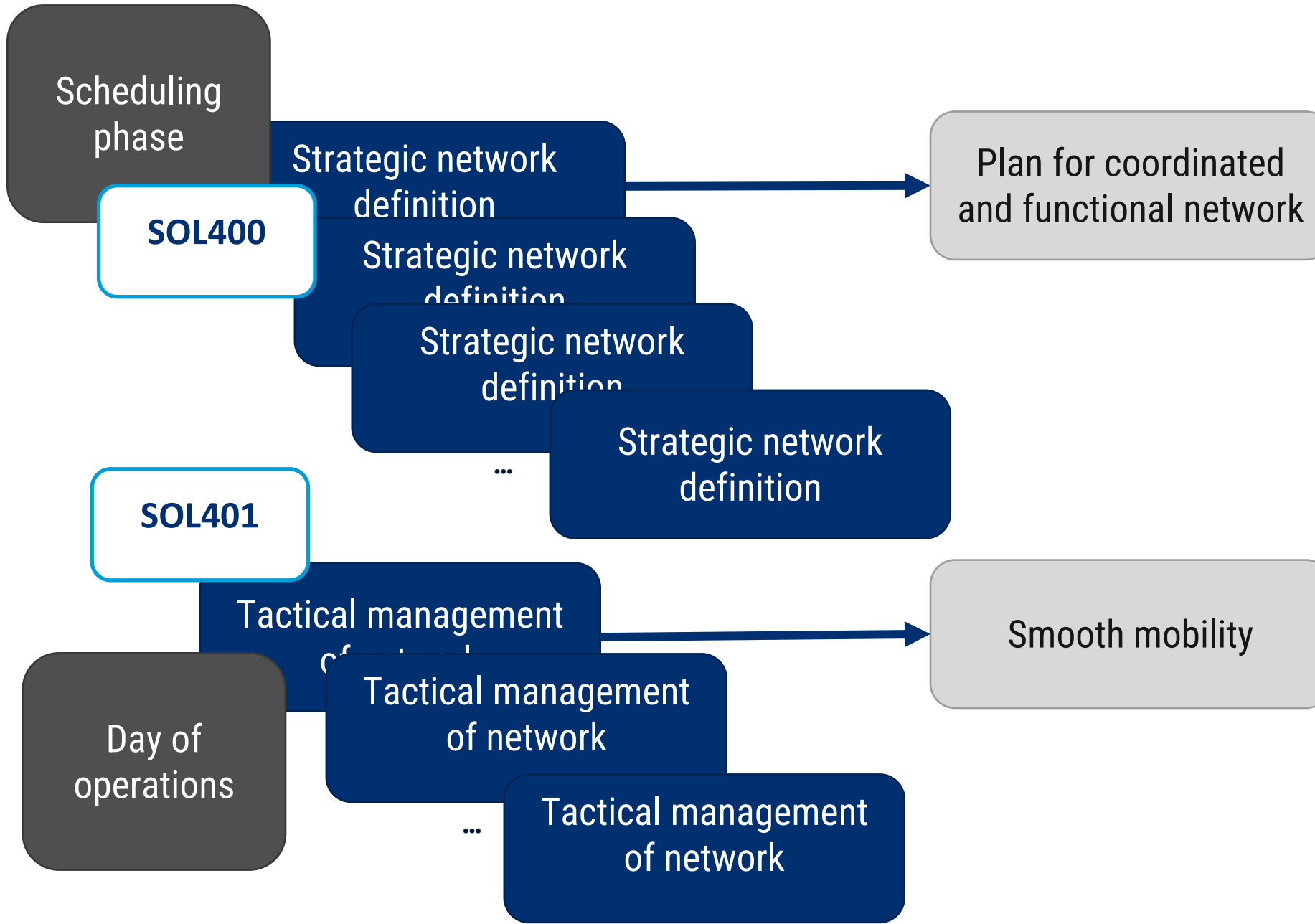
Break

MultiModX

MultiModX: Tools for evaluating and optimising air-rail networks

Passenger-centric digital airport and multimodality
24 February 2026

Modelling multimodal networks



Need for an **evaluation framework and tools**

SOL399



- **Solution 399 – Multimodal Performance Evaluation** measures door-to-door passenger outcomes using a structured catalogue of passenger-centric indicators, extending existing aviation performance frameworks to multimodal journeys and providing open-source tools for evaluating multimodal networks.
- **Solution 400 – Multimodal Schedule Design** improves planned connectivity by optimizing air and rail timetables within operational constraints, increasing feasible connections and reducing transfer times.
- **Solution 401 – Multimodal Disruption Management** protects passengers during disruptions through coordinated, cross-modal recovery strategies that minimise stranded passenger numbers and preserve journey continuity.

■ **Solution 400 – Multimodal Schedule Design**

- Modest air–rail timetable adjustments (± 10 – 20 minutes) significantly improve connectivity at multimodal hubs:
 - Door-to-door travel times were reduced by up to 20%
 - Number of feasible connecting itineraries increased by 5–7%

■ **Solution 401 – Multimodal Disruption Management**

- Coordinated air–rail disruption management reduced:
 - Stranded passengers by 17%
 - Average journey times by 20%
 - Service delays by up to 50%

Multimodal Performance Framework

Multimodal Performance Framework

- Digital catalogue of indicators

- Passenger-centric
- Open

- KPAs and example indicators

- **Operational Efficiency**

- Pax processing time
- Total journey time
- Buffers in itineraries
- Missed connections
- ...

- **Interoperability**

- Modal share
- Infrastructure connectivity
- ...

- **Flexibility**

- Diversity of destinations
- ...

- **Cost-Efficiency**

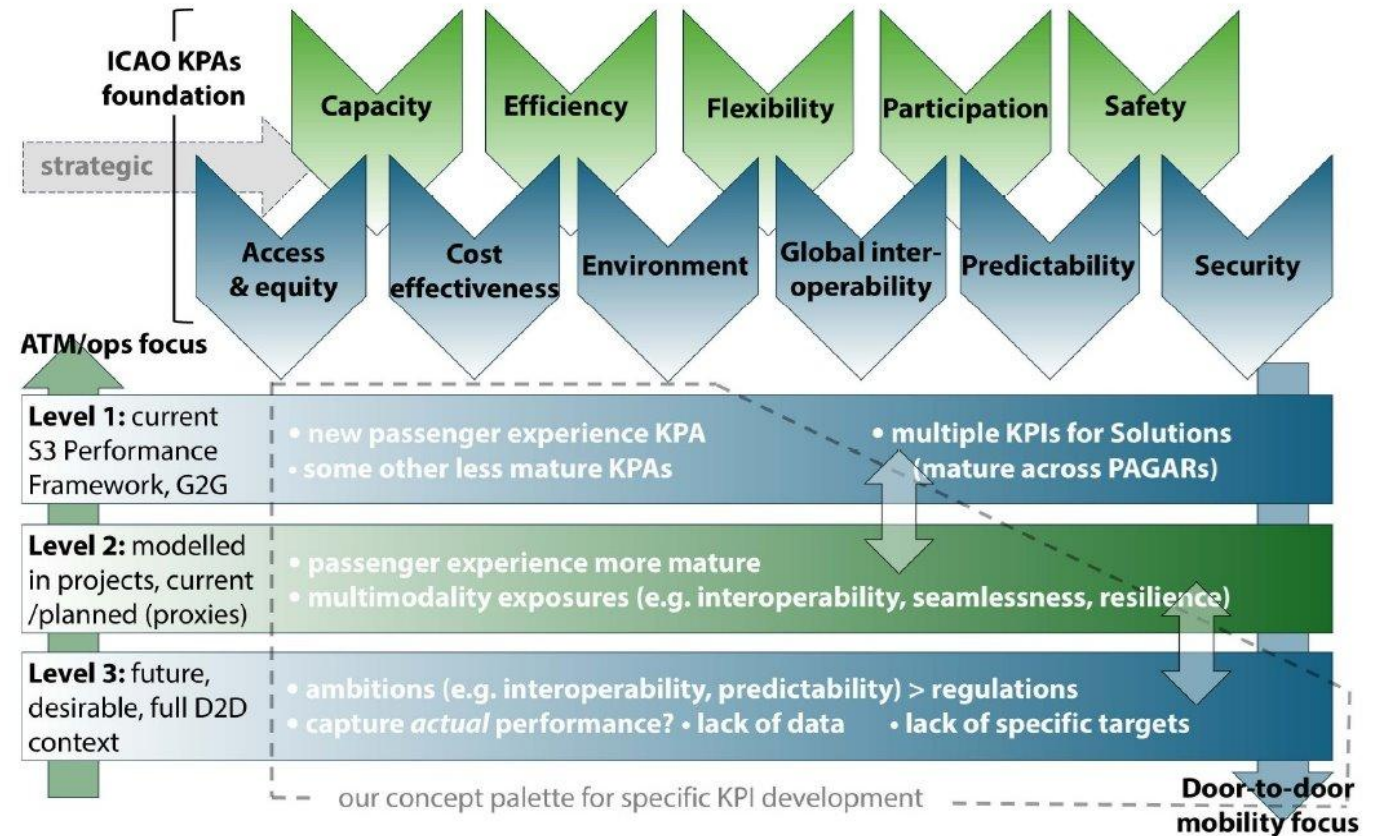
- Load factors
- ...

- **Capacity**

- Demand served
- Catchment area
- ...

- **Environment**

- **Predictability**



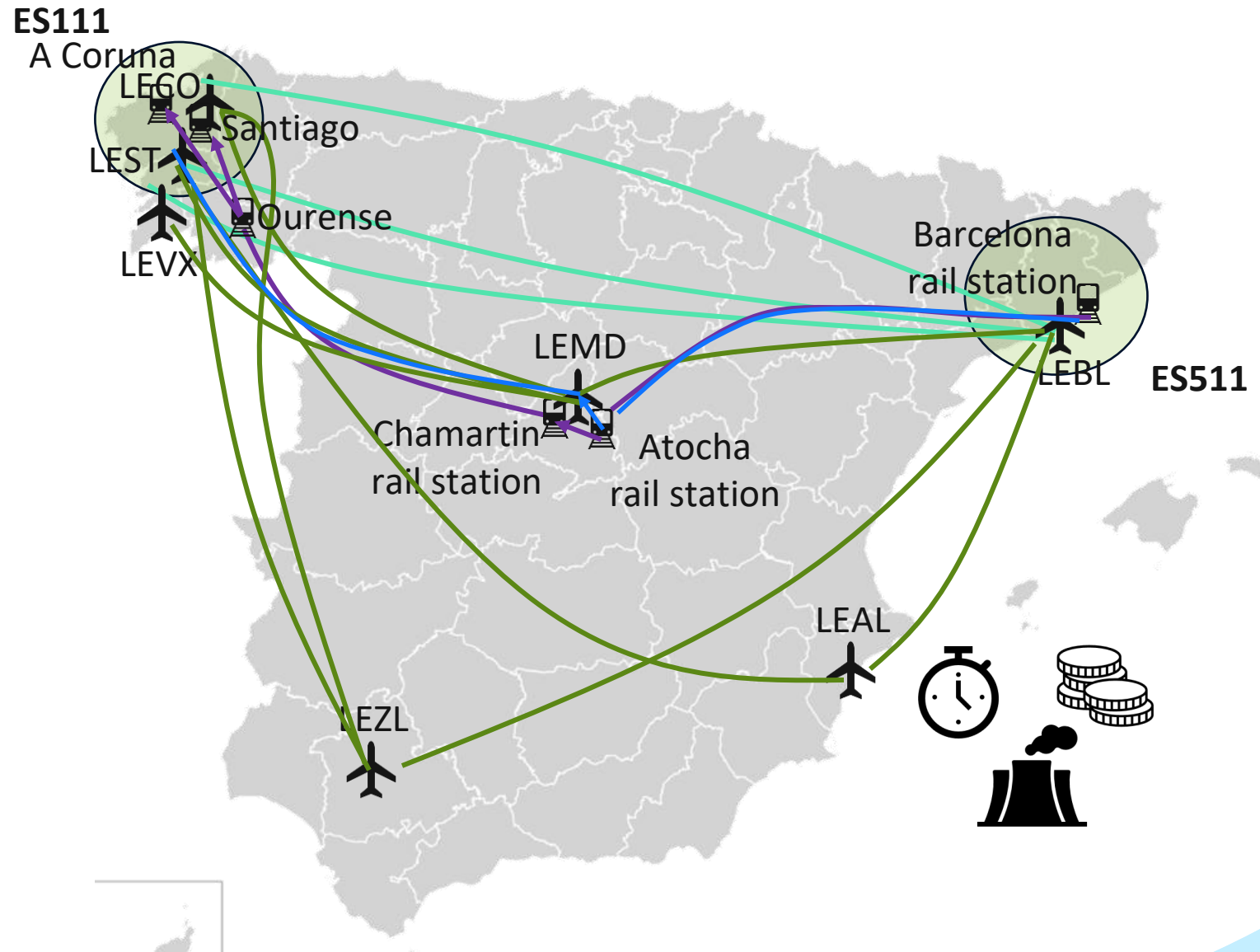
Open Multimodal Evaluation Tools

Evaluation of planned networks

Strategic Evaluation of Networks

Evaluate mobility from a
passenger-centric perspective

Path finding algorithms



Strategic Evaluation of Networks

Clusters: [2 air, 1 multimodal 1 rail]
(13 itineraries)

Evaluate mobility from a
passenger-centric perspective

Demand distribution
(pax preferences)



Demand per cluster

Pax flows
disaggregation
(pax itineraries)

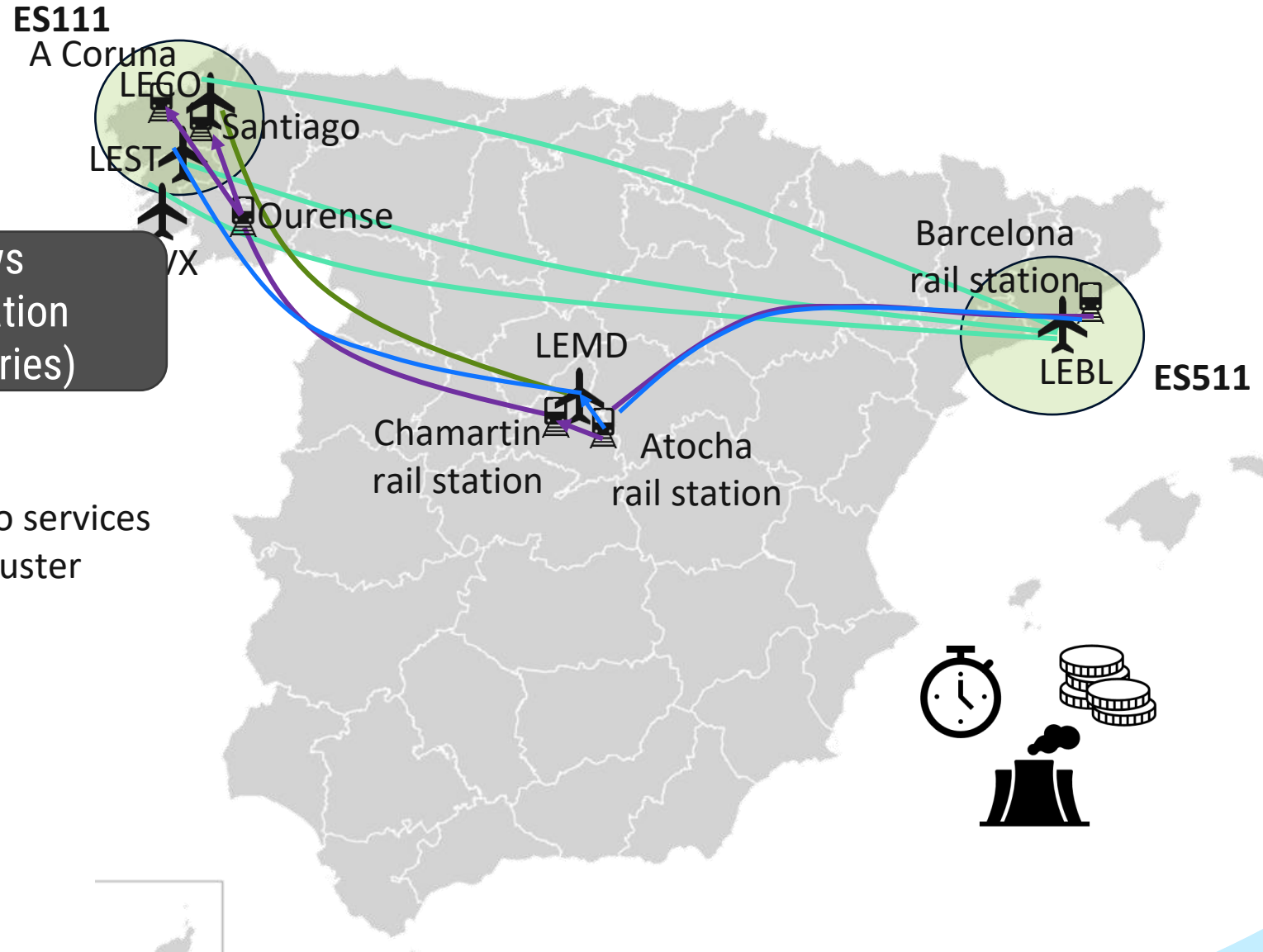


Passengers to services
within cluster

Metrics computation



Region, infrastructure,
operator, etc.



Strategic Evaluation of Networks

Evaluate mobility from a
passenger-centric perspective



Considers

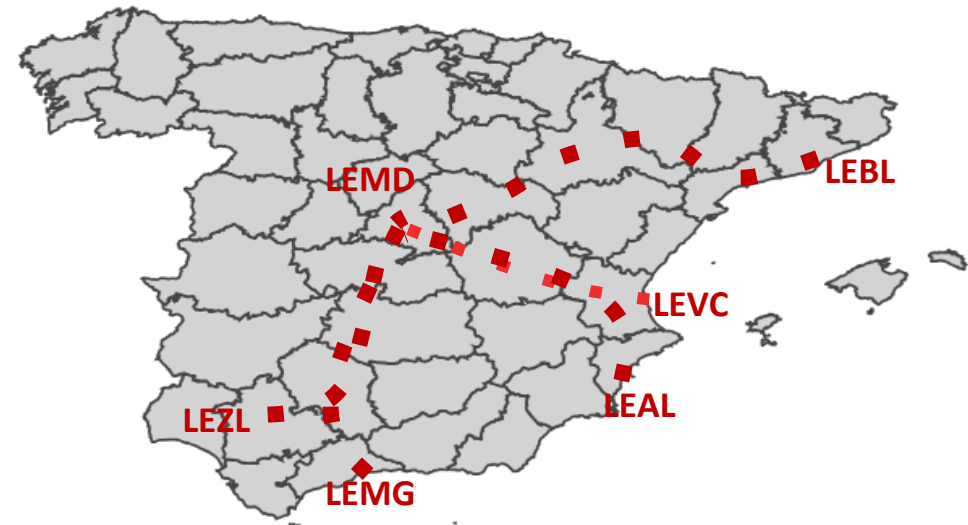
- New schedules
- Policies
- Changes in infrastructure
- ...

SOL400

Example of strategic evaluations

■ Policy-packages

ID	Policy Package	Individual policies definition
PP00	Reference (no particular policies)	• No integrated tickets (buffers in multimodal MCTs)
PP10	Multimodality incentivised	• Fully integrated (respecting alliances) • CO₂ tax applied to emissions
PP20	Multimodality enforced	• Fully integrated (respecting alliances) • CO₂ tax applied to emissions • Short-haul flight ban if rail available between regions $\leq 2h30$



Example of strategic evaluations

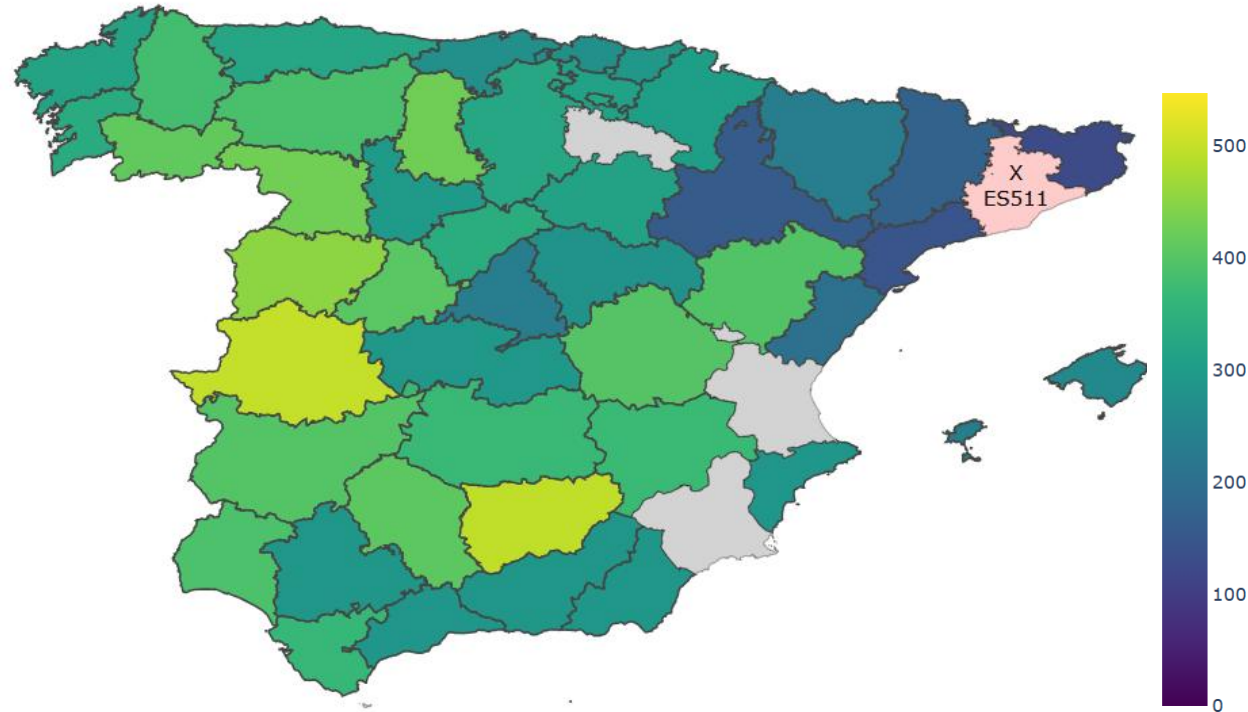
Demand satisfied and mode usage

- 81% demand satisfied
- 70% average load factor

	PP00 – Baseline	PP10 – Incentivised	PP20 – Enforced (flight-ban)
Rail	72.1%	71.9%	74.1%
Air	26.3%	26.0%	23.8%
Multimodal	1.6%	2.0%	2.1%

Example of strategic evaluations

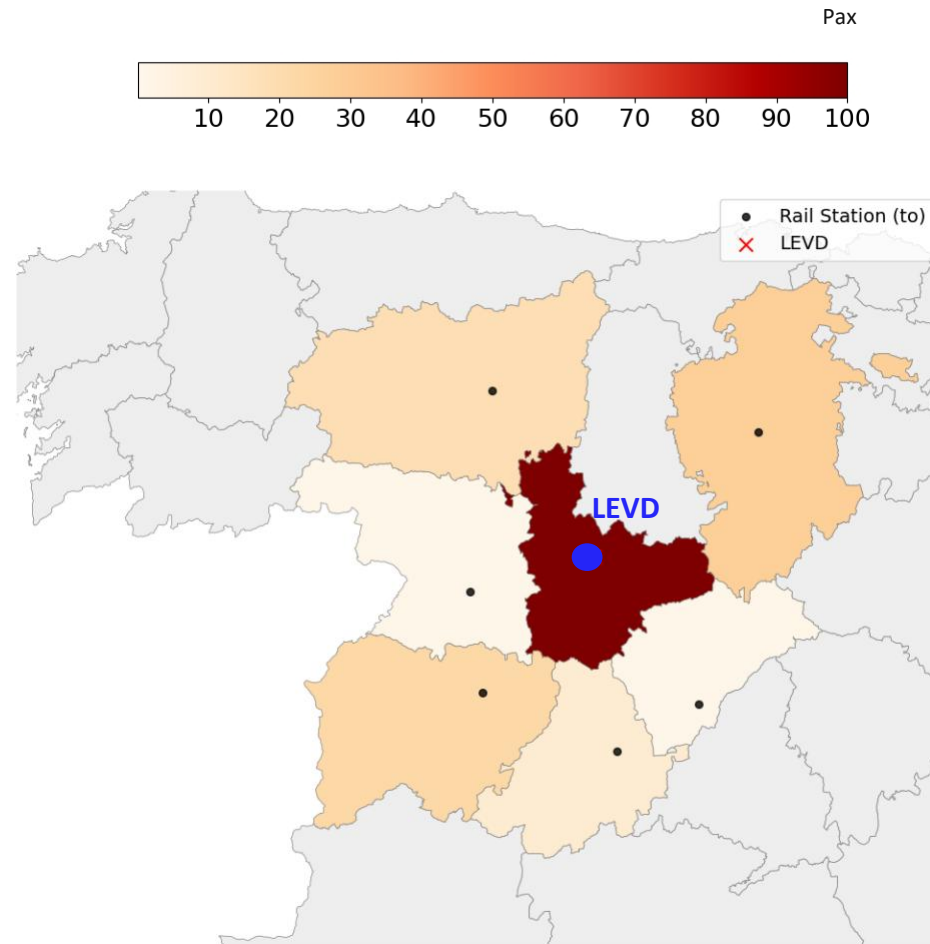
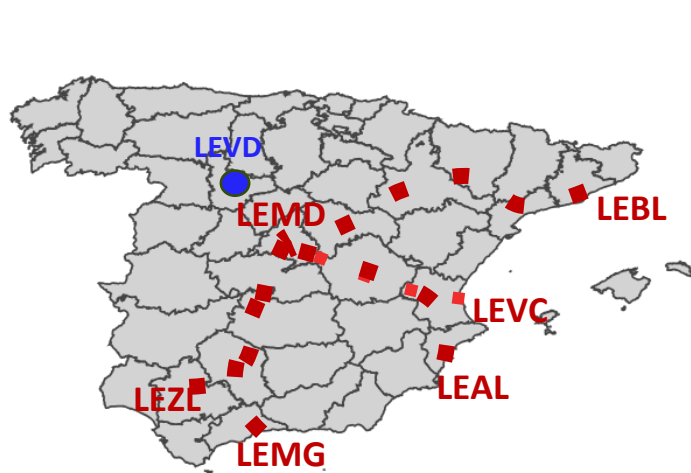
Total mobility time



Total mobility time from
ES511 to NUTS3 regions for
PP00

Example of strategic evaluations

Infrastructure connectivity



Egress PP00

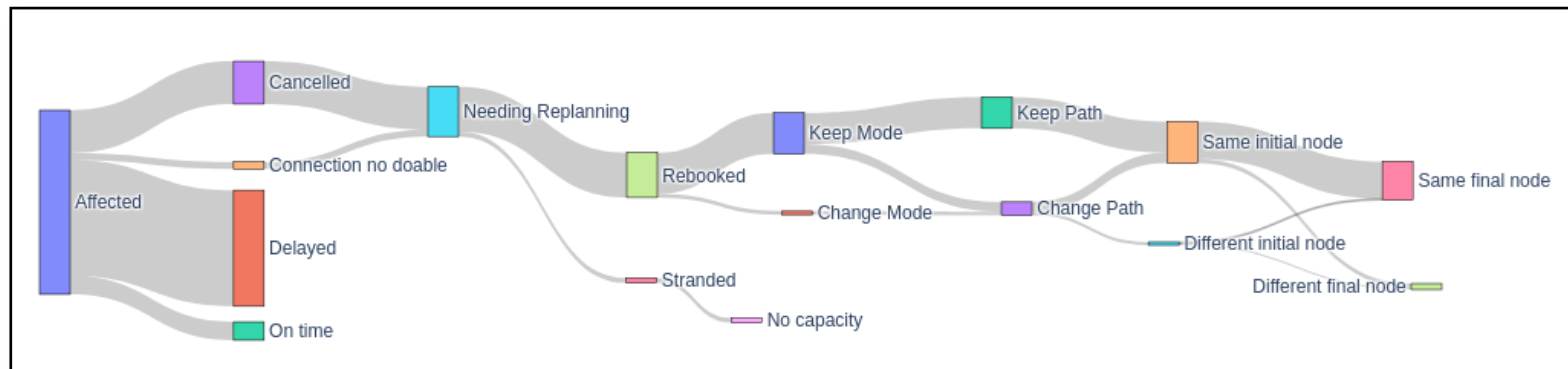
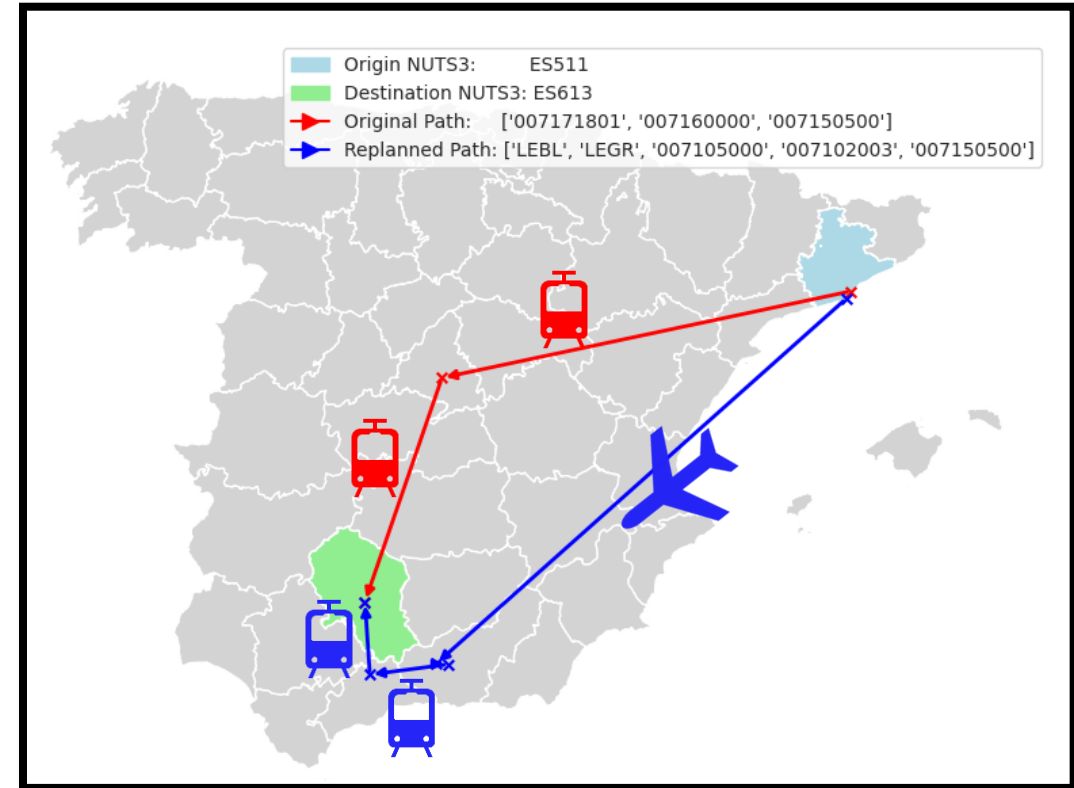
Evaluation of replanned networks (under disruptions)

Evaluation of replanned networks (under disruptions)

Multinetwork support each other

- Update network (delays, cancellation, additional services)
- Assess passengers impacted (delayed/stranded) and replanning alternatives for them.

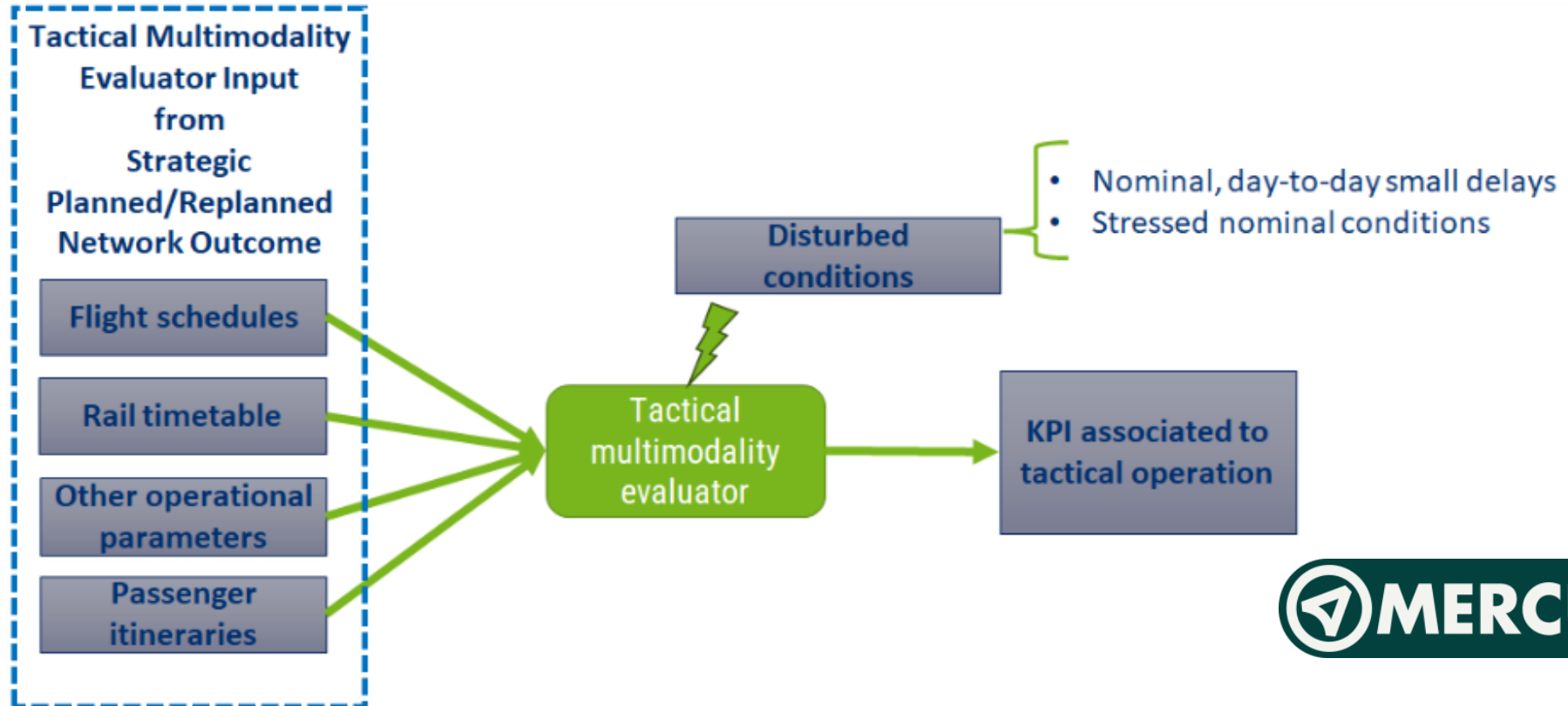
SOL401



Tactical Multimodal Evaluation

Description

Tactical Multimodal Evaluator



Fast-track to process passengers arriving at airport ? impact on multimodal missed connections

Conclusions

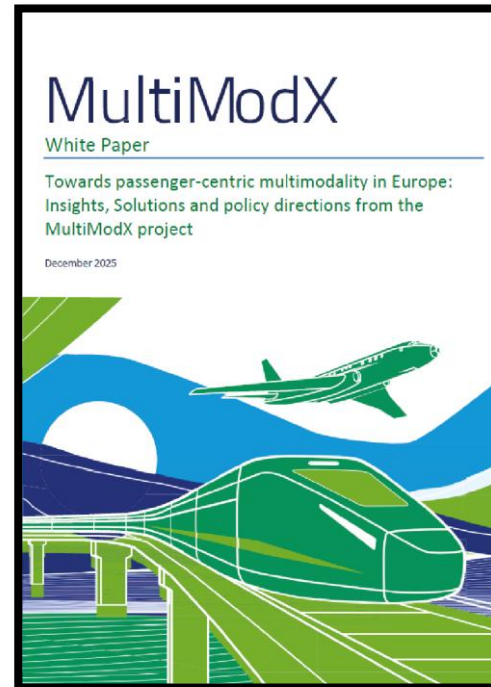
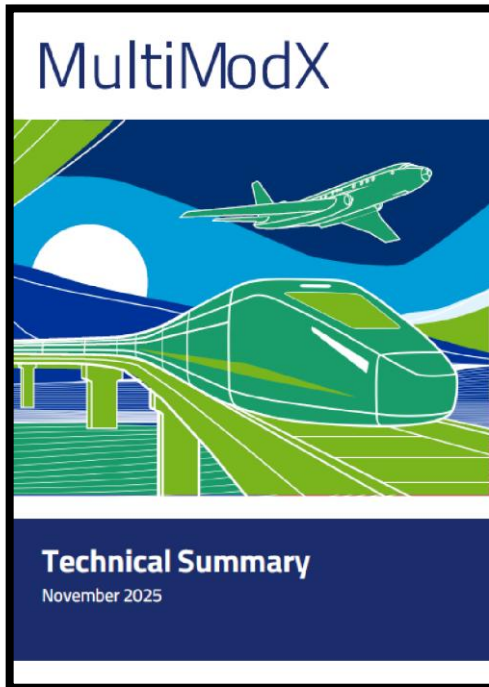
Conclusions

- MultiModX provides
 - Multimodality performance framework (passenger-centric focus)
 - Strategic (planning) Multimodal Evaluator
 - Tactical (day of operations) Multimodal Evaluator
 - Multimodal scheduler (SOL400)
 - Network replanner considering disruptions (SOL401)

MultiModX



<https://multimodx.eu/>



[https://github.com/
UoW-ATM/MultiModX](https://github.com/UoW-ATM/MultiModX)

MultiModX

Thank you!

ORCI Project

Digital Airport & Multimodality
Athens, 24-25 Feb 2026

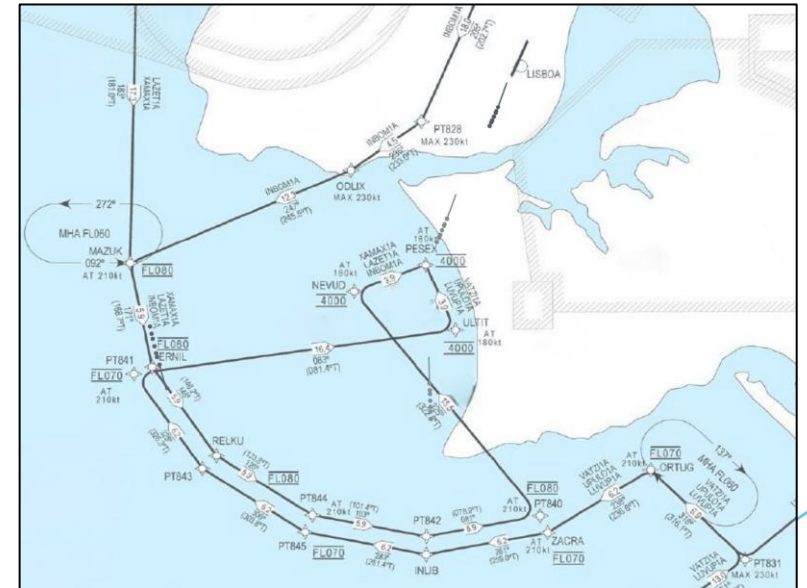
Optimised Runway Centreline Interception (ORCI)

- AI-based Decision Support Tool for Final Approach Sector operations
- Supports EC managing arrival spacing at merge/interception point
- Focused on TMA environments (*medium to very high* complexity)
- Applicable to:
 - Trombone systems (e.g., Barcelona-type operations)
 - Point Merge Systems (e.g., Lisbon-type operations)
 - Other (*future research*)
- Supports runway operation in both segregated and mixed modes

ORCI is an Advisory tool – ATCO remains sole decision-maker

- No change to existing separation minima or regulatory framework
- Can work to any desired target separation
 - ... thereby accounting for sub-nominal conditions - by design
- Easy to integrate in the future into existing CWP
- Positioned within Digital European Sky objective:

AI supporting human roles

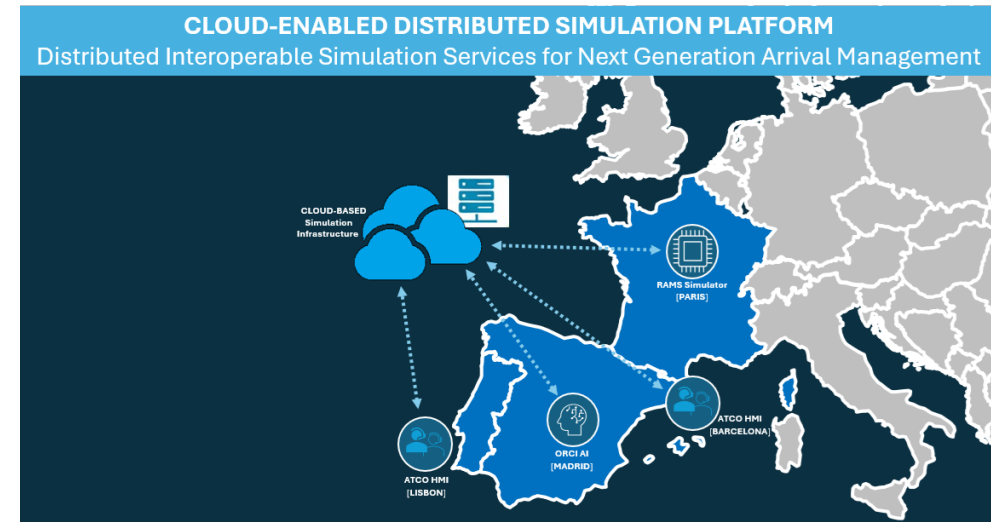


Technology

- ML-based predictive model
- Continuously predicts spacing at ILS interception/PM merge point
- Accounts for:
 - ATCO phraseology delay
 - Pilot response time
 - Aircraft turn dynamics/momentum
 - Wind & compression effects
 - Refresh rate target < 5 seconds
 - Transparent AI approach to maintain controller trust
- Validation using SDM aligned distributed, service-based validation platform

Overall Objectives

- Improve interception timing precision
- Increase arrival throughput without reducing existing separation minima
- Reduce excess spacing buffer
- Reduce unnecessary vectoring and path extensions
- Improve human performance and peak-hour resilience
- Contribute to Capacity, Efficiency, Safety and Cost KPAs



ATC Experts in Lisbon/Barcelona manage arrival flows using “Hybrid” Human-in-the-Loop / Model-based simulations (RAMS / ORCI-AI DST / ORCI-ATCO HMI) in a fully distributed ATM simulation environment via the cloud

ANSP Perspective – System Operator

- Increased effective TMA throughput without reducing separation minima
- Optimised Arrival Spacing Buffer → reduced excess spacing margin
- Higher peak arrival handling capability (segregated & mixed mode)
- Fewer merging issues under high/very high complexity
- Reduced communication load during peak periods
- Potential increase in flights handled per ATCO hour
- Improved resilience during demand > capacity situations

ATCO Perspective – Human Operator

- Real-time predicted spacing at interception point
- Reduced cognitive burden in estimating timing uncertainties
- Lower need for corrective second vector instructions
- Improved situation awareness through dynamic spacing visibility
- Better workload distribution during peak traffic
- Increased confidence in decision timing
- Maintains full authority and tactical control

Experience Shift:

From mentally managing uncertainty → supported precision decision-making.

Airport Operator Perspective

- Increased peak runway throughput (segregated & mixed mode)
- More consistent arrival spacing → improved runway slot predictability
- Better gap management enabling departure integration in mixed mode
- Reduced arrival variability at threshold
- Improved operational stability during traffic peaks
- Supports surface and turnaround planning predictability

Experience Shift:

From reactive runway gap management → more predictable & homogeneous arrival streams.

Airline Operator Perspective

- Reduced unnecessary vectoring and outbound leg extensions
- Reduced nautical miles flown in TMA
- Lower fuel burn during sequencing phase
- More stable and predictable arrival times
- Reduced variability in final approach management
- Fewer speed/vector corrections

Experience Shift:

From tactically stretched paths → to more optimized & consistent sequencing.

ORCI

Human Performance [HP]

Mechanism:

- Reduced ATCo cognitive estimation burden
- Improved ATCo situation awareness
- DST trust through transparent AI & reliable prediction

KPIs Impacted

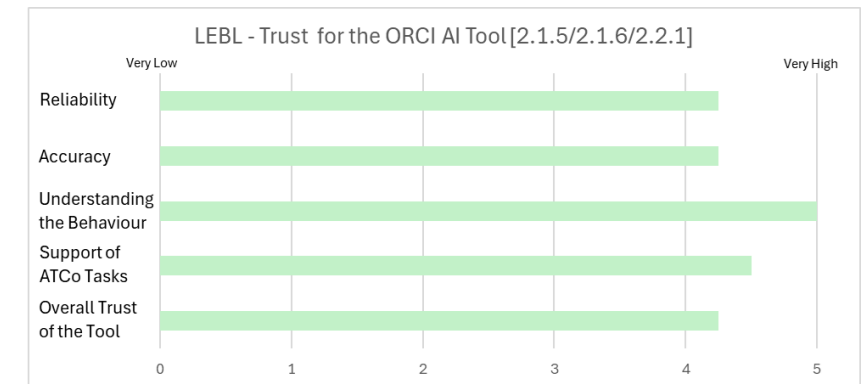
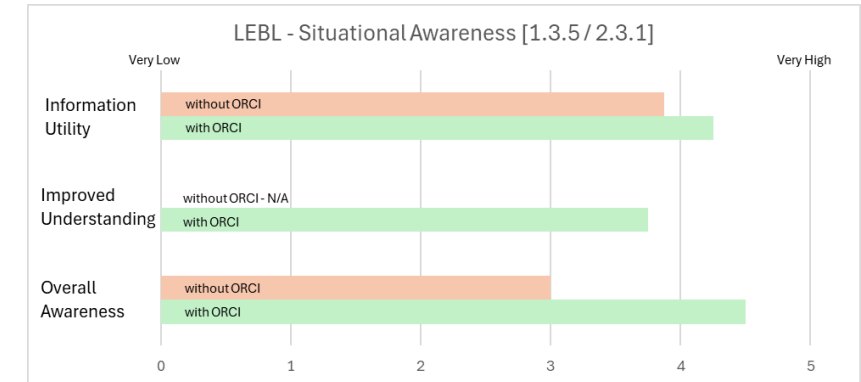
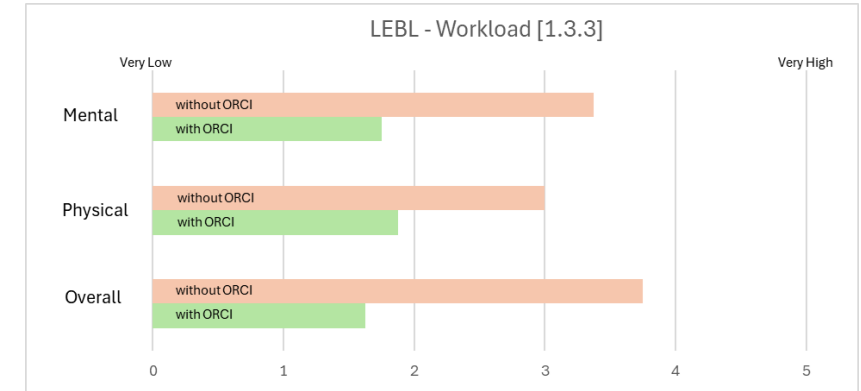
- Controller workload indices
- Situation awareness metrics
- Trust in DST predictions

Quantifiable Effects [*Qualitative from HITL validation runs with ATCo*]

- Reduction in perceived workload
- Increase in situational awareness
- High level of trust in the tool

Operator Experience

- ATCO: Supported decision precision
- ANSP: Improved peak-hour human/team performance



ORCI

Mechanism:

- Improved separation management at interception point
- Reduced excess Arrival Spacing Buffer
- More frequent single-vector interceptions

KPIs Impacted

- CAP1 – TMA throughput per unit time
- CAP3.2 – Peak arrival throughput (segregated mode)
- CAP3 – Peak runway throughput (mixed mode)

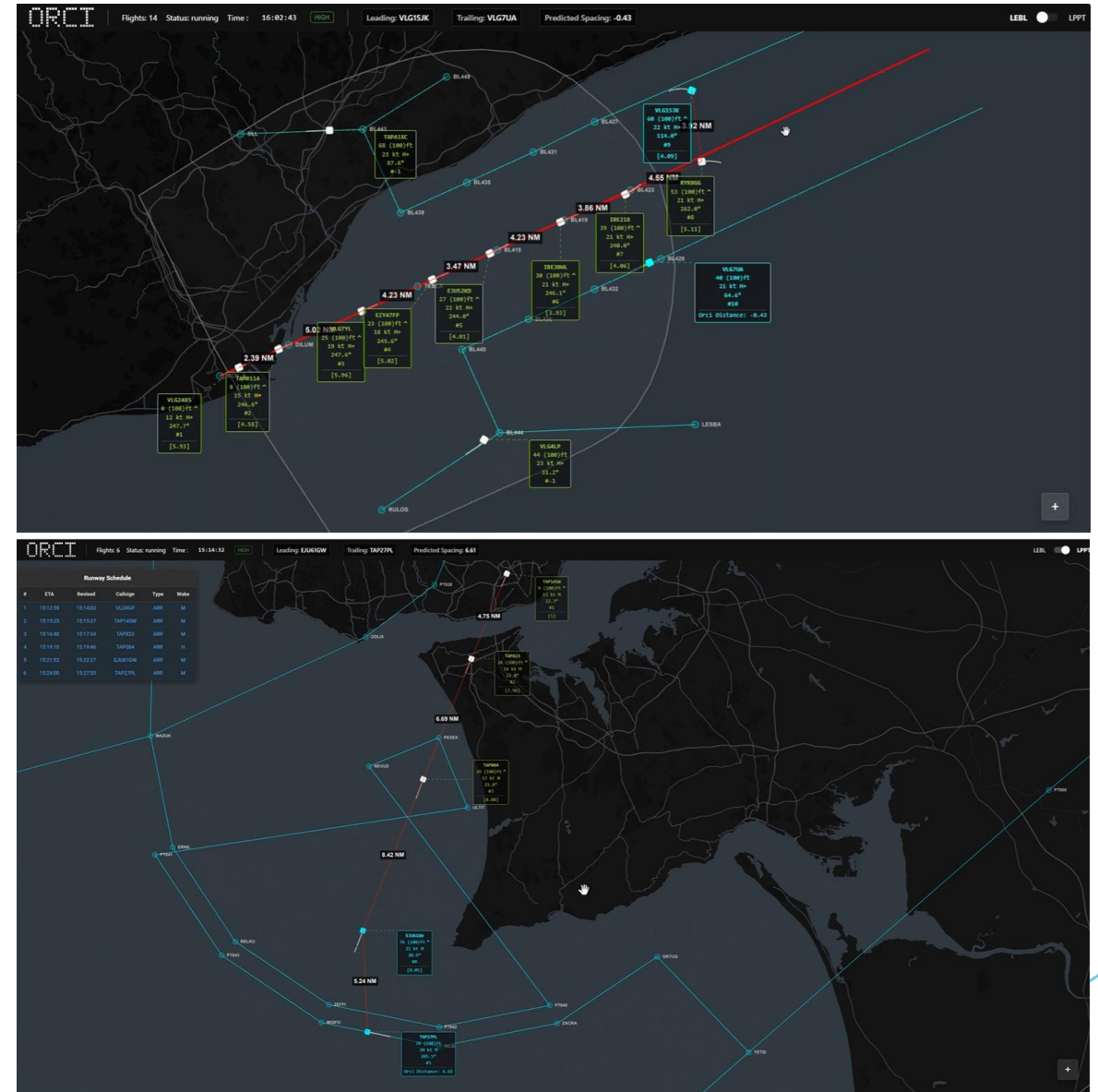
Quantifiable Effects (Validation Targets)

- Increase in peak arrivals/hour
- Reduction in average spacing buffer (NM)
- Consistent/homogeneous arrival spacing
- Increase in percentage of single-vector interceptions
- Reduction in corrective vector/speed instructions

Operator Experience

- ANSP: Higher declared capacity confidence
- Airport: Increased runway utilisation stability
- System: Better peak-hour resilience

Capacity



Mechanism:

- Reduced unnecessary outbound extensions
- More precise interception timing
- More stable TMA sequencing

KPIs Impacted

- TEFF4 – TMA arrival time
- Average Flying time/NM flown (in the arrival phase)
- FEF1 – Reductions in average fuel burn per flight

Quantifiable Effects

- Reduction in average Flying time/NM flown in TMA
- Reduction in average fuel burn per arrival
- Reduced variance in TMA arrival time

Operator Experience

- Airline: Lower fuel and track-mile variability
- Airport: More predictable arrival streams

Work in Progress

Mechanism:

- Improved dynamic parameter awareness
- Reduced merging issues

KPIs Impacted

- **MF9** – Number of merging issues

Quantifiable Effects

- Reduction in suboptimal spacing events

Operator Experience

- ATCO: Reduced risk of LoS issues
- ATCO: Reduced risk of issues due to excessive workload/overload
- System: Maintained or improved safety/risk levels

Work in Progress

THANK YOU FOR
YOUR ATTENTION



Co-funded by
the European Union

DSD2 Project PEACOCK

Predictable and Environmentally friendly operations of regional Airports with COnnectivity and
Climate as Keyword

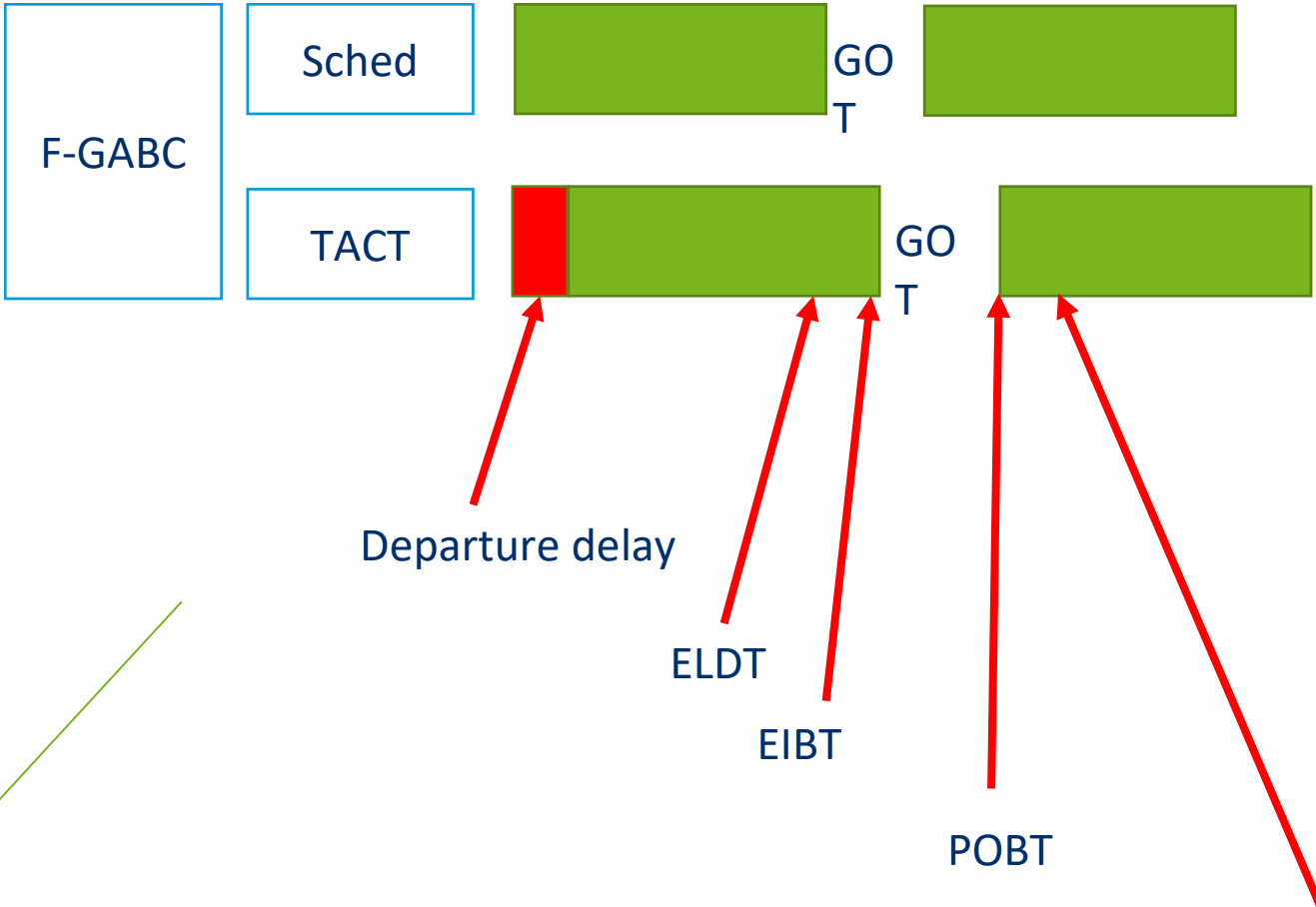
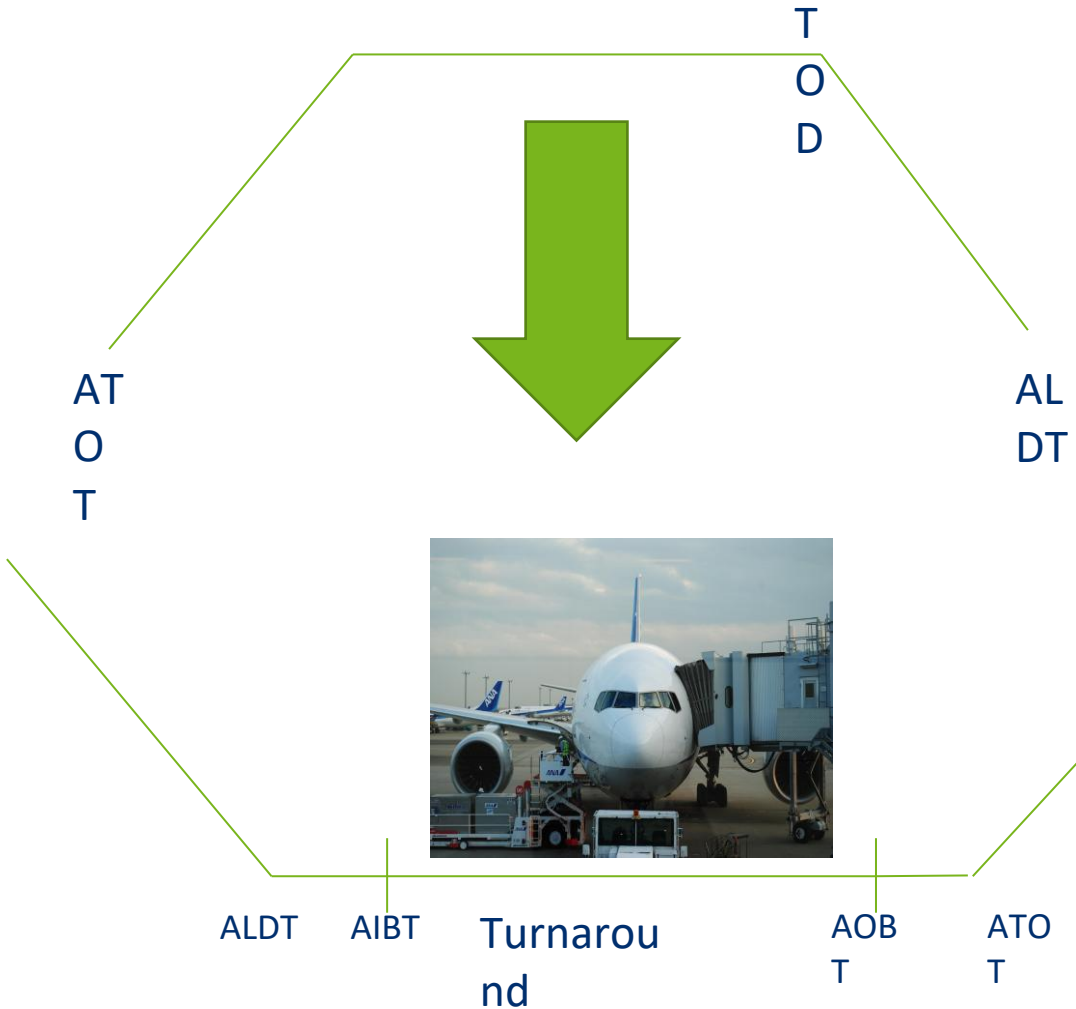
SESAR Solutions 0532 and 0533

PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY

Athens : 25 February 2026

Alan Marsden & Vladimir Kuran

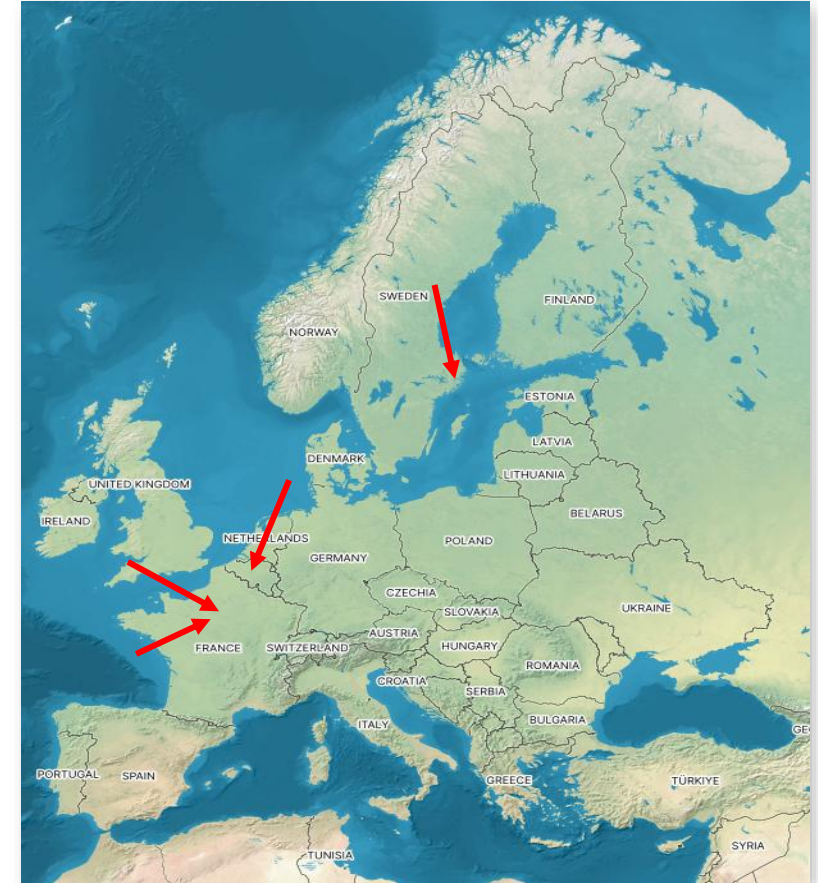
From a traditional flight view to an Airport Transit View



Pre-requisite : Link inbound to departure
Objective : Better predict 'reactionary delay'

Turnaround
TTOT

- Digital Sky Demonstrator
- Purely technological solution
- Expected demonstrated maturity level TRL8
- Relevant technological environment:
 - ANI or RNI airport
 - AOP implemented
 - able to share A-CDM data with the NM
- Demonstrations conducted at very large and large airports
 - Paris CDG
 - Paris Orly
 - Stockholm Arlanda
 - Brussels



UC-#1: Near real-time monitoring of noise contours and impacted population in the proximity of airport (**modelling**)

- New app with display of isophones and number of impacted population (results of INTACT)
- Demonstration site: **BRU**

UC-#2 – Real-time monitoring of taxiing aircraft emissions (modelling)

- New app with display of emissions
- Demonstration site: **CDG, ORY, BRU**

UC-#3 – Real-time monitoring of taxiing aircraft emissions with N-1 engines (modelling)

- New app with display of emissions
- Demonstration site: **ORY**

UC-#4 – Post-ops holding / landing & take-off emissions (modelling)

- LTO EE or a new app
- Demonstration site: **BRU, ARN**

UC-#5 – Alert in case of taxiing CO2 emission overrun

- Local app
- Demonstration site: **ORY**

UC-#6 – Post-ops monitoring of taxiing CO2 emissions (modelling)

- Current LTO EE
- Demonstration site: **CDG, ORY, BRU**

SUPPORTING EUROPEAN AVIATION



Thank you

PRIAM

Passenger-centric Digital Airport and Multimodality Workshop

David Mocholí
Nommon

The PRIAM project

PRIAM - Planning Regional-Scale Multimodal Operations for Innovative Air Mobility Services

- **Call:** HORIZON-SESAR-2023-DES-ER-02
- **SESAR Topic:** WA1-6 'ATM Excellent science and outreach for multimodality and passenger experience'
- **Start date:** 27/09/2024
- **Duration:** 24 months + 6 months for communication, dissemination and exploitation activities
- **Project partners:**

NOMMON

 **TRANSPORT
& MOBILITY
LEUVEN**

 **deepblue**

HAIKAI

 **ENAC**

 **bluenest**
by globalvia

 **ARC**
AIRPORT REGIONS COUNCIL

 **Aeroports**
de Catalunya

Background and motivation



European policy goal

90% of travellers to reach any destination in ≤ 4 h, requiring better regional accessibility



Current gap in regional mobility

Regional travel remains poorly served in remote or underserved areas with limited rail or air connectivity. Many regions still struggle to meet the 4-hour D2D target



Need for multimodal regional strategies

HSR–air comb. improve travel times and emissions, but gaps persist where they are not feasible/efficient. **An additional mode is needed to close the regional accessibility gap**



Innovative Air Mobility (IAM)

Opportunities:

- Improve regional connectivity
- Reduce environmental impact
- Enhance network resilience

Uncertainties

- Real demand for IAM regional services
- Integration with existing transport modes
- Required infrastructure & ops models



The missing piece

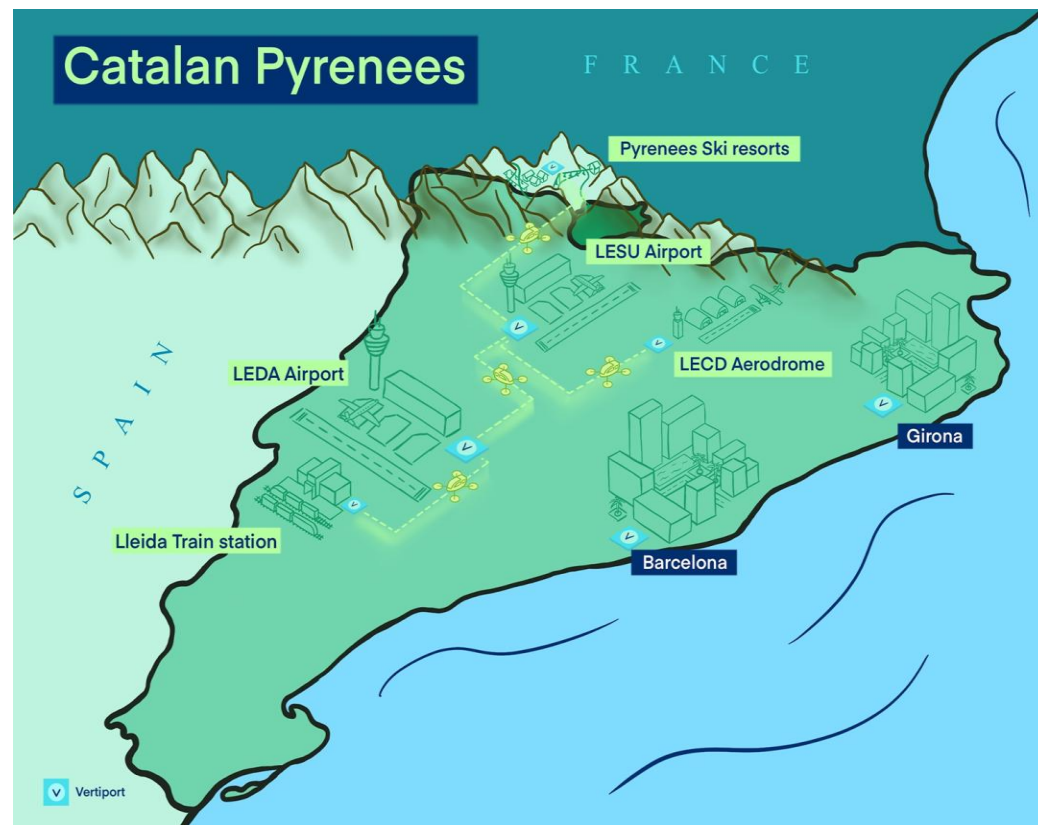
Europe still lacks data-driven tools to understand regional demand, predict IAM adoption, design resilient networks, and assess the multimodal benefits of IAM



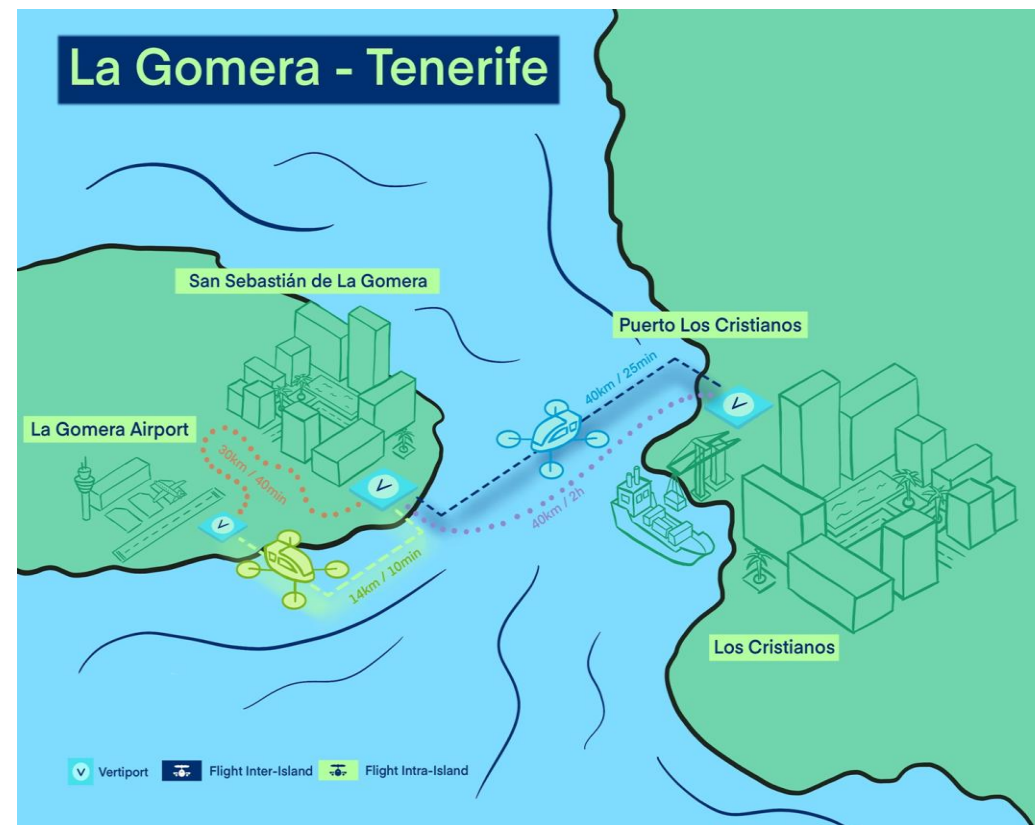
The goal of **PRIAM** is to develop a data analytics and modelling toolset that supports a **passenger-centric** integration of IAM into multimodal regional transport networks across Europe

Case studies

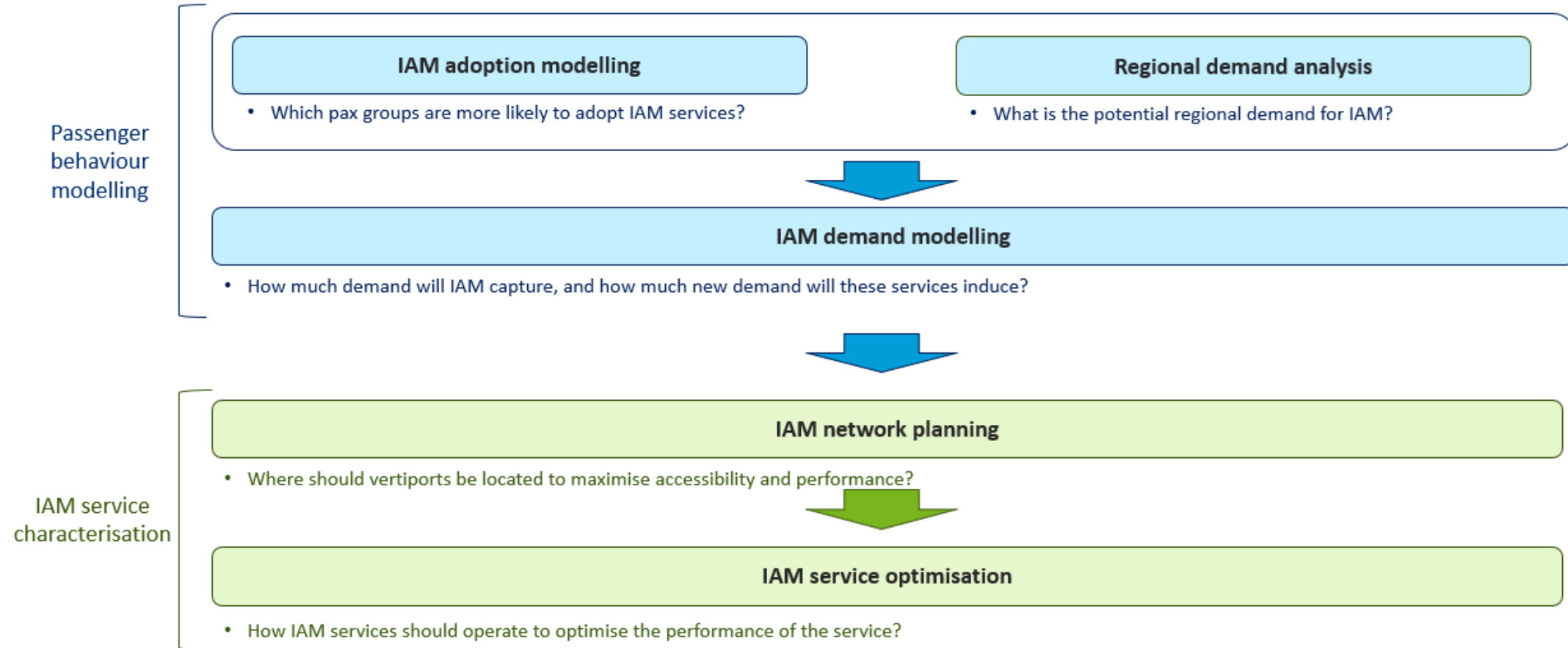
Mountainous region



Inter/Intra-island connectivity



A data analytics and modelling toolset that supports a passenger-centric integration of IAM into multimodal regional transport network across Europe.



IAM adoption modelling



Identify which passenger groups are most likely to adopt IAM services and under which conditions


Stated preference
surveys



- User propensity level
- Service adoption level



User profiling and clustering




Groups by
likelihood of
becoming IAM
users

- Development of AI-based algorithms to identify factors influencing IAM acceptance and propensity to use (e.g., cultural and geographical aspects relevant to adoption).
- Machine learning and statistical analysis will be applied to cluster target users and generate groups according to their acceptance and likelihood of use.

IAM adoption modelling

PRIAM has designed and distributed an SP survey about the adoption of IAM services

Air taxis are coming --- Would you ride one? TEST

juan.blasco@nommon.es [Switch accounts](#)

Not shared

Case Study 1: La Gomera Tenerife

Imagine you are in the Canary Islands, specifically between **Tenerife**, the most populated island with bustling coastal towns like **Los Cristianos**, and **La Gomera**, a smaller island known for its mountains, natural parks, and slower pace of life. Travel between the two islands usually involves ferries and winding roads. Whether you're visiting as a tourist or travelling for work, the journey can be time-consuming.

In this section, you'll be asked to consider how you would travel between these locations today, and how your choices might change if **air taxis** were available – offering faster and more direct connections.

Let's suppose you are on holiday in the Canary Islands and you consider travelling in the archipelago.

Here's a map of the La Gomera - Tenerife region showing key locations mentioned in the following travel scenarios.

THIS IMAGE WILL BE CHANGED

Back Next Clear form

Future situation *

Now assume that air taxis are an available option – which travel option would you choose when travelling **for leisure** from the south of Tenerife to San Sebastián de la Gomera?

Tenerife (South) San Sebastián de La Gomera

1. 30min 20€ 1h20 25€

2. 30min 20€ 1h20 (wait+fly) 15€ 50min 35€

3. 35min 50€

☐ 1. Ferry | Duration: 1h50 | Cost: 45€

☐ 2. Plane | Duration: 2h40 | Cost: 70€

☐ 3. Air taxi | Duration: 35min | Cost: 50€

☐ ☒ I would not travel

Back Next Clear form

Regional demand analysis



Estimate the potential regional demand for IAM based on mobility patterns and underserved travel needs.

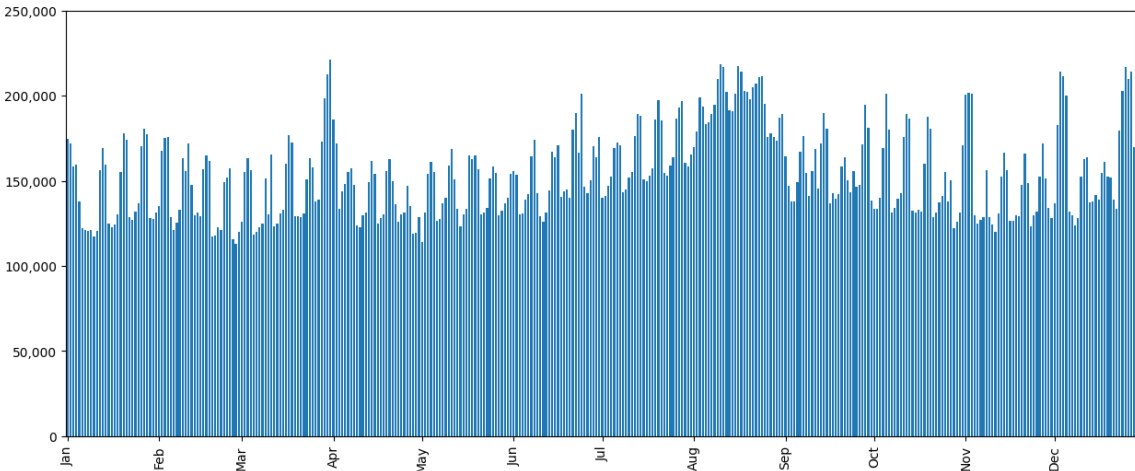


We complement MND with additional data sources to infer passenger attributes not directly observed in mobile data but essential for estimating IAM potential demand. This includes variables such as:

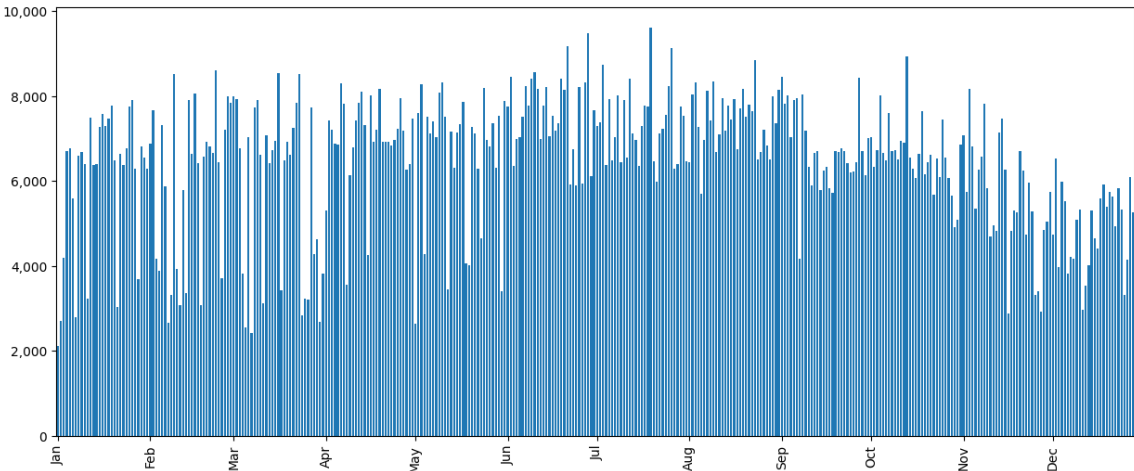
- trip purpose (business vs. leisure)
- road-mode distinctions (e.g., bus trips).

Regional demand analysis

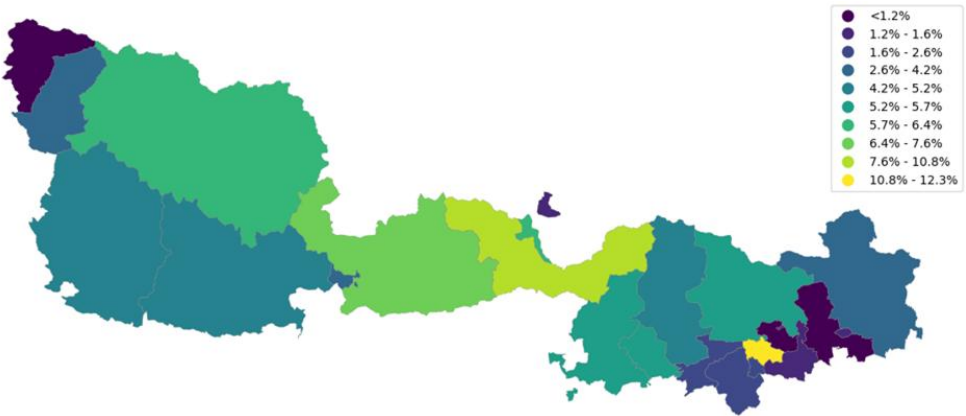
Daily trips to/from the Catalan Pyrenees in 2024



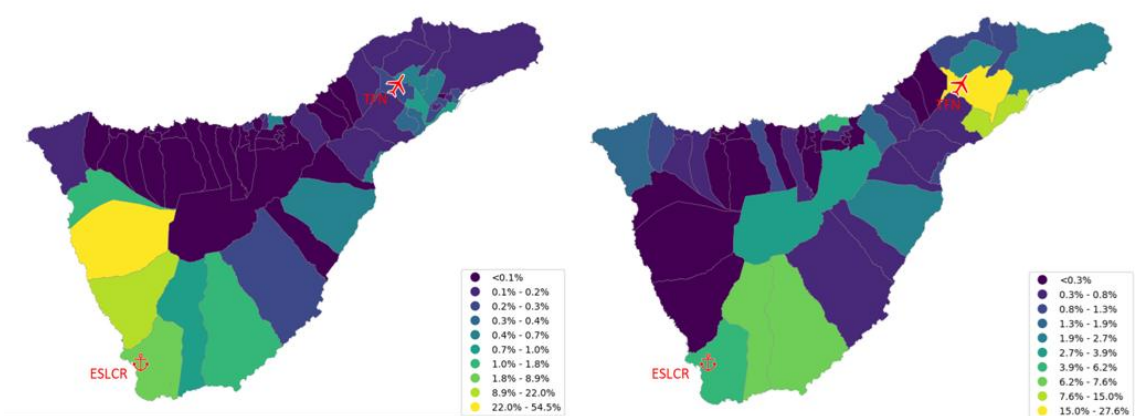
Daily trips between La Gomera and Tenerife in 2024



Origin/Destination of the trips to/from the Catalan Pyrenees



Origin of the ferry vs plane trips from Tenerife to La Gomera



IAM demand modelling



Quantify: 1) how much demand IAM will capture from existing modes 2) induced demand.

IAM adoption modelling

 Surveys +  Pax clusters

Regional demand Analysis

 MND +  Other data



IAM demand modelling

 Mode choice model



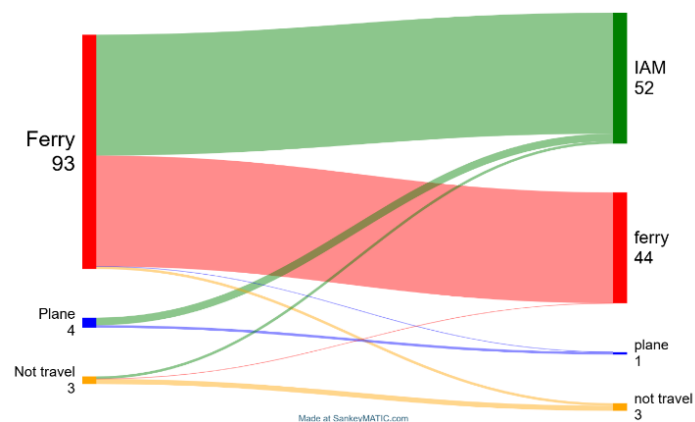
Results

IAM captured demand estimation
IAM induced demand estimation

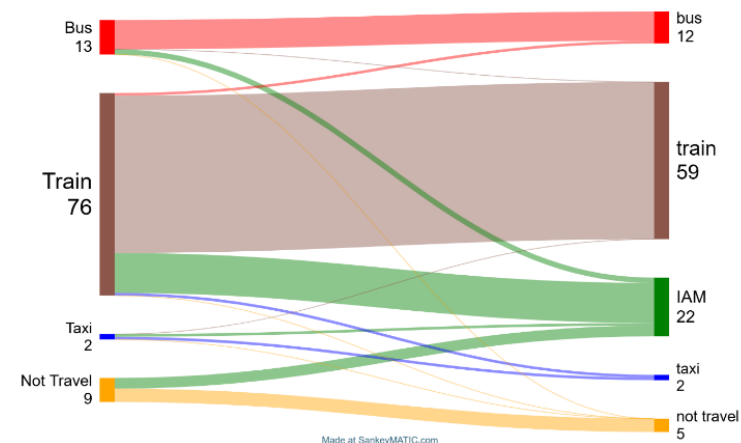
PRIAM’s methodology integrates SP-based choice models with Mobile Network Data to estimate modal shift and induced IAM demand in real case studies.

IAM demand modelling

Some results from the survey that are being used to calibrate the mode choice model:



Scenario 1: Tenerife to San Sebastián de La Gomera

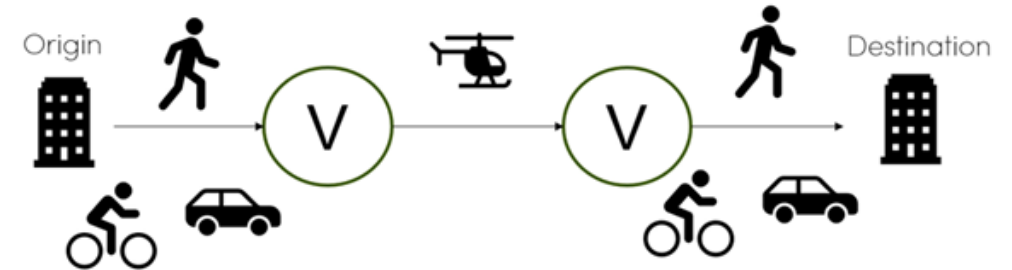


Scenario 4: Barcelona to Puigcerdà

IAM network planning



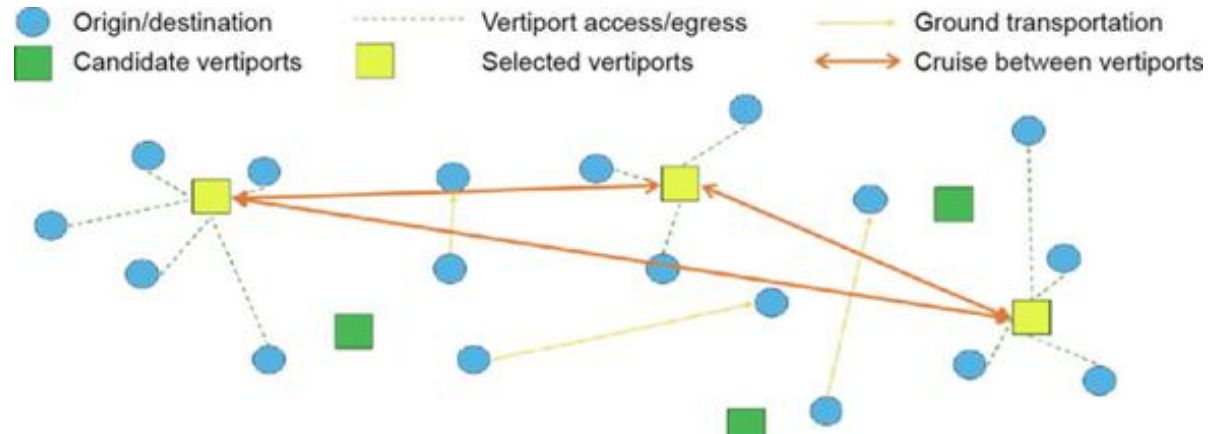
Determine the optimal vertiport locations to maximise accessibility, connectivity, and network performance



Problem formulated as a **Hub Location Problem (HLP)**, where the goal is to select the best vertiport locations that minimise total travel time while maximising accessibility and connectivity across the region.

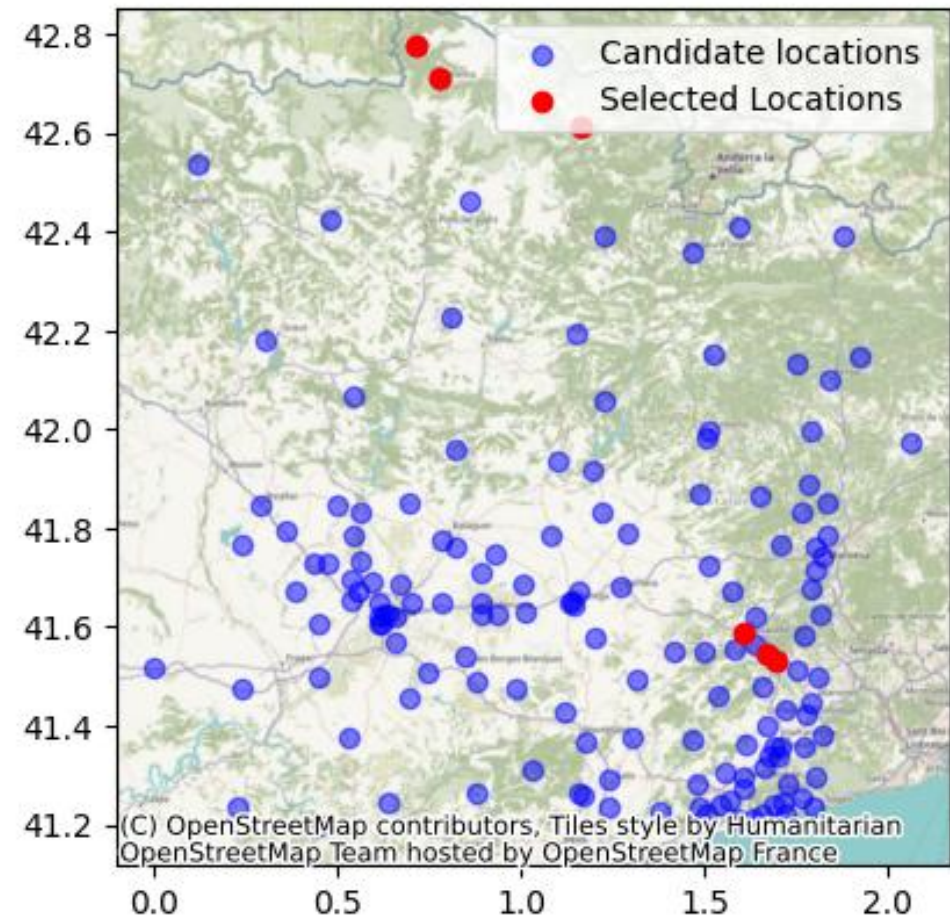
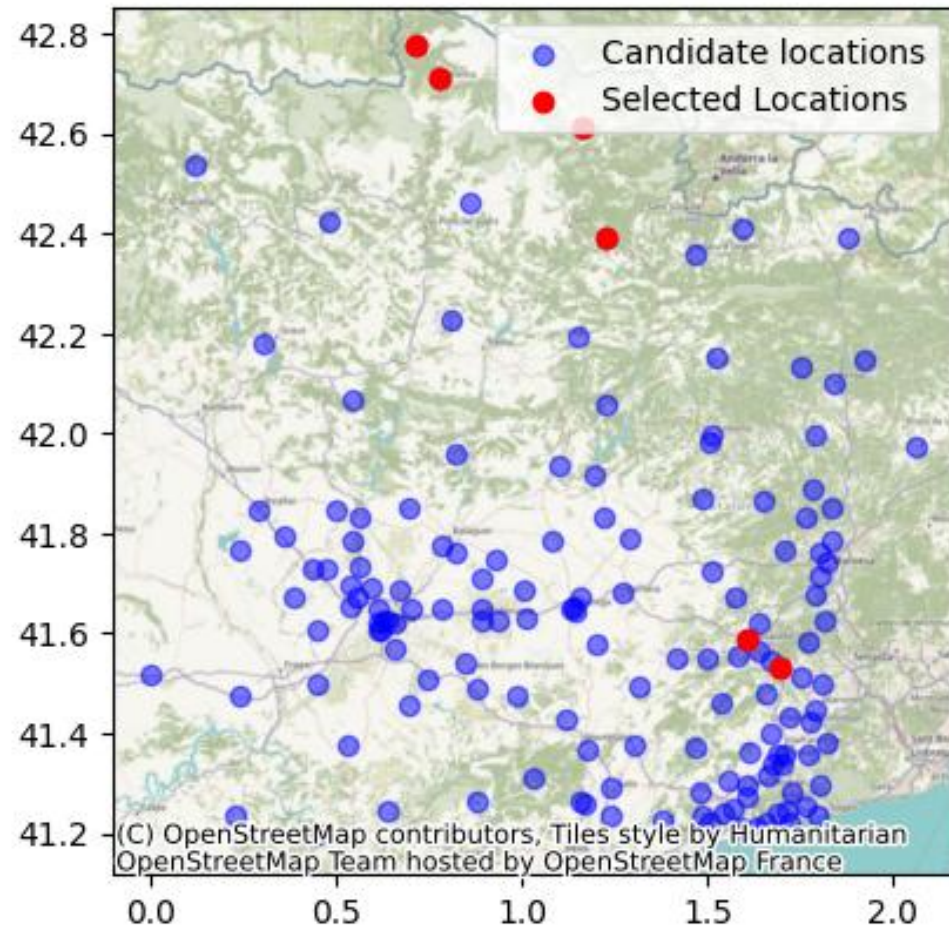
Constraints:

- Maximum number of vertiports (users' input)
- Capacity of daily operations (depending on the type of vertiport)
- IAM demand estimation (mode choice model)
- Cost of operating vertiports
- Cost of land
- Cost of electricity



IAM network planning

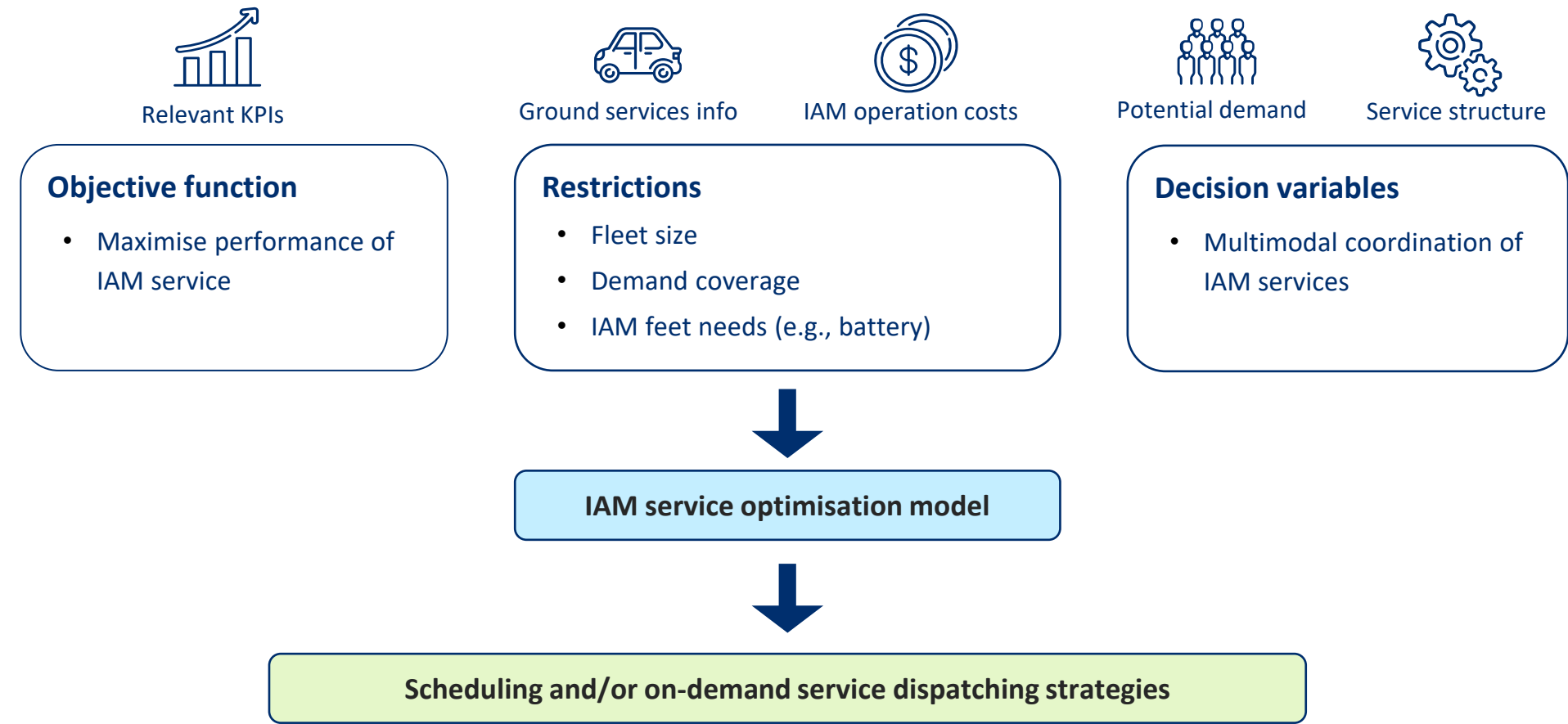
Same assumptions but different objective functions



IAM service optimisation



Define how IAM services should operate to maximise performance, efficiency, and passenger experience



THANK YOU FOR
YOUR ATTENTION!

SIGN-AIR

PASSENGER-CENTRIC DIGITAL AIRPORT AND MULTIMODALITY

Ismini Stroumpou, UPC
Athens, 24 February 2026

Title: Implemented Synergies, data sharing contracts and Goals between transport modes and AIR transportation

ID: 101114845

Project duration: 36months

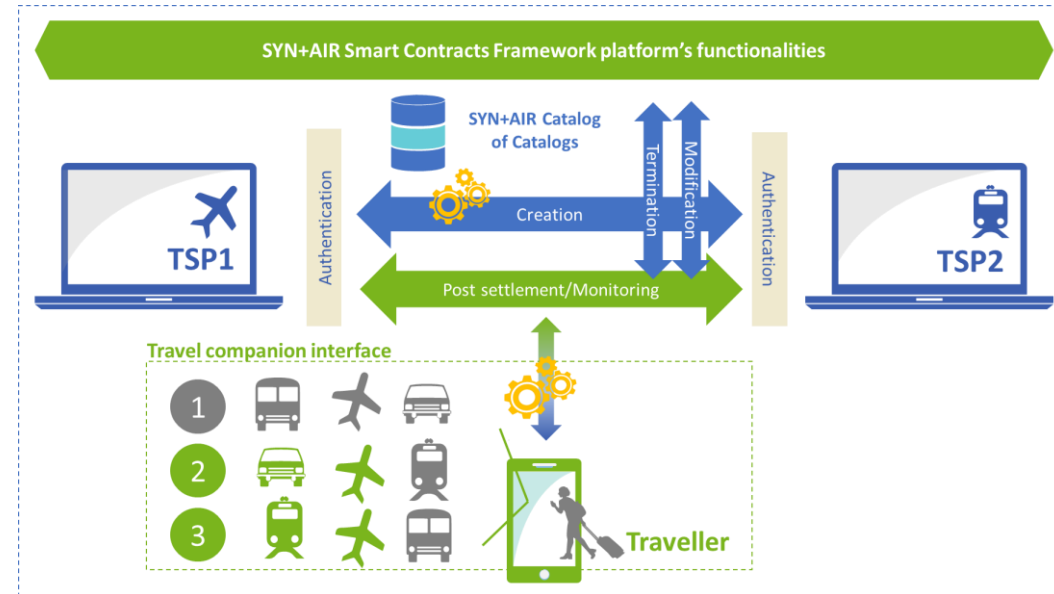
Starting date 01/06/2023

Ending date: 31/05/2026

EU contr.: 3.562.807,51€

16 partners from 7 countries

Coordinator: Universitat Politècnica de Catalunya (UPC)

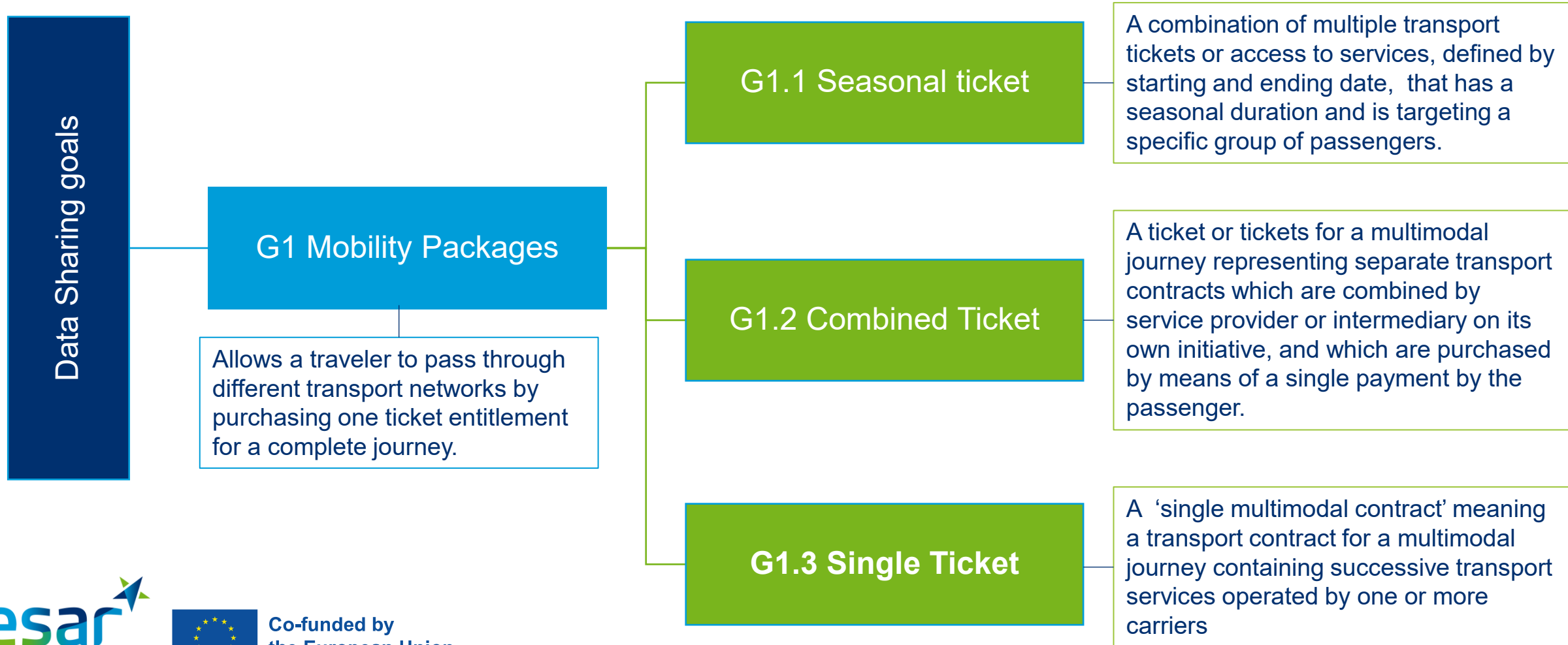


SIGN-AIR has developed and piloted a web platform for orchestrating contractual aspects of data sharing in multimodal travel.

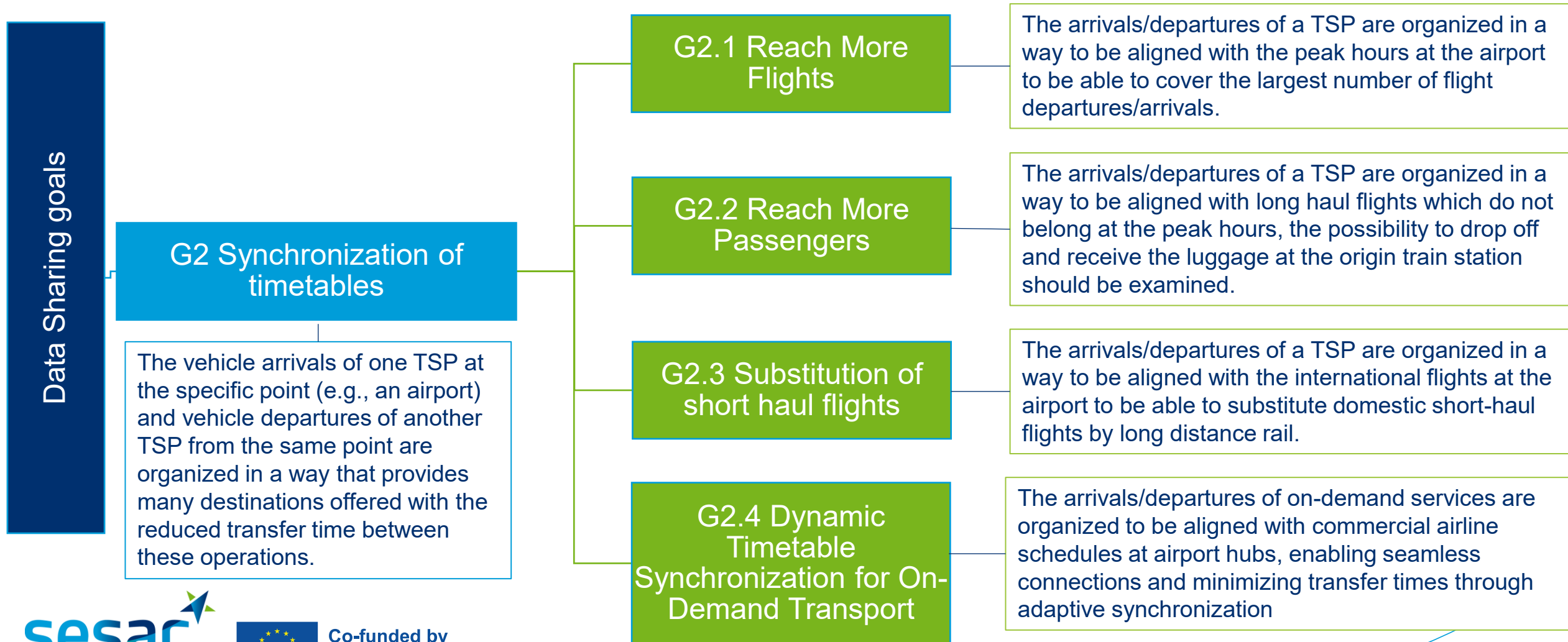
A **business process** that defines data exchange rules among TSPs that share the common goal of getting the passenger to the destination through a multimodal chain of trips

- provides a **centralized hub** for **contracts management** via a web platform (named SIGN-AIR platform) that allows TSPs to create, modify, terminate, and validate signed contracts (both data **sharing agreements** and **smart contracts**).
- the storage of TSPs' data and, all the data sharing processes are executed **outside** of the SIGN-AIR platform

Data Sharing goals-Mobility Packages



Data Sharing goals-Synchronization of timetables



G3 Disruption management

Detail the coordinated process between airports and railway and/or bus operators designed to identify minor delays, moderate and major disruptions and propose mitigation actions. This process is facilitated by integrated technological systems that enable real-time monitoring, communication, and response actions across the different transport modes involved.

G3.1 Event detection and classification

aims to establish communication protocols and real-time data-sharing frameworks that enable the detection, classification, and impact calculation of events, such as minor delays or major disruptions, across multiple transport modes. By integrating pre-stored planned schedules with real-time alerts from airlines, rail operators, and multimodal transport providers.

Focus on Max & Min Connecting Time

G3.2. Event Response Coordination

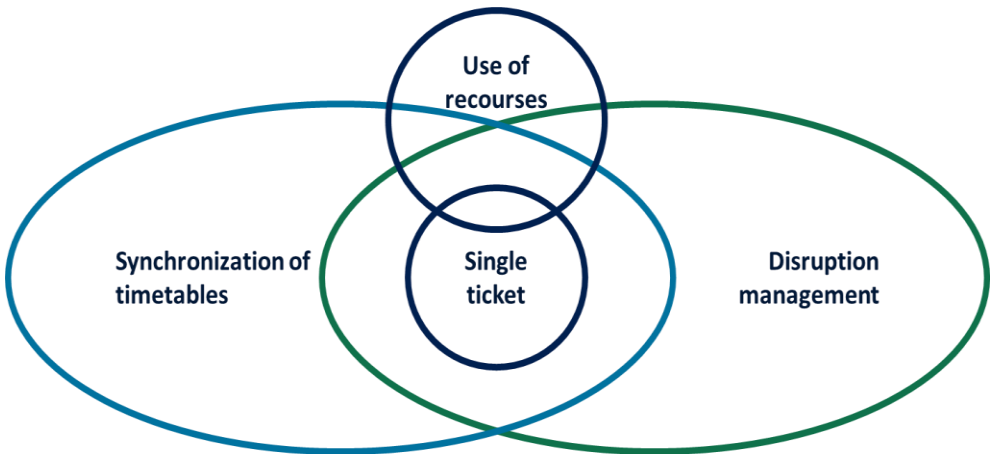
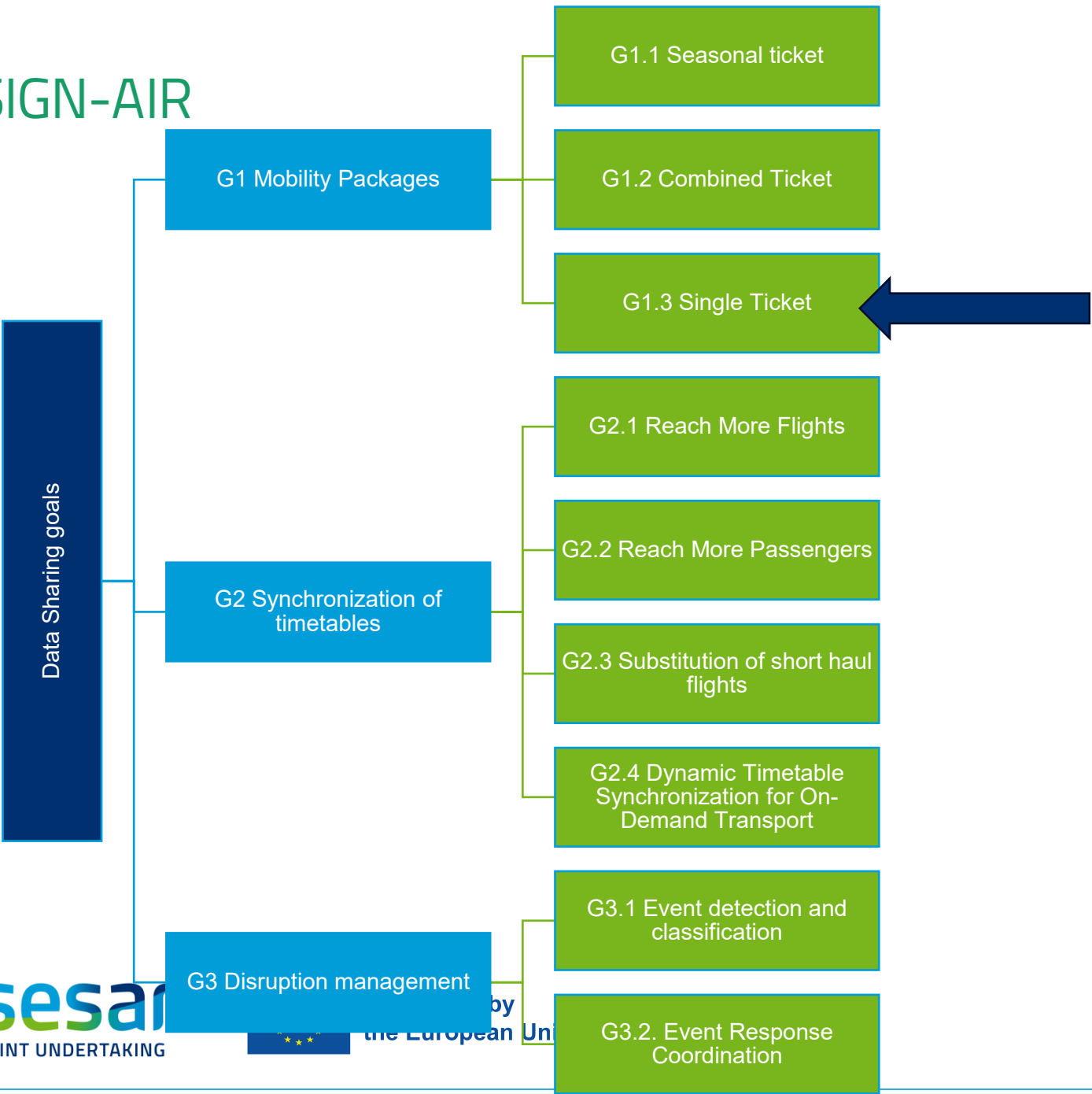
focuses on assessing the impact of disruptions and executing a series of coordinated actions between ecosystem actors to respond effectively. These actions include **timely notifications to passengers**, processing information about affected travellers, and optimizing operational adjustments.

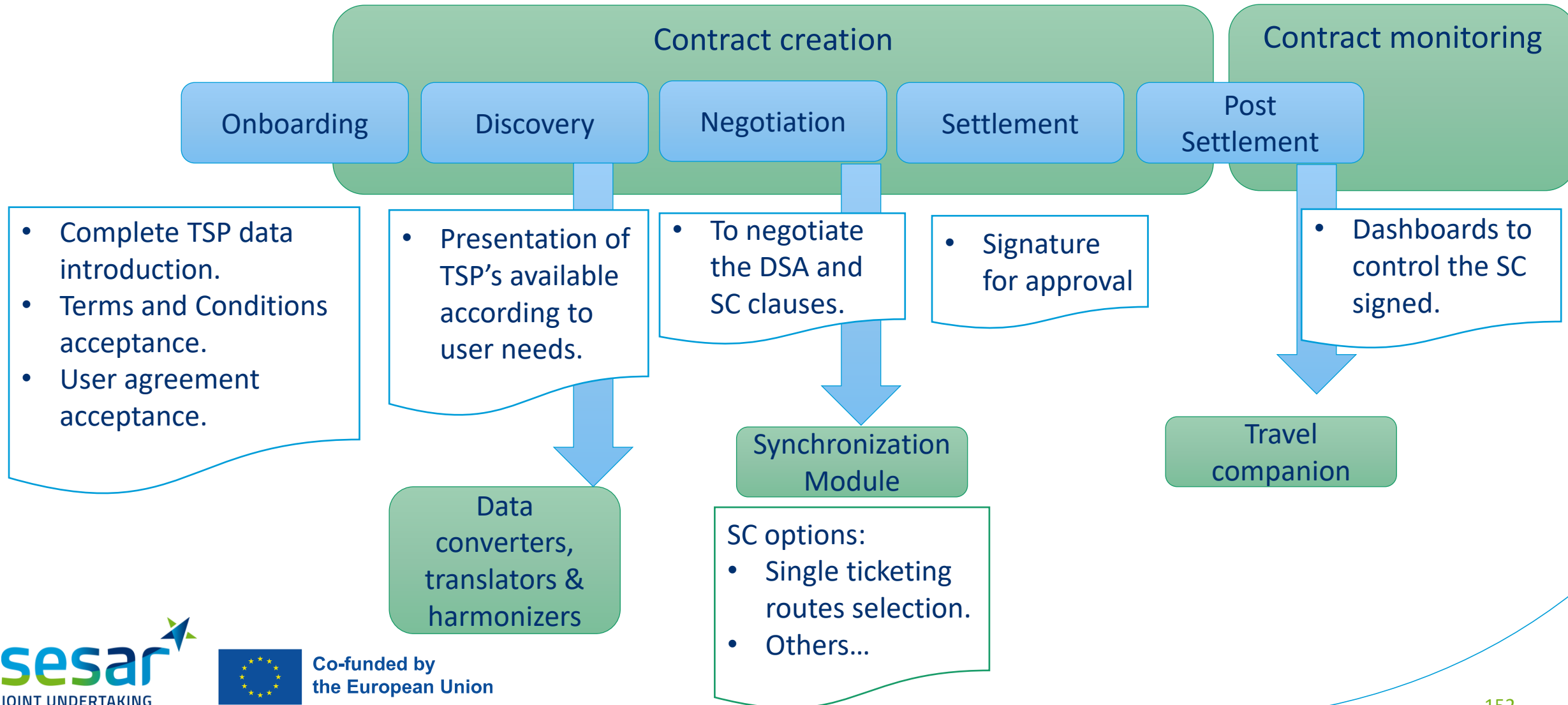
Key features and considerations include:

- Execution of smart contracts to manage the disruption
- Identification of **rebooking, rerouting, or diversion needs based on Minimum Connecting Time (MCT) thresholds.**

- Automated **mitigation recommendations** (e.g., next available flights/trains, alternative transport options).
- Resource optimization for TSPs e.g. a. Opening Additional Security or Fast-Track Lanes:

SIGN-AIR





Passenger Experience Synchronization of timetables

Connectivity index



Synchronisation of timetables

Objective

- The objective is to support Transportation Service Providers (TSPs) in achieving timetable synchronization goal



...smooth transfers between e.g. rail and air service for passengers

G2.1 Reach more flights

G2.2 Reach more passengers

G2.3 Substitution of short haul flights



Synchronisation of timetables

Objective

- The objective is to support Transportation Service Providers (TSPs) in achieving timetable synchronization goal

➡ ...smooth transfers between e.g. rail and air service for passengers

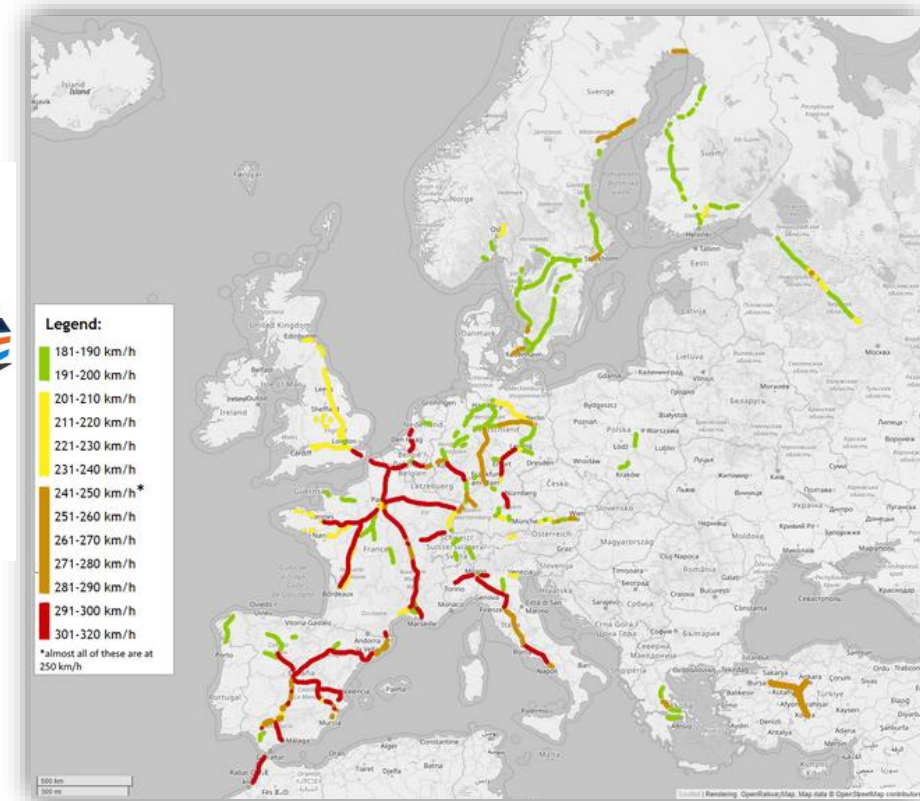
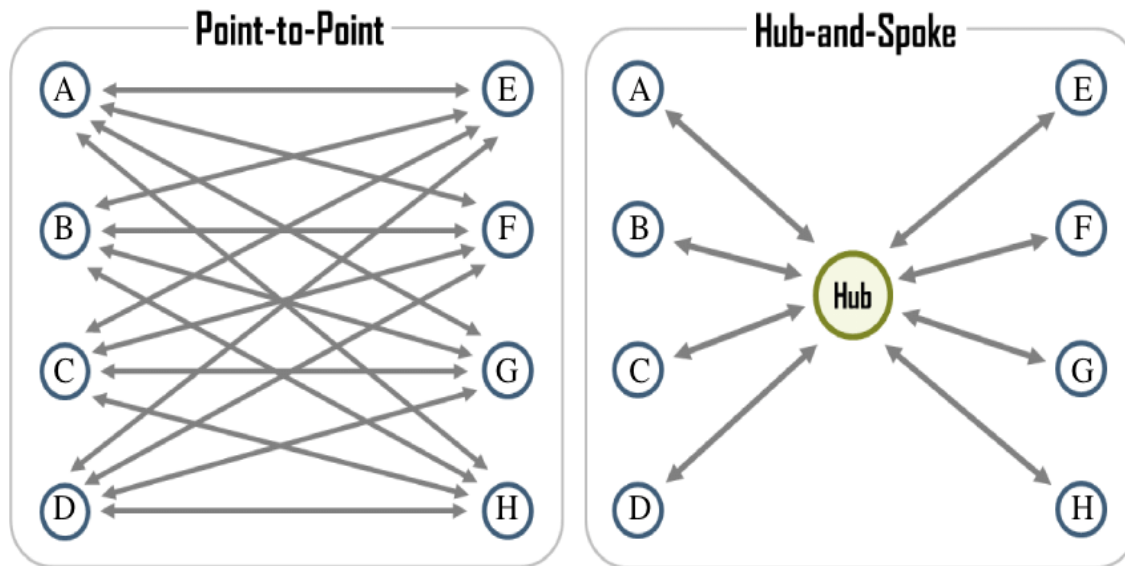
- How to evaluate the net impact of timetable synchronization?

...e.g., improved connectivity, reduced waiting times, increased passenger satisfaction, or operational efficiency, access to the airport



Air connectivity

Definition



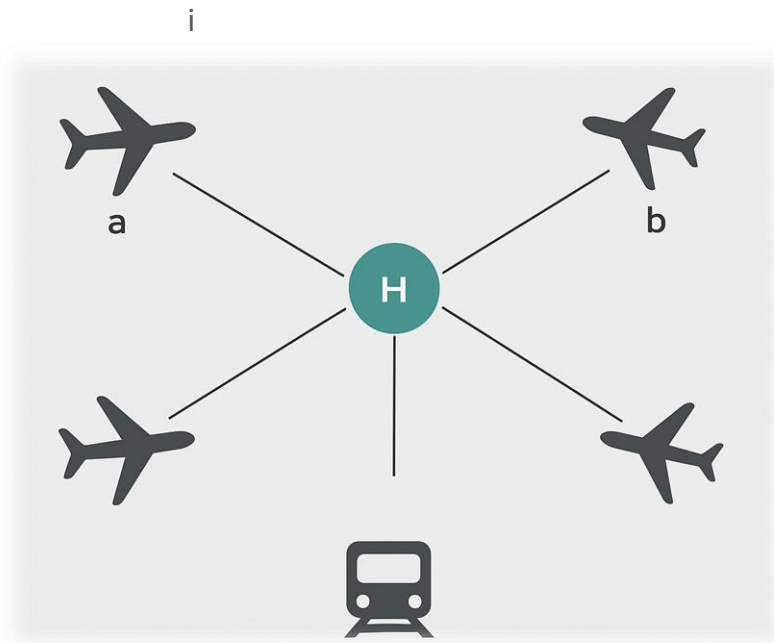
Hub connectivity is defined by:

- the number of airports served with direct flight services
- the frequency of these services
- the transfer time.

Combined flight-train journey must be as easy and comfortable as a connecting flight.

AIR-RAIL connectivity index

Methodology



$$C_h = f(\text{Travel time}, \text{Transfer Time})$$

$$C_h = \sum_{k \in K^{\text{air-air}}} CU_{k,\text{indirect}} + \sum_{k \in K^{\text{air-rail}}} CU_{k,\text{indirect}} + \sum_{k \in K^{\text{rail-air}}} CU_{k,\text{indirect}}$$

Air connectivity

Minimum/maximum connecting time

The Minimum Connecting Time (MCT) is the shortest time interval, established by airports and airlines, required for a passenger and their luggage to physically and legally transfer between an arriving flight/rail and a departing flight at a specific airport.

Maximum Connecting Time - a time threshold often applied in air connectivity modeling and network analysis to exclude impractical or highly unpopular itineraries.



Impact on Air Connectivity:

- Determines Feasible Connections
- Operational Efficiency
- Risk vs. Reward

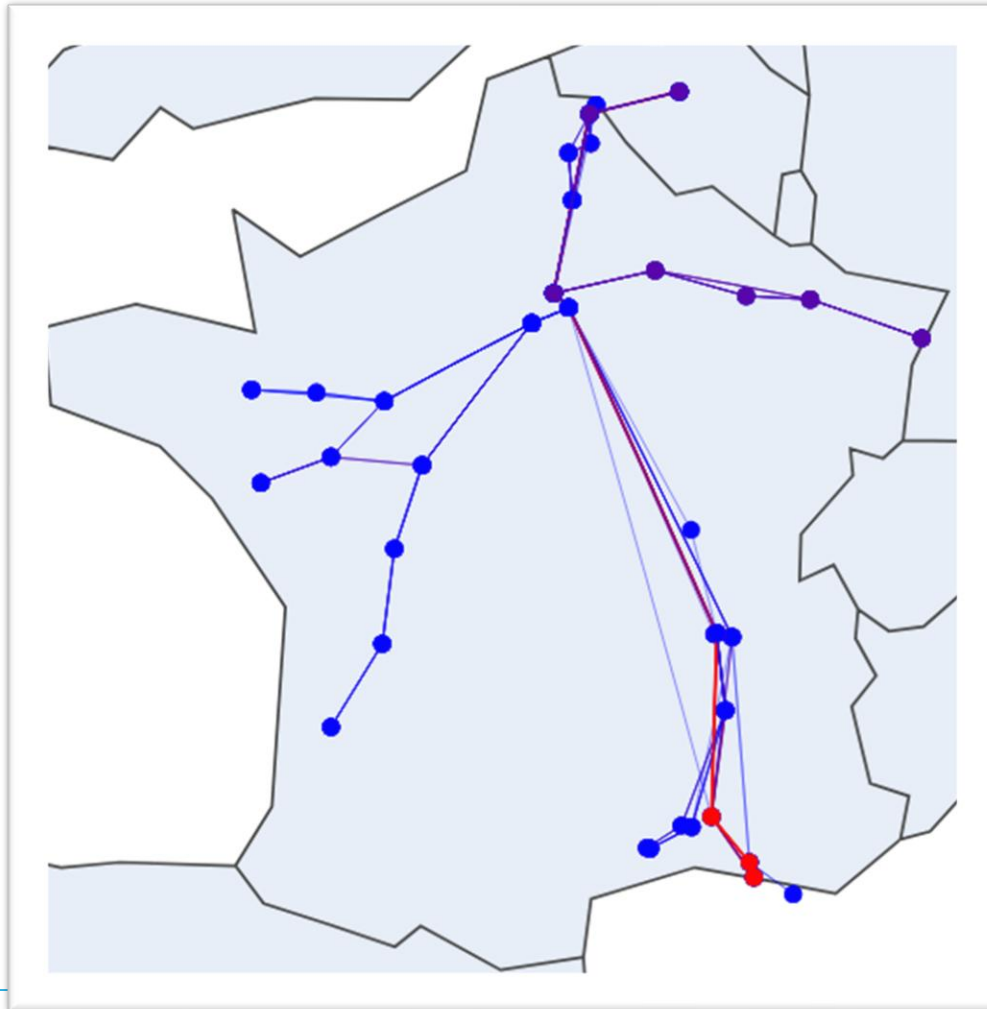
Impact on Air Connectivity:

- Connection Quality Metrics
- Passenger Preference
- Network Competitiveness

Air-rail hub connectivity index

Paris-Charles de Gaulle case study

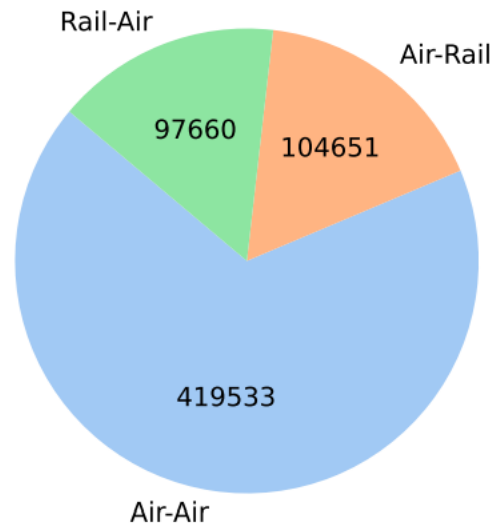
□ First week of June 2024



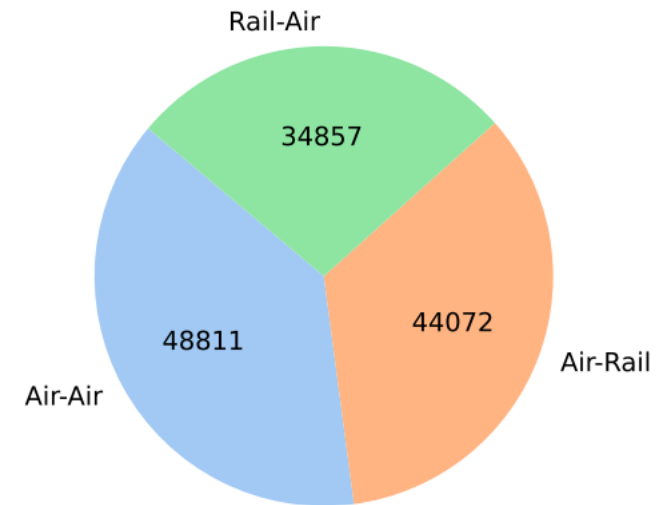
Connections with train stations located within the Paris area (i.e. Marne-la-Vallée Chessy and Massy) are not considered in the study, since they are considered as direct connections from Paris.

Global connectivity at CDG

Number of feasible connections

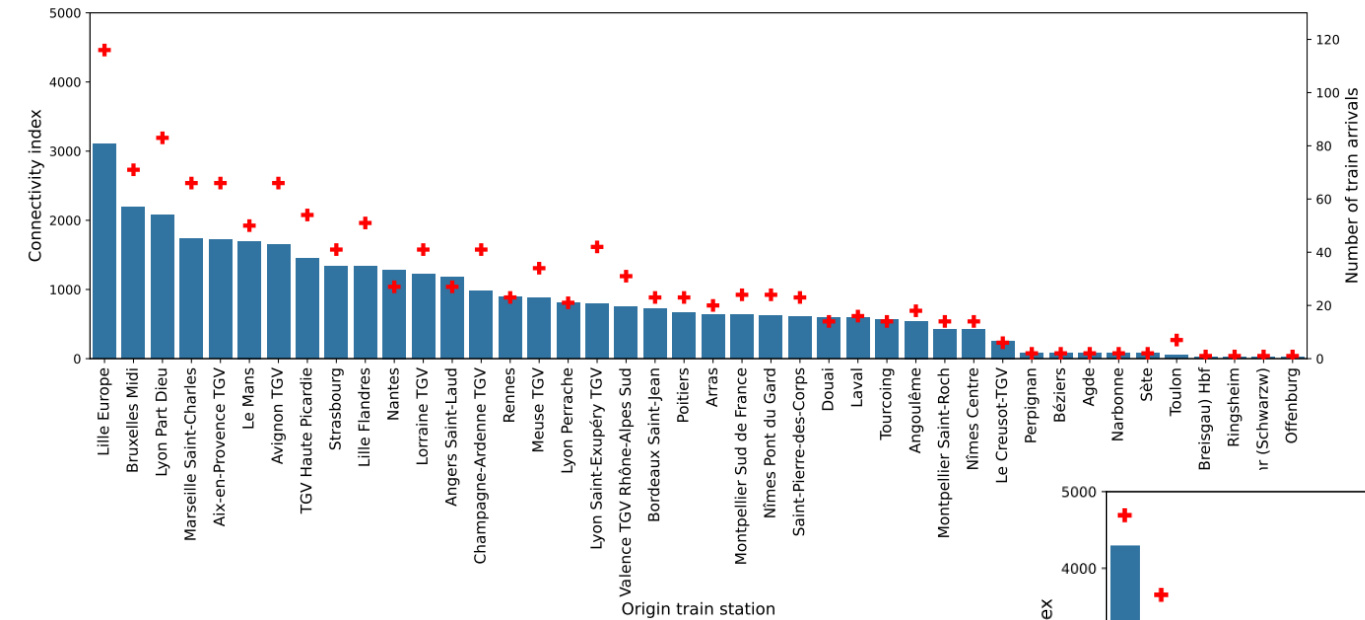


Connectivity index

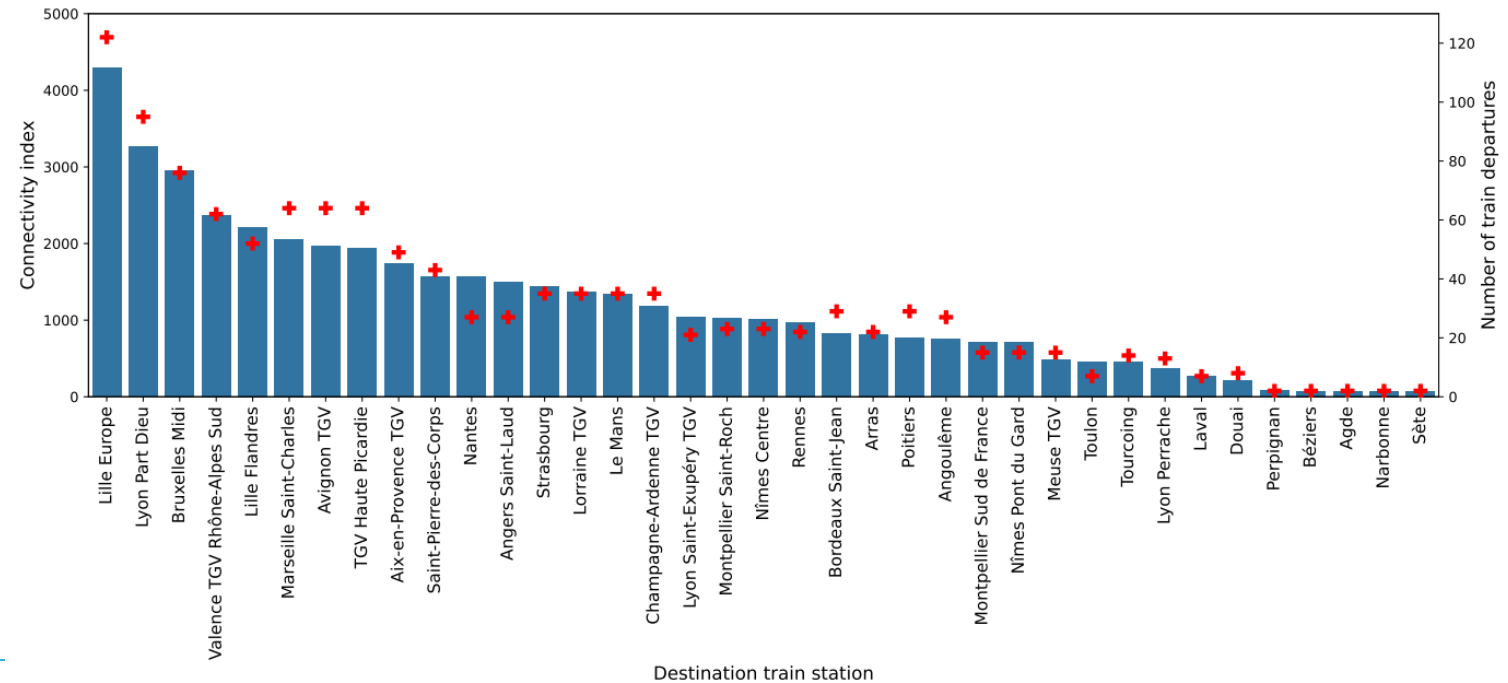


HCI increases the hub connectivity by 162%

Origin-destination connectivity Analysis

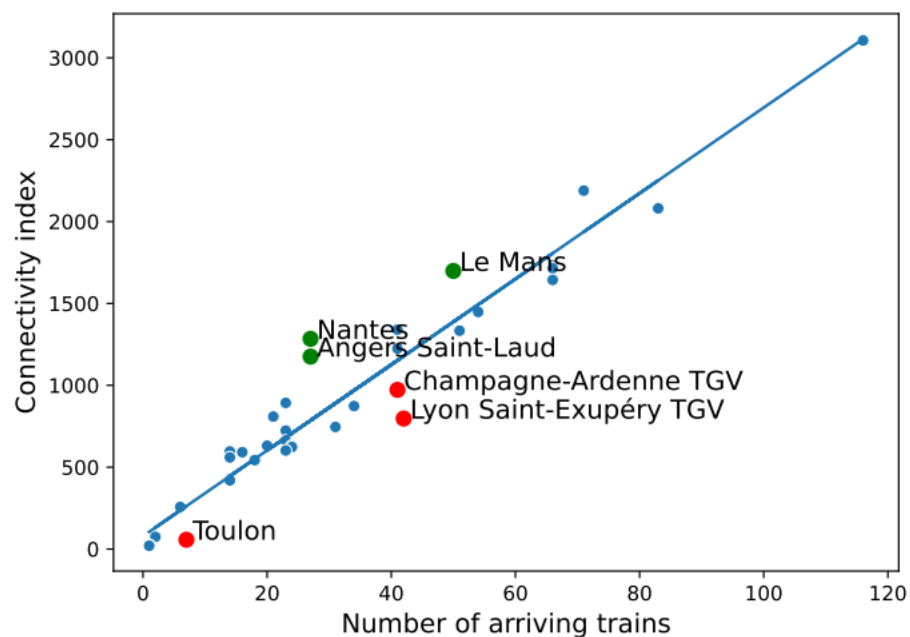


High frequency does not necessarily means high quality

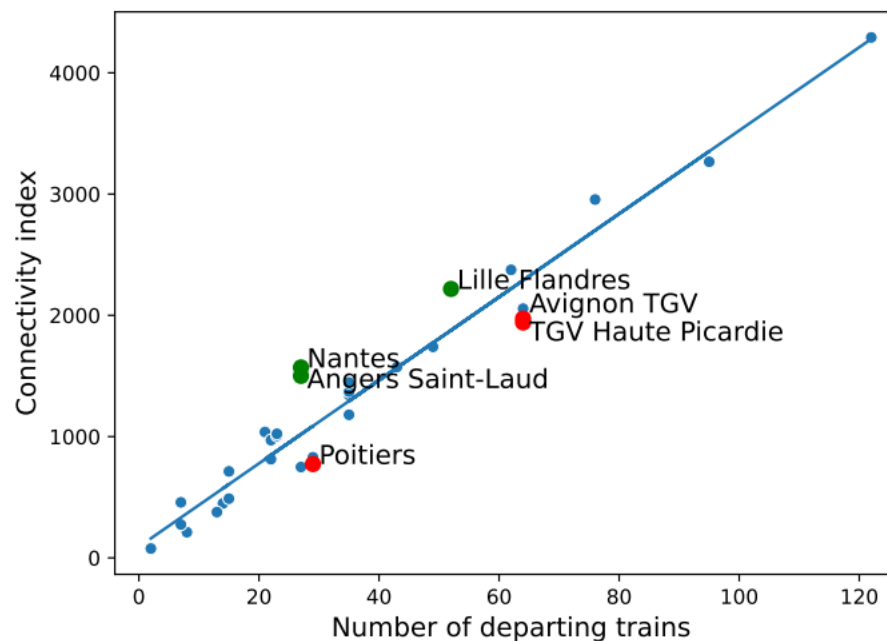


Connectivity index

as a function of the number of arriving (a) and departing (b) trains



(a) Rail-to-air



(b) Air-to-rail

An analysis per OD pairs allows to detect lack of synchronization between air and rail

Achieving a sufficient level of connectivity for air-rail connections could assist TSPs in identifying opportunities to remove feeder flights.

SIGN-AIR synchronisation module - Benefits

- Facilitates HSR connections to major airport hubs
- Expands airport catchment areas
- Focus on air-rail collaboration (HSR)
 - Hub is used as a model, but module is applicable on any type of airport
 - High-speed rail is used as model, but module is applicable for other modes of transport
- Module is flexible and easy to use
 - Not tailor-made module, but it can be adapted to specific needs

THANK YOU FOR
YOUR ATTENTION



Travel



FA1
Wise



Travel Wise

Project Overview

- Project Title: **Transformation of Aviation and Railway solutions towards Integration and Synergies**
- Acronym: **Travel Wise**
- Topic: **HORIZON-JU-ER-2023-FA1-SESAR**
- Duration: **36 months**
- **Start date: 1 October 2024**
- Coordinator: **Deep Blue srl**
- Project Website: **www.travelwise.eu**
- Total Project Value: **4 999 172.81€**
- Co-funding: **1st project co-funded by EU-Rail and SESAR JUs**



Funded by the European Union under Grant Agreement 101178579. The project is supported by the Europe's Rail Joint Undertaking and the SESAR 3 Joint Undertaking and their members. The Swiss participant is funded by the Swiss State Secretariat for education, research and Innovation (SERI).



**Co-funded by
the European Union**

The views and opinions expressed herein reflect the author's view only and do not necessarily reflect those of the European Union or Europe's Rail Joint Undertaking or SESAR 3 Joint Undertaking or SERI. Neither the European Union nor the granting authorities can be held responsible for them.

Partners



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Co-funded by
the European Union

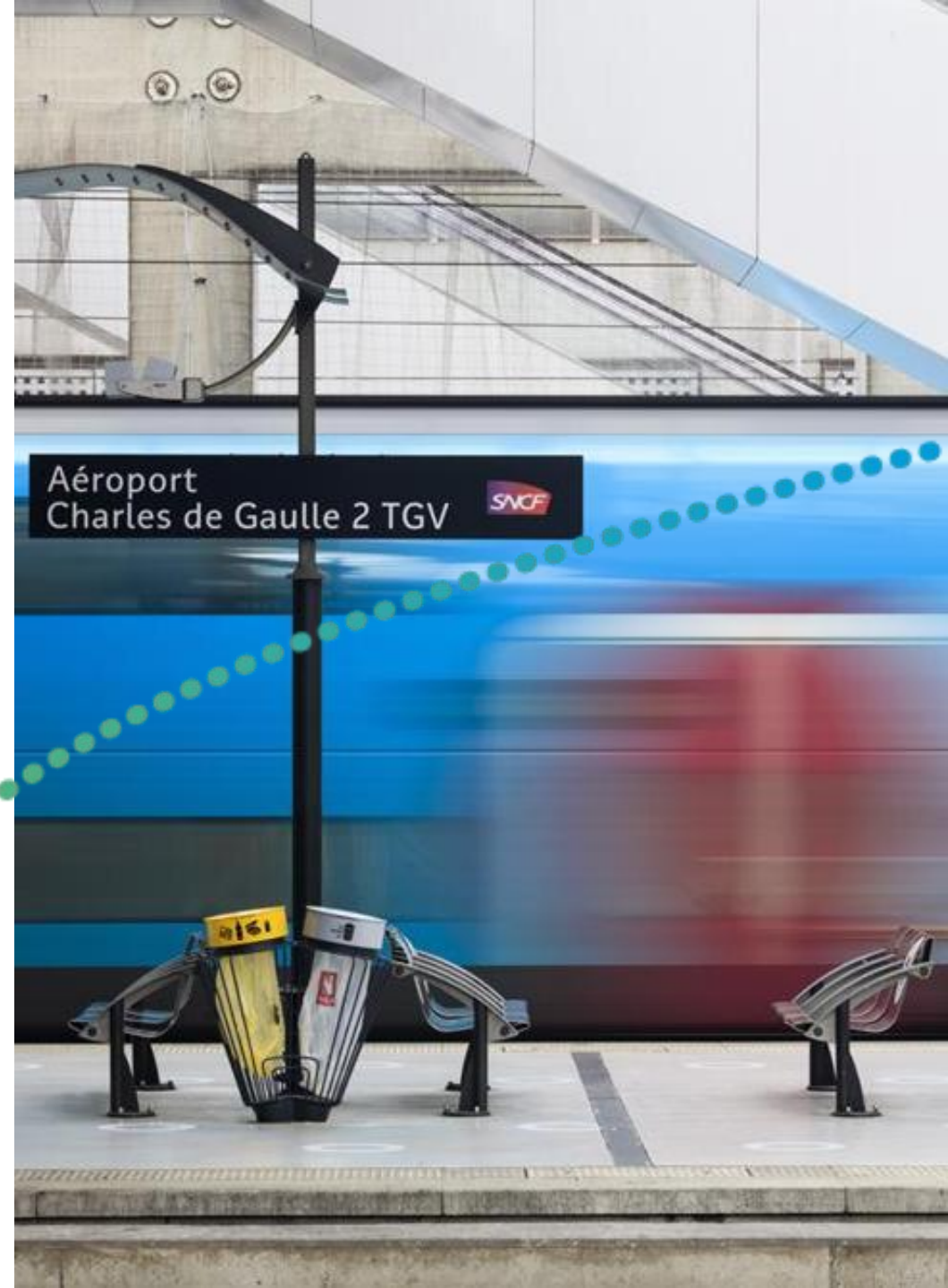
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About the project

What is Travel Wise?

Travel Wise is a multimodal innovation project for the aviation, railway (and maritime) sectors, focused on building intermodal common situation awareness and setting the base for increased coordination between air/rail/waterborne transport modes to facilitate intermodal journeys.



Challenges and actions to support the Travel Wise uptake

Challenges

No air-rail unified framework to assess the performance of door-to-door, intermodal journeys



Rail domain highly fragmented from an operational point of view



The information about passenger itineraries and/or about where she/he is, is almost never available



Different terminology, different time horizons, different operations



Common performance framework



Standardisation of rail operations



Collection of pax info through single ticketing, voluntary sharing



Common glossary of terms



Necessary actions

Vision

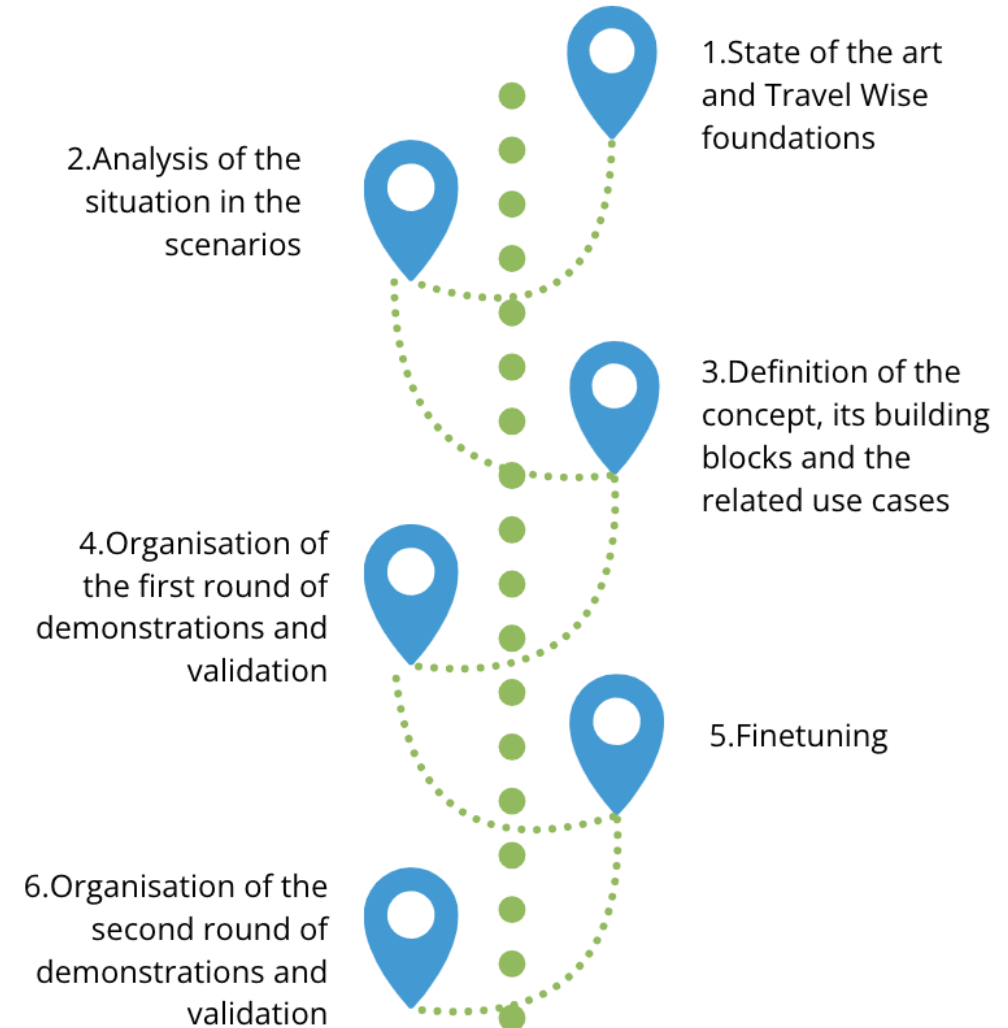
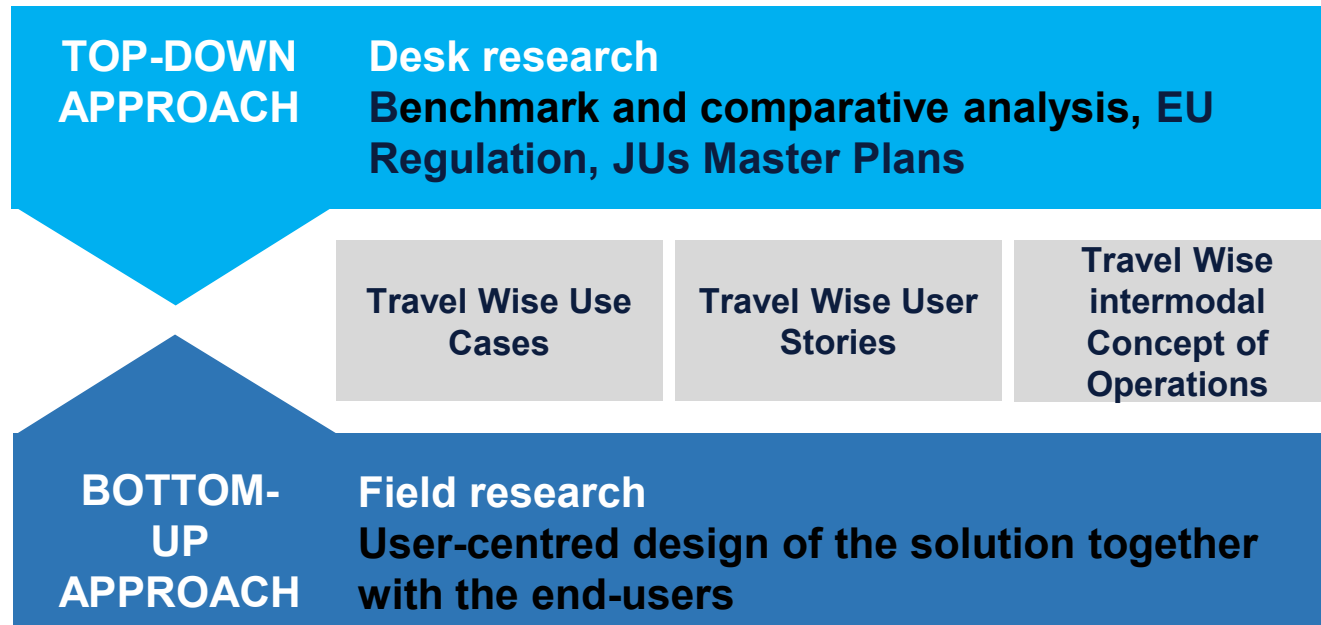
To enable seamless and resilient multimodal travel by increasing intermodal common situational awareness, also in case of disruptions, and ultimately **improve passenger experience and journey continuity across air, rail and waterborne.**

Mission

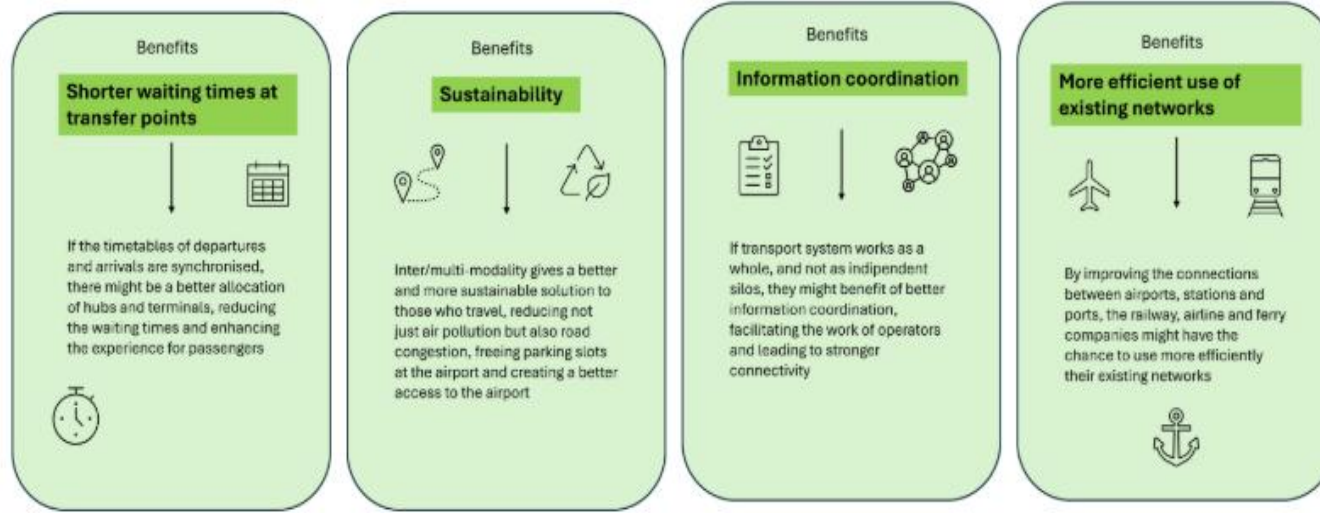
To monitor traffic and passenger flows supporting intermodal coordination among air, rail and other transport modes and enabling **informed and smarter decision-making.**

Travel Wise approach

The effectiveness of the Travel Wise solution relies on **understanding the needs and expectations of its end users**, as their feedback and involvement play a key role in shaping a solution that aligns with real-world requirements.



Users Needs & Requirements



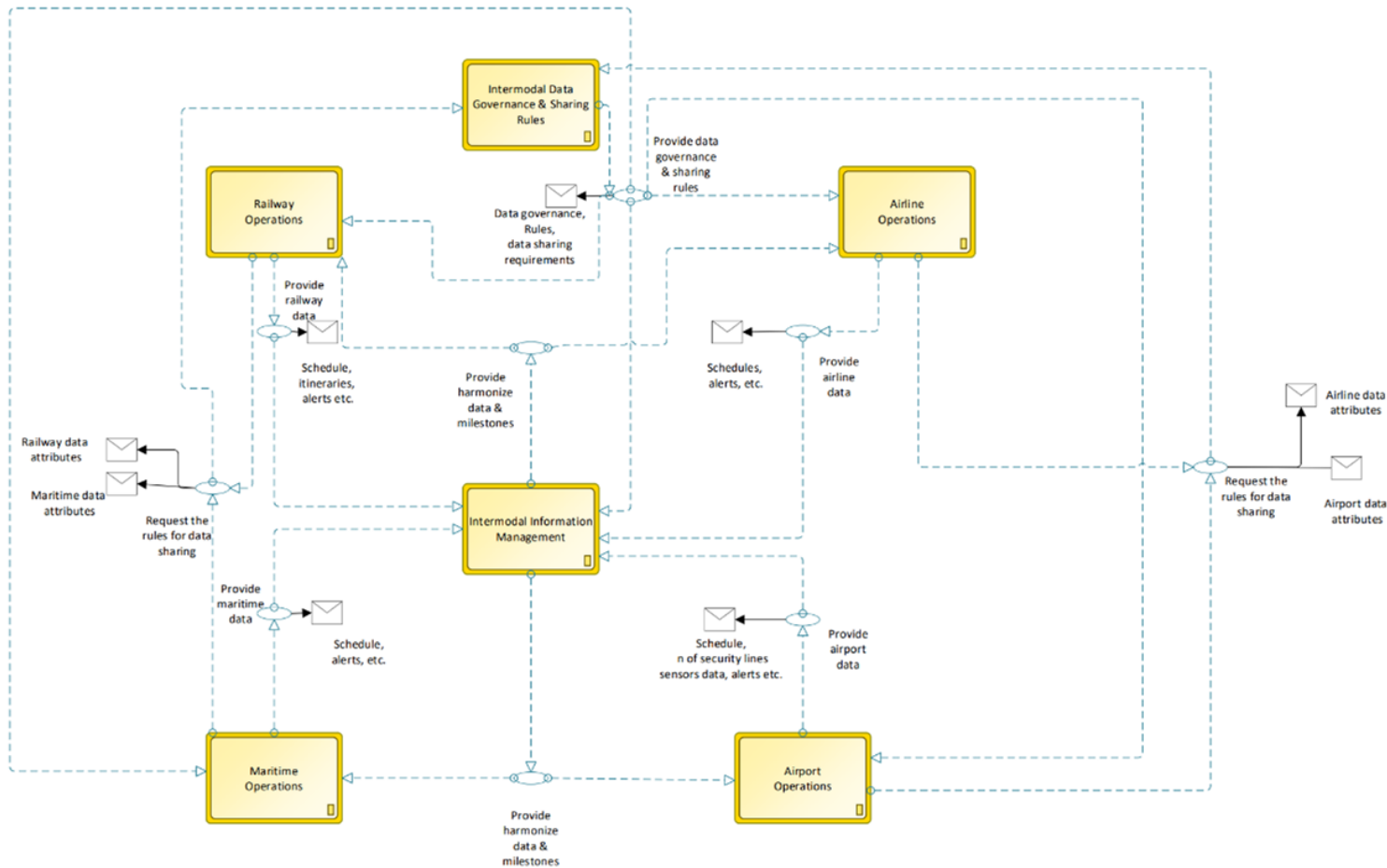
Methodology:

- 5 Workshops with End Users mapping Needs, Benefits and Challenges
- 1 Benefits and Impact Mechanism (BIM) Workshop

Needs & Expectations:

- **Multimodal integration:** TW is expected to enable interoperable GDPR-compliant data exchange and coordinated planning across air–rail operators.
- **Sudden disruptions:** TW is expected to provide early cross-mode alerts to contain cascading disruptions.
- **Information coordination:** TW is expected to deliver a shared operational picture with role-specific updates to support aligned decisions.
- **Timetable synchronisation:** TW is expected to align schedules to protect connections.
- **Situation Awareness:** TW is expected to improve TSP intermodal situation awareness

Travel Wise solution



- A framework that establishes the principles and coordination mechanisms needed for an intermodal transportation environment
- Independent integration layer; a non-intrusive technical interface that enables existing, separate operational systems to interact in real-time while respecting data sovereignty and voluntary participation
- Connection between diverse ecosystems (such as air, rail, and maritime) into a coordinated network. This allows operators to exchange data (in nominal and non-nominal situation) seamlessly to achieve Intermodal Common Situational Awareness (I-CSA).

Travel Wise components:

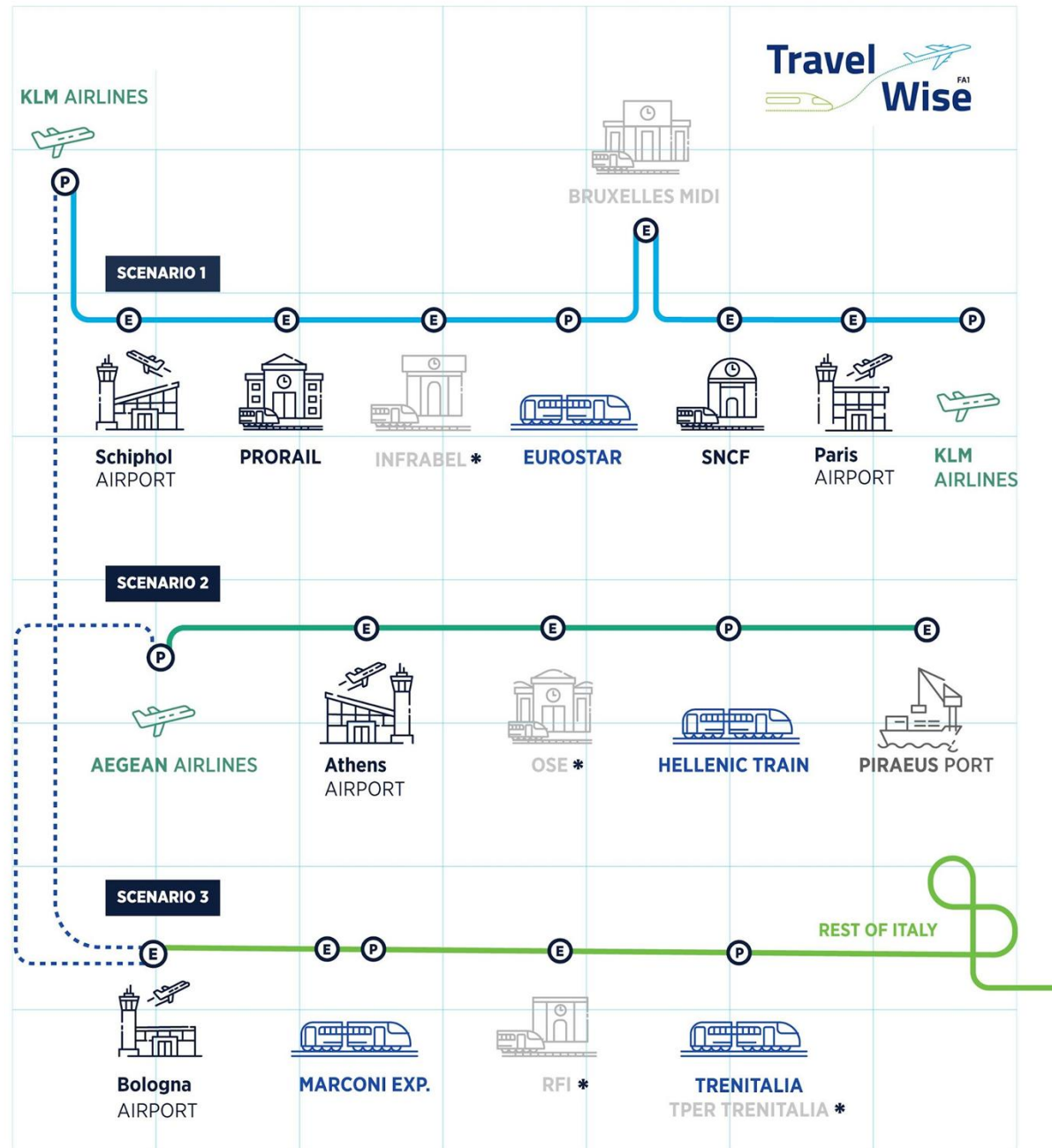
- **Intermodal Data Governance & Sharing Rules** establishes rules, roles, and procedures to securely collect and share intermodal transport data across air, rail, and maritime operations.
- **Intermodal Information Management** collects and harmonizes intermodal transport data to define processes by specifying rules, roles, and procedures for tracking intermodal milestones and executing intermediate actions such as predictions of milestones.

Scenarios

The project will run two rounds of testing in three key travel scenarios:

- **Paris-Amsterdam city pair**
- **Athens International Hub**
- **Bologna regional airport**

First round of validations May-June 2026





“A disruption occurs on a train and this impacts x passengers. Knowing the multimodal journey of those passengers, thanks to the Travel Wise solution it will be possible to highlight problematic passengers, alert all the relevant operators involved, enable mitigation measures and improve passenger experience...”



Travel Wise Contact

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Lunch

Round table discussion

INSTRUCTIONS

Participants are divided into four groups, each led by a dedicated moderator. Each group will take part in round-table discussions on one topic, then rotate to a different table for the second topic. 35 minutes are allocated per topic, with a 5-minute transition between sessions for table changes and setup.

TOPICS:

1. Passenger experience
2. Operator experience

Moderators:

- Alan Marsden (EUROCONTROL)
- Luis Delgado (UoW)
- Papagiannaki Anna (AIA)
- Ricardo Herranz (Nommon)

Results of Passenger Experience

Results of Operator Experience

Wrap Up and closing remarks