PUBLIC SUMMARY OF DELIVERABLE

D8.3 – Smart Airport Turnaround Release 1

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This document is a public summary of a confidential deliverable of the TT project. It serves as a summary of the release 1 demonstrators and provides links for external actors to connect to the TT pilot leaders if they are interested in more information.

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Motivation

TransformingTransport (TT) demonstrates, in a realistic, measurable, and replicable way the transformations that big data can bring to the mobility and logistics market. TT is structured into 13 different pilots in 7 pilot domains, which cover areas of major importance for the mobility and logistics sector in Europe. The **Smart Airport Turnaround** domain addresses the situation that in the aviation transport domain, significant, double digit saving potentials cannot be found any-more in aerodynamic improvements or engines that are more efficient. Instead, the use of inte-grated information will allow freeing up significant savings potentials.

These savings potentials will be realized through analysis, integration, networking and implemen-tation of smart applications and services across domains, to optimize operations on a holistic level. Instead of optimizing single stove-piped services, smart algorithms optimize processes ac-cording to selected criteria: best economy, best performance, maximum safety/security and maximum availability. Industry can define, prioritize and realize performance criteria according to their business goals. At the same time, data can provide insights to help to answer key business and process questions. The insights can be turned into decisions and actions that improve oper-ations and business, achieving a complete data driven decision making process.

The “Smart Passenger Flow Pilot” focusses on the full passenger process, analysing and describing the passenger behaviours in order to anticipate the number of resources required to manage the expected volume of passengers and predicting when passenger process might affect the aircraft departure times. The partners of the initial pilot are INDRA SISTEMAS SA (INDRA), AEGEAN AIR-LINES AE (AEGEAN), AIRPORT GURUS SL (AG) and ATHENS INTERNATIONAL AIRPORT. (AIA)

The “Smart Turnaround, ETA Prediction and Passenger Flow” pilot is monitoring key times of the total turnaround process, e.g. analysing and predicting estimated arrival times, predict turna-round processes and aircraft delays, and making a link with passenger process at the boarding gate. Findings will be fed into a shadow system of a real operational Airport Operational Database (AODB) system. The partners of the replication pilot are JEPPESEN GmbH (JEPP), BOEING RE-SEARCH & TECHNOLOGY EUROPE S.L.U. (BRTE) and SOCIETA PER AZIONI ESERCIZI AEROPORTUALI (S.E.A.).

Smart Passenger Flow Pilot

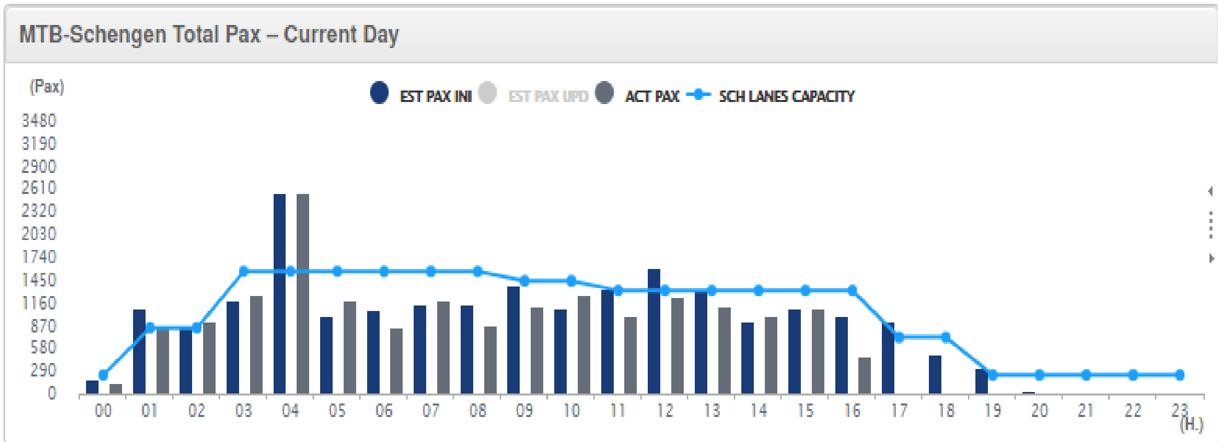
The main objective of the Smart Passenger Flow pilot is to acquire new insights on how passen-gers behave. Based on this, additional objectives have been defined to optimize the predictability in operations management, including predicting aircraft delays due to late passengers, improving the predictability in the transfer process by decreasing the number of passengers missing connections, supporting the scheduling of daily operation and resources required in security areas, allowing the creation of new business models based on data driven decision making in retailing and enabling a better understanding of the impact of every single process step on the overall airport operation performance.

In order to improve the understanding of these behaviours, additionally to the descriptive analysis done in previous documents, new analysis has been developed.

- Relation between international flights, baggage check-in and passenger arrival times: One of the first descriptive results obtained were the dependence and impact between passenger arrival times to the airport and the flight destination (international or domestic) and checked-in baggage.
- Gender composition analysis: The pilot has analysed and compared the behaviours between male and female passengers, attending to different variables, such as, arrival times to the airport, the ratio of male and female passengers in domestic and international flights, the ratio of business and economy class passengers, detecting than business passengers are predominantly male, checked baggage and check-in channels.
- Business composition detail: There exists a slight asymmetry through the week regarding Business passengers. A specific analysis has been done to evaluate how weekday impacts on the proportion of business passengers. Additionally, Business passenger proportion is heavily influenced by flight departure time.
- Transit passengers composition detail: For this kind of passengers has been analysed how weekday and flight departure time impact on its number.
- Check-in channel detail: This analysis has helped us to understand how passengers change their preferred check-in channel depending on the weekday and the time they do it. This information helps the airport to predict passenger flows in the check-in area during the different operational days.

Based on this descriptive analysis, a set of KPIs and metrics are calculated and represented on different dashboards.

The figure below shows one of the main metrics referred to the flow of passengers through the Intra-Shengen Security Zone at the Main Terminal Building of the airport. This graph represents the number of predicted vs actual number of passengers per hour. Additionally, these figures are compared with the security lanes capacity, in order to predict queues or underused infrastructure.



Passenger flow over time

The pilot focuses in applying the Big Data paradigm capabilities to improve the current experience and market approach of each of pilot's stakeholders. Such improvement could be materialized in the following identified motivations:

1- **Increase incomes** via: (1) Retailing adjustment by enabling a more adequate implementation of indirect and direct (adapted to customer profile and its preferences) marketing initiatives, (2) Optimising/Increasing the number of operations in the airport by optimizing data management.
2- **Reduce costs** via: (1) Avoiding passengers or luggage flight losses, (2) Optimizing the number of required security staff attending the expected demand, (3) Retailing adjustment, through a better management of available stock.
3- **Improve passenger experience** while, at the same time, it changes the customer behaviour and reduces costs (for instance, avoiding passenger flight losses). This means (1) Reducing queues in security areas, (2) Offering personalized services depending on passenger patterns, (3) Adapting the offered products to its customer profile.

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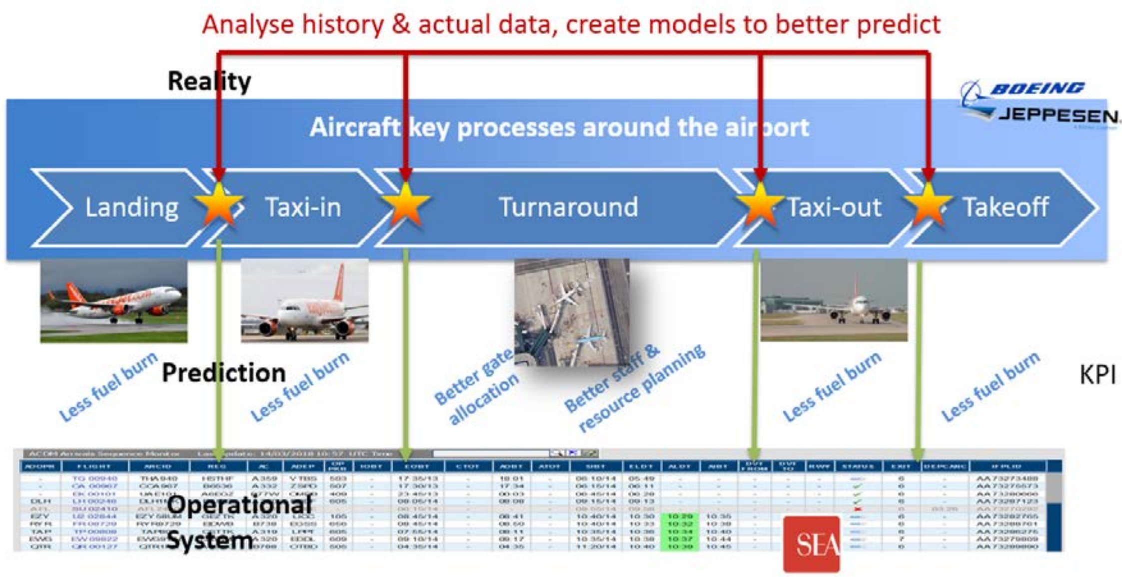
Smart Turnaround, ETA Prediction and Passenger Flow Pilot

The ambition of this pilot is to optimize the aircraft turnaround time by improving the predictability of the processes analysed and increasing the situational awareness of all actors involved in those processes. To achieve the target, a set of objectives have been defined considering SEA's clients' needs regarding the current situation of passengers and flight flows through Milan (Malpensa) airport. These objectives have been distributed in different tasks, summarized here below in working blocks. These working blocks will be described in the following paragraphs and are shown in the figure below.



Precise prediction of key event times to improve the planning processes of airport ground services

ETA predictions: Understand current patterns in Arrival Times to MXP airport (TDT in the dataset) compared with the Scheduled Times (STA in the dataset) and show how recurrent deviations can be found in order to allow the airport to take measures accordingly. This aims at fulfilling the following pilot objectives:

- Improve allocation of STA based on historical operation data analysis
- Track and predict Aircraft turn-around timing process

Taxi time predictions: Improve taxi in/out estimations with the analysis of the historical A-CDM timestamps off-block and take-off for the taxi out, as well as, landing and in-block for the taxi-in. This analysis will enhance the number of features used for the estimations, currently based on runway, aircraft type (heavy/medium) and airport taxi section. This aims to fulfil the following pilot objectives:

- Taxi time in and out accuracy improvement
- Track and predict Aircraft turn-around timing process

Boarding time predictions: Predict boarding times using historical gate openings and closing timestamps recorded by Malpensa system. This aims to fulfil the following pilot objectives:

- Track and predict boarding process
- Track and predict Aircraft turn-around timing process

Visualize and monitor results in SEA's A-CDM shadow system: Visualize and evaluate existing estimations of the arrival, taxi and boarding times for flights arriving to MXP airport in order to set and prepare the current performance for a comparison with a new machine learning predictor. In particular ETA from commercial provider FR24 and from Eurocontrol B2B service "Flight Data" have been used. These results will be added in the SEA's shadow system to obtain a validation in real scenario allowing SEA, to evaluate the predictions and eventually increase SEA's front line system with these different variables. This will contribute to the following pilot objectives:

- Feed enhanced ETA (- 20‘) into Airport A-CDM platform based on historical operation data analysis
- Monitor performance of the Airport A-CDM platform estimations

The pilot highlights the concrete impact of Big Data technology in improving the efficiency of airport operations, which translates into improved business performance.

The STA, taxi and boarding time predictions' business impact can be seen from two points of view:

- for the airline, it can be used to optimize operations by better estimate turnaround and better planning, fuel loading or the avoidance of fines. Detection in competitor network can be used to claim slot coordination intervention to guarantee fair competition;

- for the Airport, it increases situational awareness and improves coordination with airlines. This translates in better predictability, larger facilities utilization by the increase through-put. Long term it can help with better planning and in the day of operations it could help to better handle disruptions.

Enhanced ETA (TA prediction), taxi or boarding times business impact contribution are related to the Turnaround process duration. The shorter the turnaround the better utilization of both the aircraft and the airport resources. A more predictability in the turnaround process (ETA, taxi and boarding) can help airlines to reduce buffers in the schedule, since there is less deviation expected to be absorbed. This buffer reduction means savings for the airline.

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