Dispatcher3 – Machine learning to support flight planning processes

Luis Delgado
University of Westminster

Sergi Mas-Pujol
Georgy Skorobogatov
Universitat Politecnica de Catalunya

Clara Argerich
Ernesto Gregori
Innaxis

***Abstract*—This poster will present the final results of the Clean Sky 2 project Dispatcher3. Dispatcher3 focuses on the use of machine learning techniques to support flight operations prior departure with holding predictions, runway at arrival estimation and fuel deviations pre-departure to support the flight crew, and ATFM and reactionary delays on D-1 to support the duty manager.**

Keywords-machine learning; pre-departure; support tool

I. INTRODUCTION

To conduct more efficient and sustainable operations an early anticipation of discrepancies between the planned and executed flights is paramount. Otherwise, those responsible for the flight operations - duty managers, dispatchers and pilots - might make sub-optimal decisions which could lead to higher costs and more emissions.

Dispatcher3 applies machine learning techniques to historical data supporting airlines' processes before departure from the day prior operations to the final flight plan definition and selection, including advisories to pilot.

II. DISPATCHER3 ARCHITECTURE

Dispatcher3 is composed of three layers:

- Data infrastructure, which stores historical planned and actual data such as flight plans, flight data monitoring records, network information or historic weather forecasts.
- Predictive capabilities, which contains a pool of machine learning models. These models are individually trained and validated, targeting specific indicators, e.g. probability of being regulated by air traffic flow management (ATFM), estimation of the delay issued, probability and severity of holdings at arrival, discrepancy between planned and realised fuel consumption.
- Advice generator, which combines the outcome of the previous individual models into high-level advice to be passed to the relevant stakeholders.

III. CHALLENGES

Two important challenges must be addressed when using machine learning models: the consideration of prediction horizons and presenting the information considering uncertainties.

Machine learning models should be trained with the data available at the moment of performing the predictions. This means distinguishing between static and dynamic features. Therefore, the same indicators should be computed for models at different prediction horizons (from D-1 to 3 hours prior departure). This is a challenging task as it might not be obvious which data are available at a given horizon.

IV. ADVICE GENERATOR

The advice generator considers which individual models should be used for a given prediction. In some cases, the outcome of the different models is combined in a model-driven architecture to produce the relevant information. For example, to produce an estimation of the probability of missing an ATFM slot or breaching a curfew. Non-linearities of cost means that the amount (and distribution) of uncertainty on the predictions is very relevant and should be considered.

The advice generator differentiates between flights which have already flown at the current moment, flights which are being operated at that time, flights which are currently at pre-departure (up to 4 hours from current time) for which predictions on tactical operations might be relevant for the crew (e.g. expected holding at arrival), and flights which are still planned and for which more long-term predictions might still be useful for the duty manager planning of the day (e.g. ATFM and reactionary delays).

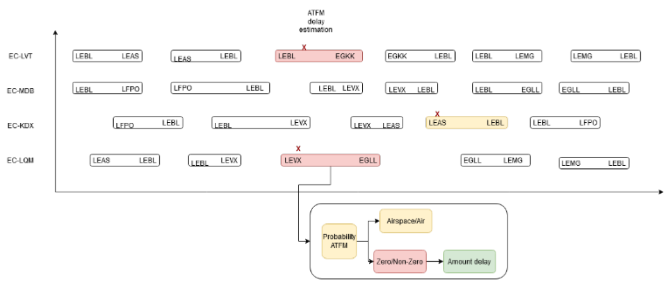

Figure 1. Example of advice generatator with estimation of ATFM delay

This poster will present Dispatcher3 architecture, and the final machine learning models integrated in the advice generator platform (as sown in Fig. 1).

ACKNOWLEDGMENT

This work is performed as part of Dispatcher3 innovation action which has received funding from the Clean Sky 2 Joint Undertaking (JU) under grant agreements No 886461. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Clean Sky 2 JU members other than the Union. The opinions expressed herein reflect the authors' views only. Under no circumstances shall the Clean Sky 2 Joint Undertaking be responsible for any use that may be made of the information contained herein.