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Traffic forecasts, delay and costs: A backcasting exercise

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" *The sixth InterFAB Expert Talk on 8 September used backcasting to review the impact of under- or over-estimated traffic demand on delays and costs*"

Air Navigation Service Providers (ANSPs) rely on forecasts to plan resources, staffing and capital investment programmes. EURO-CONTROL STATFOR prepares traffic forecasts by working with stakeholders to determine low, medium and high traffic scenarios looking up to seven years into the future. At the FABEC Expert Talk on forecast accuracy in March 2021, Director of the Institute of Logistics and Aviation at TU Dresden, Faculty of Traffic Sciences, Prof. Dr. Hartmut Fricke highlighted significant differences between forecast traffic and actual throughput in individual states across Europe. This bias, leading to uncertainty in resource planning, may impact service levels for airspace users and have significant economic consequences for ANSPs. In the case of underestimation (actual traffic is higher than forecast) the probability of delay is likely to increase, while overestimation (actual traffic is lower than forecast) will result in higher capital expenditure.

The FABEC Expert Talk on 8 September 2021 entitled: *'Traffic forecasts, delay and costs: a backcasting exercise'* reviewed new research conducted by BC3, Metroeconomica, FABEC and TU Dresden which measures the consequences of low forecast quality. The research compared actual traffic with predicted traffic to assess the extent to which forecasting errors influence service quality in terms of delay and subsequent additional costs for the ATM system between 2015-2019.

The backcasting exercise sourced data from STATFOR, the Performance Review Unit (PRU) and ANSP performance plans in saturated airspaces in Europe. It used common PRU delay causes – namely ATC Capacity, ATC Routing, ATC Staffing, ATC Equipment, airspace Management and sPecial events (CRSTMP) – and measured the difference between actual delay (i.e. the delay that actually occurred) and backcasted delay (i.e. the delay that may have happened in case the forecast was correct) as well as the subsequent costs. Several different methods were employed to analyse the data.

Initial analysis clustered flights into classes to calculate average delay minutes (ADM) and the probability of a mismatch with the target level of delay. This showed CRSTMP delay minutes to increase exponentially between 2015 and 2019, a period that saw actual traffic rise 8%, significantly above the 3.4% forecast.

Establishing a functional relationship for the ADM curve allows a calculation (backcast) to measure the delay and subsequent costs by reducing the (actual) demand to the forecasted.

A second iteration removed flight clustering and estimated mathematical functions for delays for each ANSP by year over the five-year period, increasing the accuracy of the estimations. Obtaining a mean time of delay revealed backcasted delays to be lower than CRSTMP delays in almost all cases, in some cases reduced almost by half. That is, the delays that "actually" occurred were much higher than the forecasted ones.

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To measure subsequent financial impact, the analysis used the number of flights delayed due to forecast quality and, through an estimated mathematical function for the data on costs per minute from the University of Westminster, calculated the financial cost. As backcasted delays were lower than CRSTMP delays the cost of delays were also lower. The results showed that the underestimation of forecast traffic levels resulted in a 200% increase in cost across the saturated airspace.

In conclusion, initial research found that backcasted delays (i.e.those that would have occurred if STATFOR forecast data were correct) were lower than actual delays in saturated European airspace. Further analysis generated more detailed results that showed airspace users in reality experienced an extra 12.5 million minutes of extra delay as a direct result of forecast biases. This is an increase of 157% and resulted in a cost increase of Eur678 million, or 200% rise. The average cost per minute also rose by 127% because of the deviation between forecasted and actual demand.

The large deviation between predicted traffic and actual traffic identified in the research has significant impact on saturated airspace. Already experiencing high demand, unplanned traffic places extra demand on limited resources and challenges the industry to look at ways to respond more flexibly to unpredictable events – whether peaks and troughs in traffic demand, unexpected weather or other natural events.

InterFAB Expert Talks provide a platform where experiences can be shared and views exchanged on the key issues which relate to data and performance in ATM. **www.fabec.eu/ExpertTalks**

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