Improving Performance through ‘Operating to Plan’

Objective
Happy Passengers, on time, travelling with their bags

Plan
Dynamic Modelling of Pax Flow
DMAC (Dynamic Monitoring of Arrivals and Connections) identifying variances to plan of passenger flow in connections process

Forecast & Plan
Integrated Plans, using Day Types, driving resourcing and operational preparedness

Staff
ATMs

Passengers

Review

Performance Review

Benefits:
- Service
- Efficiency
- Capacity

Prepared | Informed | Collaborative | Proactive

Live Performance Dashboard

Operations Performance Dashboard

Heathrow
Making every journey better
Unlocking the Opportunity of ‘Operating to Plan’

Data Liberation
- PTM
- Flight
- Buses
- Car park
- PRM
- Security
- Pax Flow
- Ticket Presentation
- Feedback

Liberated Data

Modelling & Analysis

Connections modelling to identify passenger at risk of misconnecting

Business Change

Airline Collaboration

Prepared | Informed | Collaborative | Proactive
Focus: Connecting Passengers

Percent transfer PAX: 32%
Percent covered in this study: 17%

International arriving PAX

T5 outbound Flight

Predictive model for $\Delta t$

Arrive at T5 → Disembark
Arrive at T2, 3 or 4 → Disembark
Take connecting bus to T5 → Ready to Fly

Prescriptive Model

Immigration
Security Screening
Boarding
Departure

Data-Driven Predictions

BOSS
BDD
Conformance data
IDAHO
PTM

Machine Learning Techniques

Security Lane Resourcing

TOBT Adjustment

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TOBT Adjustment
Predictive Model

3.7M Passenger records over 2015 from the BOSS, BDD, and Conformance data sets. 10 Significant predictors out of 33 tested. 47 Passenger categories.

Five Most Important Predictors

1. Whether or not the passenger arrives at T5
2. Inbound flight body type
3. Perceived connection time
4. Inbound flight travel class
5. Inbound flight stand type

The Regression Tree Model

Arrive at T5? → Business/First class passenger? → Connect to a domestic flight? → Perceived connection time is less than 90 min? → Categ. 1

Samples: 1% Median = 34.0

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Predictive Model

The full regression tree

Distributions of each leaf

Model accuracy

15 Minutes Connecting Passengers Flow - 07 June 2016

- Actual flow
- Predicted median
- 5% Prediction Interval
- 95% Prediction Interval

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An eight-hour live trial took place on 19 July.

Predictions are made every five minutes.

The script takes 200s to produce the upcoming two hours’ forecasts.

Update decisions and wait for the next iteration

Generate input data file from IDAHO

Predict from the model and save the outputs
Ib flight Number of PAX median p75 p90 P(late)

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Prescriptive Model - TOBT

Flight: BA 774
Destination: ARN (Stockholm)
STD: 09:15
Total PAX: 129
Transfer PAX: 79
Int. transfer PAX: 43
Aircraft: Airbus 319

Predictions: Outbound flight late passengers

Need to change TOBT?

Y: Make accurate adjustments
N: Risk of impacting TOBT

Predictions: Individual connection times

Identify and expedite late passengers
Prescriptive Model - Resourcing

Predictions: Connecting passenger flows

15 min. intervals

9:45 to 10:00 a.m.

\[ f(x) \]

Dynamic resourcing plans

Detailed passenger flow profiles

Busyness level overview
Conclusions

- Big data
- Machine learning
- Data-driven decisions

Robust and stable TOBT
Better operational performance
Efficient resourcing allocation

Better passenger experience
Potential reduction in flight delays

How do we smooth the aircraft, passenger, and bag flows?

How do we improve data collaborations?
Heathrow Current and Future Challenges

**Service & Efficiency**

- End to end passenger delay reduction – landside and airside
- Information collaboration to enable predictable journeys

**Capacity**

- Enabling passengers to turn up at the airport at the ‘right time’
- Optimising passenger dwell at the airport to unlock capacity

**Resilience**

- Enhancing integrated situational awareness during disruption
- Standardising approach to airport and airline information collaboration
Heathrow
Making every journey better