Total Airport Management

Emerging technologies Workshop
ATC Global 2016 - Beijing
“Challenges of growth 2013” report:
- Optimized use of available airport capacity is crucial to keep delays at a minimum.

Structure of departure delays (10.4 min/flight in 2015):
- 46% due to reactionary
- 36% due to turn round
- 13% due to ANS

Very high leverage effect and potential benefits to address these delays.

Lots of predictable & unpredictable events.

Lots of stakeholders and processes involved.

Lots of airport databases.

Question: How is it possible to:
- Improve airport performance;
- Identify problems as quickly as possible;
- Find the best solution in a cooperative manner.
ACDM as a first good solution

- ACDM provides a first answer:
  - A recent EUROCONTROL study has confirmed the tangible benefits of A-CDM.

- Sharing same flight information.
- Allocating clear responsibilities for the various time stamps.
- Linking airports with the Network (both way).
Many positive results

- Final report published.
- Clear benefits due to A-CDM.
- Good stories on A-CDM implementation at 17 European airports.
- Identification of some areas for further work.
- Leaflets available on EUROCONTROL stand.
- Full report available here:

http://www.eurocontrol.int/publications/a-cdm-impact-assessment
A-CDM: where we are in Europe

- 20 full A-CDM airports in Europe.
- Acceleration since 2013.
- Represents 36% of European (ECAC) departures in 2015. (44% with Advanced TWRs)
- Still more European airports to become CDM:
  - 15 additional airports have initiated the process.
  - Part of SESAR Deployment Programme.

→ Next step: more holistic approach: Airport operations Center (APOC)
The Airport Operations Centre (APOC) (1/2)

- SESAR concept for **Total Airport Management**, extending A-CDM.

- More holistic view, moving away from pure aircraft view:
  - **Airside** processes.
  - **Landside** processes.

  ➔ All contributing to efficiency and punctuality.

- APOC can be centralised or decentralised.

- Reinforce information sharing (**single ‘Airport Operations Plan’**).
The Airport Operations Centre (APOC) (2/2)

- Manage airport performance in a pro-active way:
  - Common operational overview:
    - Visualise current and future performance;
    - Detect AOP deviations through monitoring;
    - Alert concerned actors;
  - Enhanced collaborative processes and decision-making:
    - Propose actions (AOP update, launch of ad-hoc collaborative procedures, ...);
    - Assess impact of potential actions (do nothing, what-if).

→ Total Airport Management (TAM) is a key enabler for the Trajectory Based Operations (TBO) concept through:
  - Increased TTOT predictability;
  - Full inclusion of airport activities in the calculation of the trajectory.
Performance Interactive Dashboard

• **Display** performance information (historical, actual and forecast);
• **Draw attention** when alerts are reached;
• Provide tools to **dig and find the roots** of any alert.

What-if support to decision tool

• **Propose options for action** to APOC members;
• **Evaluate impact** of selected options on airport performance in the coming hours.
APOC Performance Dashboard

*Principles*

- High level APOC view.
- Structured around airport processes.
- Aggregated & summarized view of more detailed levels.
- Possible drill down (3 levels max).
APOC Interactive Performance Dashboard

- Tailor dashboard to airport needs and data availability,
- Visualize current & historical performance.

- Provide future performance for some KPIs.
- Work under development to extend prediction to more KPIs.
- Make best use of emerging web and mobile technologies to share these dashboards.
APOC What-if support to decision tool

**CAST**

“*What-if*” options:
- What happens if change of runway configuration C in x minutes?
- What happens if closure of taxiway T in x minutes for y minutes?
- What happens if opening of y new security position in x minutes?
- In case of reduction of departure capacity, which flows should be prioritized: arrival/departure: 50/50, 80/20?

Fast time simulations

What-if results
Performance prediction techniques

- Calculation based on known data (schedule…):
  - Pb: limited to a few KPIs.

- Fast time simulation:
  - Launching fast-time simulation on an accurate airport model, initialized with real time data.

- Big Data & Machine learning:
  - Use state-of-the-art statistical techniques to use historical data for real time prediction.

- Test at Paris CDG in April 2016
- Test at Madrid Barajas in September 2016
- Live Trial at London Heathrow in July 2016
Cooperation with Paris-CDG
…soon with London Heathrow and Madrid Barajas
Big Data and Machine learning techniques

- Assemble a large number of historical data.
- Select a model such as:
  - Classification and regression Trees (CART);
- Train the model on a large subset of this historical data;
- Identify key influencing variables;
- Set up a decision tree…
  - Based on these variables;
  - By carefully considering the tree depth;
  - Where each leave is assigned a specific distribution.
- Run the model using real-time data:
  - To make predictions based on historical patterns;
  - Update the knowledge of the model regularly.
Conclusions on Total Airport Management

- Very promising concept, putting airports at the heart of TBO;
- Extends cooperation and information sharing to all airport processes;
- Ensures predictive performance management;
- Makes use of the huge amount of data being collected by airports (flights, pax, ...);
- Huge potential for emerging technologies to predict performance:
  - Fast time simulators connected to real operations;
  - Big data and Machine Learning techniques;
  - Web tools and mobile applications to display and share information.