Outbound Punctuality Sequencing by Collaborative Departure Planning

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Introduction

- CDM and Departure Management
- Simulation Environment
- Objectives
- OPS Methodology
- Runway Queuing
- Runway Punctuality
- OPS DMAN Properties
- Conclusions
- Future steps
CDM and Departure Management

CDM enables Flow Management

Flight Trajectory basic data to exchange

Add constraints or preferences from CFMU, pilot and Airline

Apply stakeholder preferences into runway sequence

Use DMAN tool for automation

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Simulation Environment

Stockholm Arlanda Airport and Terminal Maneuvering Area

2004 busiest day scenario (404 departure flights)

Scenario converted to parallel runways in mixed mode: 19L+R

FTS and RTS experiments coupled to verify results
Objectives

- Regulate taxi traffic to runway
  - Reduce runway queuing and controller workload

- Create Pre-tactical Runway and Off-block planning
  - to support Ground and Runway controllers

- Achieve a Punctual Outbound Sequence
  - optimised for stakeholder preferences (CDM)

General Conclusion

- Departure Management proven to contribute significantly to all high level objectives Capacity, Environment, Efficiency, Safety
OPS Methodology

- Stakeholders constraints transformed into preference functions
- Combine stakeholder functions into flight profile
- Algorithm: optimize overall punctuality using profiles
- Verify OPS with FCFS sequence

Flight Profile:
0.9 = Most optimal value after combining preference functions
Runway Queuing

24 hour sample: 404 departures

Departure sequence: FCFS versus OPS

FCFS: 4200 [s] for 32 flights between 6-7 hr

OPS: 2,5 hour less time spend in runway queue
Runway Punctuality

Punctuality at Arlanda over 24 hours 404 flights sample

Average CTOT deviation reduced from 124 [s] to -88 [s]

Standard deviation reduced from 320 [s] to 120 [s]

Depending on shape Preference Function: plan as early possible in CFMU slot
Highly **Configurable** DMAN-prototype

Algorithm is **Flexible** to sudden events, or additional information

DMAN used as **Decision Support Facility**

Enables **Collaborative Decision Making** in Departure Planning

Algorithm optimises **Punctuality**

Algorithm solutions are **Transparent**
Conclusions

- Minimised separation by optimising punctuality of ALL flights → increased Capacity
- Improved punctuality by CDM and preference functions → enhanced Predictability
- Regulated queuing and taxi movements → reduced controller workload

**OPS Departure Management by CDM** leads to

- **Economic** benefits for Airlines, ATC, Airports
- **Safety** and **Capacity** improvements for Airport, ATC & CFMU
- **Efficiency** and **Environment** gains for Airports, Passengers
Future steps

- Integrate pre-tactical **OPS DMAN** to tactical **DLR DMAN**
- Extend functionality to coupling with
  - AMAN
  - A-SMGCS
  - Gate Assignment
  - Taxi-Planner
- Incorporate **Airline Preferences** into **ATC Runway Planning**
  - Enhance CDM levels
- **Tactical and Pre-Tactical DMAN** into Live Operations

Any Questions ??