UDPP SESAR 1 Step2

Concept in brief
VP730 Demo

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UDPP Step2 objectives

Continue to deeply involve the AUs in ATM solutions
Step1: slot swapping

Give a mean (tool) to the AUs to decrease the Cost of the Delay.

Re-organize their flights in Hotspot Airport congestion -> Holistic (SESAR 2020)

UDPP Defines prioritisation rules:
To apply **Equity**
To limit **Coordination**
Cost of Delay for AU?

+ Cost of delay on 1 flight

Slope = punctuality policy

Cost disruption due to:
- PAX flow: Transit, VIP, Rotations, ...
- Resources Mgt: CREW constraints, pilots constraints, Maintenance, Curfew ...

First max delay target (Margin of manoeuvre 1)

2nd max delay target (Margin of manoeuvre 2)

Use of Cost disruptions to find an optimum face to delay in hotspot

AU goal: Decrease the Cost of the delay in the hotspot
2 features: FDA, SFP

UDPP Step2 Prioritisation:

- FDA: Fleet Delay Apportionment
  - Priority values: from 1 (highest) to 9 (lowest) Or B (Baseline).
    Default value = 5

- SFP: Selective Flight Protection
  - A binary approach for flights management (Joker)
  - Suspend or Protect Flights according to Operating Index (severity of the Hotspot)
UDPP Equity

All UDPP Concept and features are based on **Equity**

Don’t penalize others AU when doing Prioritisation

1. Ration By Effort rules (RBE) (on SFP but also on FDA)
   • First Give (to others), then Get (from others)

2. Sum Baseline delays = Sum UDPP delays (For FDA only)

SFP and FDA apply these Equity Rules
FDA : Fleet Delay Apportionment (with integrated RBE)

• AU gives priority to their own flights for delay reapportionment according to the need.

• Take proportion of delay on AU Flights according to given priority
  • \( \text{UDelay} = \sum (B\text{Delay}) \times \frac{(\text{Prio} \times B\text{Delay})}{\sum (\text{Prio} \times B\text{Delay})} \)

• Priority values :
  • from 1 (highest) to 9 (lowest) given to flights.
  • Implicit value is 5: not specifying a priority means giving 5.
  • B (Baseline) Priority can be set to ignore flights from FDA calculation (keep baseline delay)
### UDPP Concept elements: FDA

**FDA (proportion of “Delay x Priority”)**

<table>
<thead>
<tr>
<th>Original</th>
<th>A1</th>
<th>A2</th>
<th>C1</th>
<th>B1</th>
<th>A3</th>
<th>C2</th>
<th>B2</th>
<th>B3</th>
<th>A4</th>
<th>B4</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
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</thead>
<tbody>
<tr>
<td>FSFS Seq.</td>
<td>A1</td>
<td>A2</td>
<td>C1</td>
<td>B1</td>
<td>A3</td>
<td>C2</td>
<td>B2</td>
<td>B3</td>
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<td>B4</td>
<td>X1</td>
<td>X2</td>
<td>X3</td>
<td>X4</td>
<td>X5</td>
</tr>
<tr>
<td>Baseline Delay</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Priority</td>
<td>B</td>
<td>9</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>FDA Seq.</td>
<td>A1</td>
<td>A2</td>
<td>C1</td>
<td>B1</td>
<td>A4</td>
<td>C2</td>
<td>B2</td>
<td>B3</td>
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<td>X4</td>
<td>X5</td>
</tr>
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<td>FDA Delay</td>
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<td>3</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**UDPP Concept elements: FDA**

**Hotspot (baseline delay)**

\[
\text{CoefPrio} = \frac{\text{Sum}(\text{Dly})}{\text{Sum}(\text{Dly} \times \text{Prio})} = \frac{8}{(9 \times 4) + (4 \times 1)} = 8/40
\]

A3 delay = Prio * Dly * CoefPrio = 36 * 8/40 = 7.2

A4 delay = Prio * Dly * CoefPrio = 4 * 8/40 = 0.8
UDPP Concept elements: SFP

SFP : Selective Flight Protection

- A binary approach face to big Hotspot

- AU can **Suspend** or **Protect** flights according to the Operating Index (OI)
  - **Suspend** = Flight will be push at the end of the Hotspot
  - **Protect** = Flight will be on-time

- OI defines the minimum credit (OC: Operating Credits) a flight need to be Protected (be on-time).
UDPP Concept elements : SFP

**Hotspot (baseline delay)**

1 2 3 4 5 6 7 8 9 X

**Suspend 1**  Positive impact for all others flights

**Then Protect**

**Protect 8**

Neutral impact for flights between Baseline 8 and Original Schedule 8  
Positive impact for all the others
UDPP Concept elements : SFP

Operating Credits
To spend (OI box)

Hotspot

OI = 140

RBE : Prohibited Area

Suspend

Protect

Protect

Protect

Suspend

Suspend

100

60

20

120

80

100

200

300

Time
End of the presentation
Base on Airport APOC platform (Airbus Defence Space)
+ Management of Departure and Arrival Sequence
  With UDPP Prioritisation algorithm and rules
+ Graphic Interface (FOC oriented) For AUs (5 positions)
+ Link with SABRE Prototype for Cost calculation (in US)
UDPP Step 2

(planning phase)

Hotspot declared

Step 1 (Slot SWAP)

PDS

FDA

SFP

Hotspot:
Affected flights = delay > 0

time
2. Terminology

CCS, Hotspot, over-delivery recovery period

- CCS definition From 0500 to 1520
- Over-capacity
- Recovery
- Back to normal capacity
3. UDPP Concept elements: SFP

The combination of the 2 gives neutral impact for flights between original schedule and baseline time and positive for the others.
Simple Logical Description of
The Recovery period, the SFP and the FDA concepts
NB: time values are logical values useful to explain the concept elements
(not operational values) Underline colours on results indicate impact to other flights due to FDA or SFP (compare with Baseline Delay)

| Time | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Original | A1 | A2 | C1 | B1 | A3 | C2 | B2 | B3 | C3 | B4 | X1 | X2 | X3 | X4 | X5 |
| FPFS Seq. | A1 | A2 | C1 | B1 | A3 | C2 | B2 | B3 | C3 | B4 | X1 | X2 | X3 | X4 | X5 |
| Baseline Delay (BD) | 0 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 1 | 1 |

In this simple example Op. Index =200

| Time | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
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| FPFS Seq. | A1 | A2 | C1 | B1 | A3 | C2 | B2 | B3 | C3 | B4 | X1 | X2 | X3 | X4 | X5 |
| Baseline Delay (BD) | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 14 |

Suspended Flights go at the end of the recovery period

FDA (proportion of “Delay x Priority” + equity rules to build list)

| Time | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
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| FPFS Seq. | A1 | A2 | C1 | B1 | A3 | C2 | B2 | B3 | A4 | B4 | X1 | X2 | X3 | X4 | X5 |
| Baseline Delay (BD) | 0 | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 1 | 1 |
| Priority | B | B | 9 | 1 |
| New Delay | 0 | 1 | 2 | 3 | 1.5 | 4 | 4 | 4 | 4 | 4 | 3 | 1 | 1 |

| Time | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
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CoefPrio = Sum(Dly) / Sum(Dly*Prio) = 8/ ((9x4) + (4x1)) = 8/40
A3 delay = Prio*Dly * CoefPrio = 36 * 8/40 = 7.2
A4 delay = 4 * 8/40 = 0.8
+ rules for merging All AU flights (equity)
Concept elements on timeline

**AIRPORT-ATC**
- R-MAN: (DCB – Airport)
- Q-Mgt Optimisation: PDS, A-MAN, D-MAN

**AUs (UDPP)**
- AU Initial flight Priority (FDA)
  - FDA: Light to heavy CCS Severity
  - Use Priority values: already assigned but can be updated
  - SFP: Heavy CCS severity
  - Need specific input: Credits Mgt
  - Enhanced ATFM Slot SWAP
- Possible AU Slot SWAP under conditions:
  - A-FLEX
  - D-FLEX
  - ...

**DCB (NET)**
- DCB-NET, coordinated solutions
- HotSpot management
- TTA ...
- DPI ...

- CCS declared (R-MAN is part of the decision)
  - (Baseline Delay, Recovery period OI value …)
- CCS UDPP solution
  - Cut-off time
  - (New Schedule: IBT, OBT)
- Q-Mgt Cut-off time:
  - Optimised sequence

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**CCS declared**
(R-MAN is part of the decision)
(Baseline Delay, Recovery period OI value …)

**CCS UDPP solution**
Cut-off time
(New Schedule: IBT, OBT)

**Q-Mgt**
Cut-off time:
Optimised sequence

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**AIRPORT-ATC**
- R-MAN: (DCB – Airport)
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