TOPLINK/ECOsystem: New Decision Support services to reduce MET impact on Aviation

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THALES AIR SYSTEMS

6 to 10 November 2017, Météo-France, Toulouse
ECOsystem: the concept

Collaborative Flow / Fleet / Flight Optimization:
- Fuel consumption
- Predictability
- Safety

- Punctuality
- Capacity
- Cost

Improving global efficiency & safety through collaborative System Wide Information Management
MET-ATM integration architecture
TOPLINK: SESAR « Large Scale Demonstration » project
TOPLINK Platform architecture

- Flight Plan services
- Surveillance services
- Flow Management Services

- D-NOTAMS, AIP, AMDB

- METAR, TAF, SIGMET services
- MET Hazard EnRoute services
- Airport MET Services

- SWIM/pre-SWIM services
- Dedicated B2B services

Cockpit applications

Ground Applications (ATFM, Airlines OCC)

Web-based applications running on standard PC
TOPLINK: « ATFM » position

- **Shared awareness**
  - Common situational picture (weather, traffic, airspace,...)

- **Assessment & alerts**
  - Assessment of impacts on user’s operations, through customized KPIs and metrics
  - Customized alerts

- **Mitigation**
  - “What-if” scenarios (regulations, ...)
  - Collaborative Decision Support
« Improved regulations » Use Case: operational concept

• Current status:
  – Departure ground slots are allocated to planned Flights (before take off) when the capacity of control sectors (or arrival airports) is expected to be degraded due to MET hazardous events
    • e.g. thunderstorms en route or on airports, fog on arrival airports
    • applied 2 to 4 hours in advance
  – The capacity degradation is in general over estimated in space and time due to the uncertainty (or sometimes absence) of MET forecasts

• Benefit mechanism:
  – Better nowcast & forecast of MET hazards (0 to 4 hours ahead) enable a better « tailoring » of regulations in space and time to avoid unnecessary penalization of flights
  – TOPLINK / ECOsystem used by ANSPs, results in direct benefits on Airlines KPIs

From an ANSP point of view, ECOsystem can be used as an incentive to attract more traffic (hence more overflight fees)
“Improved regulations” Use Case: experimental results

### Reference period:

*June-Aug 2016 (3 months)*

### Extrapolation:

- 12 months
- EU En Route Airspace
- All airlines

**20 to 50 M€**

cumulated gain p.a.

<table>
<thead>
<tr>
<th>Airspace</th>
<th>Current</th>
<th>Benefit TOPLINK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delays</td>
<td>Cost</td>
</tr>
<tr>
<td></td>
<td>(mn) (1)</td>
<td>(k€) (2)</td>
</tr>
<tr>
<td><strong>All Airlines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOVV (En Route)</td>
<td>18742</td>
<td>880</td>
</tr>
<tr>
<td>LDZO (En Route)</td>
<td>12747</td>
<td>570</td>
</tr>
<tr>
<td>LFBB (En Route)</td>
<td>45951</td>
<td>2159</td>
</tr>
<tr>
<td><strong>Total EU (En Route)</strong></td>
<td>3651</td>
<td>171.6</td>
</tr>
<tr>
<td><strong>Brussels Airlines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total EU (En Route)</strong></td>
<td>3651</td>
<td>171.6</td>
</tr>
<tr>
<td><strong>HOP!</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1704</td>
<td>79.8</td>
</tr>
<tr>
<td><strong>All Airlines</strong></td>
<td>39026</td>
<td>1834</td>
</tr>
</tbody>
</table>

(1): Sources: Eurocontrol
(2): Estimation based on average cost of ground delays, source Univ Westminster
(3): Estimation based on joint analysis of actual regulations and TOPLINK tool capabilities
TOPLINK: « Airline OCC » position

- **Shared awareness**
  - Common situational picture (weather, traffic, airspace, ...)

- **Assessment & alerts**
  - Assessment of MET impacts on user’s operations, through customized KPIs and metrics
  - Customized alerts

- **Mitigation**
  - “What-if” scenarios (horizontal rerouting, FL change, ...)
  - Collaborative Decision Support
TOPLINK “Flight Rerouting” Use Case 1: “improved horizontal diversion”

Actual scenario:
«last minute deviation» based on Weather Radar info, to avoid severe convection over the Pyrenees

TOPLINK expected benefit:
Early rerouting decision 45 mn in advance (western avoidance route)

<table>
<thead>
<tr>
<th>BEL7FP 13/09/2016</th>
<th>Planned</th>
<th>Actual</th>
<th>TOPLINK benefit vs actual (est.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRU-AGP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take-off</td>
<td>15:28</td>
<td>15:24</td>
<td></td>
</tr>
<tr>
<td>Arrival</td>
<td>17:57</td>
<td>18:08</td>
<td></td>
</tr>
<tr>
<td>Track miles</td>
<td>983 NM</td>
<td>1039 NM</td>
<td></td>
</tr>
</tbody>
</table>

Impact of weather

<table>
<thead>
<tr>
<th></th>
<th>Planned</th>
<th>Actual</th>
<th>TOPLINK benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival delay</td>
<td>0</td>
<td>+11 mn</td>
<td>- 7 mn</td>
</tr>
<tr>
<td>Extra flight duration</td>
<td>0</td>
<td>+15 mn</td>
<td>- 7 mn</td>
</tr>
<tr>
<td>Extra track miles</td>
<td>0</td>
<td>57 NM</td>
<td>- 40 NM</td>
</tr>
<tr>
<td>Extra cost (est.)</td>
<td>0</td>
<td>+ 599 €</td>
<td>- 420 €</td>
</tr>
</tbody>
</table>
TOPLINK “Flight Rerouting” Use Case 2: “Avoid diversion”

**Actual scenario:**
20 mn holding over BIO due to severe thunderstorm, then diversion to MAD. Then PAX back to BIO by bus (395 km). Aircraft back to BIO through ferry flight.

**TOPLINK expected benefit:**
Ground delay at departure in BRU 60 mn then flight as planned.

<table>
<thead>
<tr>
<th>BEL14Z 15/09/2016</th>
<th>Planned</th>
<th>Actual</th>
<th>TOPLINK benefit vs actual (est.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take-off</td>
<td>20:45</td>
<td>20:45</td>
<td></td>
</tr>
<tr>
<td>Arrival</td>
<td>22:28</td>
<td>05:00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by bus</td>
</tr>
<tr>
<td>Impact of weather</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrival delay</td>
<td>0</td>
<td>+390 mn</td>
<td>- 330 mn</td>
</tr>
<tr>
<td>Extra travel duration</td>
<td>0</td>
<td>+390 mn</td>
<td>- 330 mn</td>
</tr>
<tr>
<td>Extra cost (est.)</td>
<td>0</td>
<td>+ 10 133 €</td>
<td>- 8 093 €</td>
</tr>
</tbody>
</table>
TOPLINK « Flight Rerouting » Use Case 3: « Low altitude (FL190) ferry flight »

Brussels Airlines OCC feedback (in TOPLINK messaging system):

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/09/2016</td>
<td>13:33</td>
<td>SN2038 BHX-BRU return inflight</td>
<td>Due to a <strong>not retractable gear</strong> after take-off a/c had to return to BHX. A/C could have been dispatched ferry with gear down to BRU for repair on condition there were <strong>no icing conditions</strong> en route. Toplink tool consulted and feedback was negative as severe icing conditions all the way. A/C was grounded at BHX and repair will have to be done locally.</td>
</tr>
<tr>
<td>17/09/2016</td>
<td>14:54</td>
<td>SN9938 BHX-BRU technical ferry</td>
<td>Monitoring SN9938 BHX-BRU ferry flight. Technical issue: Gear not locked when retracting. A/C has to return gear down to BRU for repair on condition there are no icing conditions en route. Max altitude permitted 'gear down' procedure FL190. <strong>Return would never have been possible without the Toplink tool.</strong></td>
</tr>
</tbody>
</table>
TOPLINK performance results: synthesis

**Improved Ground Regulation**
- Small gains on many flights
- Better forecast of MET hazards enable a better use of regulations in space and time avoiding unnecessary penalization of flights
- Used by ANSPs for direct benefit on Airlines KPIs
- Quantitative assessment reached with a good confidence level - validating prior TOPMET results

**Other Use Cases**
- Airspace & airport capacity
- Safety and passenger comfort
- Benefits are clearly reported by end-users, but can be only qualitatively assessed at the current stage

**Support to Flight Rerouting**
- Large gains on few flights
- Better forecast of weather impact on flights, enabling early and better rerouting decisions to avoid disruptions
- Used directly by airline taking into consideration expected ATC situation
- Based on a case-by-case (flight by flight) analysis

- 20+ M€ p.a.
- Up to -70% Delay*

[*reduction through ECOsystem of the delay induced by weather effects on the initial FPL]*
From SESAR demonstrations to operations...

ECOsystem delivers improved operational efficiency through new collaborative capabilities based on shared MET, AIM, Traffic information.
Thank you