Presentation
SESAR Key Performance AREA, Performance targets and assessment

ART Workshop ‘Validation / Measuring ATM Performance’
Eurocontrol Bretigny 13th May

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Presentation content

- Some definitions (Influence diagrams, model, KPA, KPI, targets)
- SESAR Performance Framework and V-Process
- SESAR KPA and Performance indicators (ECAC, local) and ICAO
- Performance Target Setting methodology
- Performance Assessment methodology
- Example of Performances results
Better to be approximately right rather than precisely wrong

JM Keynes, Daniel Pauly,
"All models are wrong but some are useful"

G. Box
Key Performance Area

ICAO Doc 9883: Key Performance Areas are a way of categorising performance subjects related to high level ambitions and expectations. ICAO Global ATM Concept sets out these expectations in general terms for each of the 11 ICAO defined KPAs.

Key Performance Indicator

9.5.2013 EC Official Journal of Union definition: In the context EC Performance Implementing Regulation, Key Performance Indicator means specifically the performance indicators used for the purpose of performance target setting.

Performance Indicator

9.5.2013 EC Official Journal of Union definition:
Performance indicators’ means the indicators used for the purpose of performance monitoring, benchmarking and reviewing.
**Definitions 2/3**

**Target**

ICAO Doc 9883: Performance targets are closely associated with performance indicators: they represent the values of Key performance indicators that need to be reached or exceeded to consider a performance objective as being fully achieved.

**Influence Diagram**

Graphical aid to decision making under uncertainty

It represents the causal relationships of a phenomenon or situation in a non-ambiguous manner, and helps in a shared understanding of the key issues.

A 2D graphical representation to understand the factors that contribute and influence the performance.
Influence Model

An influence model is:

- An ‘quantified’ influence diagram

Software used

- Analytica – decision analysis software
SESAR Performance Framework and V-Process
<table>
<thead>
<tr>
<th>SESAR KPAs Assessed</th>
<th>KPIs Unit</th>
<th>Aggregation level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment / Fuel Efficiency</td>
<td>Average kg Fuel Burn per Flight</td>
<td>ECAC</td>
</tr>
<tr>
<td>Airspace Capacity</td>
<td>En-Route and TMA Throughput (Average movement per Hour)</td>
<td>High Complex (LOCAL)</td>
</tr>
<tr>
<td>Airport Capacity</td>
<td>Runway Throughput (Average movement per Hour)</td>
<td>BIC Airports (LOCAL)</td>
</tr>
<tr>
<td>Predictability</td>
<td>Variance of Difference in actual &amp; Flight Plan or RBT durations</td>
<td>ECAC</td>
</tr>
<tr>
<td>Punctuality</td>
<td>% Departures &lt; +/- 3 mins vs. schedule due to ATM causes</td>
<td>ECAC</td>
</tr>
<tr>
<td>Cost Effectiveness</td>
<td>Direct ANS Cost per Flight: ATCO productivity</td>
<td>ECAC</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Average delay for scheduled civil/military flights with change request and non-scheduled / late flight plan request</td>
<td>ECAC</td>
</tr>
<tr>
<td>Civil-Military cooperation and coordination</td>
<td>Distance and flight time Base &lt;-&gt;to ARES and Fuel and Distance saved (for GAT operations)</td>
<td>ECAC</td>
</tr>
<tr>
<td>Resilience</td>
<td>% Loss of Airport &amp; Airspace Capacity Avoided</td>
<td>Airports &amp; Airspace (LOCAL)</td>
</tr>
</tbody>
</table>
## ICAO and SESAR KPAs

<table>
<thead>
<tr>
<th>KPA</th>
<th>SESAR Definition Phase PF (D2)</th>
<th>SESAR Development Phase</th>
<th>ICAO</th>
<th>B.04.01 Proposal for PF S2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Yes, with target</td>
<td>PF – Edn 1 + Targets</td>
<td>Yes</td>
<td>No change</td>
</tr>
<tr>
<td>Environment</td>
<td>Yes as Efficiency (Fuel Efficiency) and Environment (emissions, noise) with targets</td>
<td>PF – Edn 1 (Fuel Efficiency) + Targets</td>
<td>Yes (as both Efficiency &amp; Environment)</td>
<td>Priority: Extend – for Noise, LAQ; include Fuel Efficiency in Environment explicitly</td>
</tr>
<tr>
<td>Capacity</td>
<td>Yes, with target</td>
<td>PF – Edn 1 + Targets</td>
<td>Yes</td>
<td>No change</td>
</tr>
<tr>
<td>Predictability</td>
<td>Yes, with target</td>
<td>PF – Edn 1 + Targets</td>
<td>Yes</td>
<td>No change</td>
</tr>
<tr>
<td>Punctuality</td>
<td>Yes (as Temporal Efficiency)</td>
<td>PF – Edn 2</td>
<td>Yes (as Time Efficiency)</td>
<td>No change</td>
</tr>
<tr>
<td>Cost Effectiveness</td>
<td>Yes, with target</td>
<td>PF – Edn 1 + Targets</td>
<td>Yes</td>
<td>No change</td>
</tr>
<tr>
<td>Civil-Military Cooperation and Coordination</td>
<td>Mission Effectiveness (as part of Efficiency)</td>
<td>PF – Edn 2</td>
<td>Yes (as part of Access &amp; Equity)</td>
<td>No change</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Yes, with target</td>
<td>PF – Edn 2</td>
<td>Yes</td>
<td>No change</td>
</tr>
<tr>
<td>Resilience</td>
<td>No</td>
<td>PF – Edn 2</td>
<td>No</td>
<td>No change</td>
</tr>
<tr>
<td>Access and Equity</td>
<td>Yes, no quantitative target</td>
<td>No</td>
<td>Yes</td>
<td>Possible New – for S2020</td>
</tr>
<tr>
<td>Participation</td>
<td>Yes, no quantitative target</td>
<td>No</td>
<td>Yes</td>
<td>Possible New – for S2020</td>
</tr>
<tr>
<td>Interoperability</td>
<td>Yes, no quantitative target</td>
<td>No</td>
<td>Yes</td>
<td>Possible New – for S2020</td>
</tr>
<tr>
<td>Human Performance</td>
<td>No</td>
<td>As a Transversal Area</td>
<td>No</td>
<td>Priority: New – for S2020</td>
</tr>
<tr>
<td>Security</td>
<td>Yes, no quantitative target</td>
<td>As a Transversal Area</td>
<td>Yes</td>
<td>Priority: New – for S2020</td>
</tr>
</tbody>
</table>
Performance Target Setting methodology

0. ATM Master Plan Starting Point

1. Derive Intermediate Targets to steps & R&D Allocation

2. Decompose targets based on Influence Diagrams

3. Derive Targets per Influence Factor

4. Establish Mapping of Influence Factors to OFAs & Relative Contributions

5. Aggregate Validation Targets to Operational Sub-Package Level
Target setting and Influence Diagrams … An example

- Baseline: 2005 Baseline
- 2011 Estimate
- Step 1
- Step 2
- Step 3

- Overall SES Intermediate Targets
- SESAR Contribution (incl. DB)

- On Stand 0%
- Taxi Out 4%
- Taxi In 3%
- TMA Arrival 20%
- TMA Departure 20%
- En Route Horizontal deviation 31%
- En Route Vertical deviation 29%

- SESAR Total: 70%

- Fuel Efficiency Airport 9%
- Fuel Efficiency TMA 31%
- Fuel Efficiency En Route 20%

- Influence Factors
- Non SESAR/R&D 30%

- Decomposition Table:

<table>
<thead>
<tr>
<th>Influence Factor</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Stand</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Taxi Out</td>
<td>40%</td>
<td>55%</td>
</tr>
<tr>
<td>Taxi In</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>TMA Arrival</td>
<td>25%</td>
<td>30%</td>
</tr>
<tr>
<td>TMA Departure</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>ER Horizontal</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>ER Vertical</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Non-SESAR/R&amp;D</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Influence diagrams for Target setting but also Performance Assessment & modeling

Performance Assessment Pls
- Average on stand fuel burn per flight (Kg per mov)
- Average taxi out fuel burn per flight (Kg per mov)
- Average taxi in fuel burn per flight (Kg per mov)
- Average TMA arrival fuel burn per flight (Kg per mov)
- Average TMA departure fuel burn per flight (Kg per mov)
- Average en route horizontal deviation fuel burn per flight (Kg per mov)
- Average en route vertical deviation fuel burn per flight (Kg per mov)

Influence Factors
- On Stand
- Taxi out
- Taxi In
- TMA arrival
- TMA departure
- En Route Horizontal deviation
- En Route Vertical deviation
- Fuel Efficiency Airport
- Fuel Efficiency TMA
- Fuel Efficiency En Route
- Non SESAR/R&D Influence Factors

KPI
- ENV1 Average Fuel Burn per Flight

Target decomposition flow
Performance assessment flow

Additional metrics and indicators for benefit assessment
What is B.5 Performance Assessment?

Progressive Performance Assessment refinement & recommendations

VALIDATION TARGET PER STEP

GAP

GAP

GAP ANALYSIS

Performance Assessment per Step Release #1

Performance Assessment per Step Release #2

Performance Assessment per Step Release #3

Cycle 1

Cycle 2

Cycle 3

SJU Programme Time Line

Estimations

Validation Results

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP

PP
What is B.5 Performance Assessment?

v1, v2, v3 Release exercises, RESULTS & ESTIMATIONS

OFA based
Step based
ECAC Level

OFA 1

OFA 2

Primary Projects

OSED
VALPs
VALRs

x.y.z

PP#1
KPIs
Benefit

PP#2
KPIs
Benefit

PP#3
KPIs
Benefit

Traffic
Applicability
Assumptions
Influence model

RESULTS & ESTIMATIONS

v1, v2, v3 Release exercises,

Assumptions
Applicability
Traffic
Example kg of fuel and number of concerned flights
Example Fuel Efficiency results comparison

- **Free Routing**: New validation results.
- **Int. Surface Management**: New benefits from A-SMGCS Guidance Function (AGL).
- **Optimised 2D/3D Routes**: New validation results - CDAs.
- **Enh AMAN/DMAN TAM/ER**: New validation results from i4D/CTA.
- **Enh RWY Throughput**: 0.07%
- **Int Surface Management**: 0.09%
- **Optimised 2D/3D Routes**: 0.20%
- **Airport Operations Management**: 0.18%
- **Free Routing**: 0.40%
- **Others**: 0.07%

**Cycle 1 to Cycle 2 - Change of traffic / applicability and general assumptions.**

- **Enh AMAN/DMAN TAM/ER**: 0.01%
- **AFUA**: 0.15%
- **Int Surface Management**: 0.01%
- **Optimised 2D/3D Routes**: 0.14%
- **Airport Operations Management**: 0.24%
- **Free Routing**: 0.33%

**Int. Surface Management - New benefits from D-TAXI.**

- **Enh RWY Throughput**: 0.18%
- **Int Surface Management**: 0.09%
- **Optimised 2D/3D Routes**: 0.20%
- **Airport Operations Management**: 0.18%
- **Free Routing**: 0.40%

**Optimised 2D/3D Routes - New validation results - CDAs.**

- **Enh AMAN/DMAN TAM/ER**: -0.12%
- **Int Surface Management**: 0.20%
- **Optimised 2D/3D Routes**: 0.20%
- **Airport Operations Management**: 0.18%
- **Free Routing**: 0.40%

**Enh AMAN/DMAN TMA & ER - New validation results from i4D/CTA.**

- **Enh AMAN/DMAN TAM/ER**: -0.06%
- **Int Surface Management**: 0.09%
- **Optimised 2D/3D Routes**: 0.20%
- **Airport Operations Management**: 0.18%
- **Free Routing**: 0.40%
More info about SESAR Performance Framework, KPIs and Performance Assessments

## SESAR Performance Framework (Edition 2)

**Document Information**

- **Project Title**: Performance Analysis of ATM Target Concepts
- **Project Number**: B.04.01
- **Project Manager**: ENAIRE
- **Deliverable**: Guidance on KPIs and Data Collection Version 1 (2014)
- **Deliverable ID**: D05
- **Edition**: 09.09.02
- **Template Version**: 09.09.02

**Task Contributors**

ENAIRE, EUROCONTROL, NATS, SELEX-Teleopti, VEGA

**Abstract**

This document provides an updated SESAR Performance Framework. It comprises updated descriptions of the European performance framework control, the SESAR performance management process and new and updated performance framework structure for both existing and new performance focus areas. The overall aim of the SESAR Performance Framework is to guide R&A within the programme to ensure that the necessary capabilities are developed and made available for deployment where and when required. It is applicable to all SESAR Concept Steps and replaces “Performance Framework (Edition 1)” published by B.04.1 in January 2014.

## Guidance on KPIs and Data Collection Version 1 (2014)

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## Updated Performance Assessment in 2014

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- **Deliverable Name**: Updated Performance Assessment in 2014
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**Abstract**

This document presents the intermediate (Cycle 3) Step 1 performance assessment results and the preliminary gap analysis undertaken by SESAR Project B.04.01. It is concerned with an update of Step 1 Performance Assessment (Cycle 1), previously submitted as D06, by principally taking into account the results of the new Release 2 validation exercise performed in the SESAR programme.

This deliverable consists of:

- A document which includes a summary of the assessment results, gap analysis, a description of the methodology applied and also identifies issues arising during the assessment process.
- The DAS (Performance Assessment Reports) providing the detailed calculations, assumptions and gap analysis for each CEA assessment. These are provided separately.
Many Thanks
Spare example Influence diagrams for Resilience

**Performance Assessment PIs**
- Airport time to recover from non nominal to normal condition
- % Airport lost capacity
- Airspace time to recover from non nominal to normal condition
- % Airspace lost capacity

**Influence Factors**
- Weather event
- Infrastructure event and technical failure
- Event causing the degraded / disrupted conditions – not subject to SESAR influence
- Design and management of ATM system in nominal conditions
- Anticipation of degraded / disrupted conditions
- Handling of degraded / disrupted conditions
- Recovery from degraded / disrupted conditions

**KPIs**
- RES2: AU impact - Delays & Cancellations resulting from capacity degradation
- RES1: % Loss of Airport & Airspace Capacity Avoided

Performance assessment flow
(no targets decomposition flow is shown as no targets are envisaged)