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| AbstractThis document is present a preliminary selection of performance indicators and scenarios to be analysed in WP-E project DCI-4HD2D “Dynamic Cost Index in 4 Hour Door to Door” which is an extension of project E.02.14 CASSIOPEIA "Complex Adaptive Systems for Optimisation of Performance in ATM". |

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# INTRODUCTION

## Purpose of the document

This document contains the definition of performance indicators and scenarios for WP-E project DCI-4HD2D "Complex Adaptive Systems for Optimisation of Performance in ATM". This document is a working document intended to help the definition of indicators and scenarios.

## Intended readership

This report is written for the professional reader with a background on DCI-4HD2D project and assumes an understanding of air transport and ATM. Without detriment to appropriate referencing and delineation, the text is not cluttered with explanations of common acronyms or principles.

## Inputs from other projects

This project is the extension of project E.02.14 CASSIOPEIA, and as such, many components will be related. However, for readability purposes, this document will be self-contained.

## Glossary of terms

| **Term** | **Definition** |
| --- | --- |
| DCI | Dynamic Cost Indexing |

## Structure of the Document

The document is structured in the following manner:

Section 2 describes the performance indicators;

Section 3 describes the scenarios.

# Performance indicators

| **Id** | **Indicator** | **Unit** | **Category** |
| --- | --- | --- | --- |
| 1 | Gate-to-gate passenger trip time | Minutes | Passengers performances |
| 2 | Door-to-door passenger trip estimation | Minutes |
| 3 | Societal cost estimation | Euros |
| 4 | Missed connections | Passenger |
| 5 | Flight delay | Minutes | Aircraft performances |
| 6 | Airlines cost | Euros |
| 7 | Hub airline cost | Euros |
| 8 | Hub airline cost variation with respect to optimum | Euros |
| 9 | Non-hub airline cost | Euros |
| 10 | Non-hub airline cost variation with respect to optimum | Euros |
| 11 | Speed variations incurred | Percentage | Complexity of the solution |
| 12 | Messages interchanged | Messages |

Table 1 – Preliminary performance indicators considered

Table 1 presents the list of 12 performance indicators that will be computed on the different scenarios. The performance indicators are divided in three categories: Passengers performances, aircraft performances and complexity of the solution.

* The passengers’ performances indicators are passenger oriented and focused on the trip time, number of connections missed and societal passenger cost estimation.
* The aircraft performances are flight oriented (i.e., flight delay) and airline cost oriented. A distinction between hub and other airlines will be considered. This categorisation will allow us to compute the benefit of the dynamic cost index strategy with different types of airlines. It is expected that the hub airline will get higher benefit as the number of connections are more relevant.
* It is worth to consider the complexity of the solution. In this case, metrics such as variation of speed and number of messages interchanged will be considered.

Finally, when appropriate, the computation of statistical parameters such as total, average and distribution will be provided for the variables, as it is important when assessing the equity of the solution.

# Scenarios

## Optimisation function

When solving the dynamic cost index problem, the airline selects the best speed for a given delayed inbound flight and the optimal delay for outbound connecting flights that are waiting for connecting passengers.

The optimisation aim at different objectives achieved with different strategies: minimisation of the cost for the airlines or minimisation of the passenger trip time. These objectives might not be aligned; the idea considered in DCI-4HD2D is to create an objective function that considers both. Then different optimisations function weighting these two objectives will allow us to analyse the trade-off between them. Therefore, for each scenario different functions will be considered in order to analyse these trade-offs.

## Variables considered

The different variables that currently are under consideration during the project are:

* Speed variation allowed: ±3%, ±5%
* Current flight plan distances
* Optimised flight plan distances

These variables along with other SESAR improvements considered (i.e., extended AMAN and AMAN-DMAN integration) will define the different scenarios to analyse. Note that the speed variation range is preliminary defined at ±3%, ±5%; the actual ranges that will be studied will be defined after further aircraft performance analyses.

In DCI-4HD2D only tactical variables will be considered. The strategic optimisation that could be implemented to minimise trip times or airline cost are initially out-of-scope of the project.

## Scenarios considered

Four different scenarios have been preliminary defined as presented in Table 2.

| **Scenario****Id** | **Current flight plan length** | **Optimised flight plan distances** | **±3% speed variation** | **±5% speed variation** |
| --- | --- | --- | --- | --- |
| 1 | ✓ | 🗶 | ✓ | 🗶 |
| 2 | ✓ | 🗶 | 🗶 | ✓ |
| 3 | 🗶 | ✓ | ✓ | 🗶 |
| 4 | 🗶 | ✓ | 🗶 | ✓ |

Table 2 – Preliminary scenarios considered

* Scenario 1 considers that the flight plans are maintained as in the current situation and the speed variation allowed are moderate;
* Scenario 2 considers that the flight plans are maintained as in the current situation with a more aggressive the speed variation allowed;
* Scenario 3 considers that improvements in the routes derived from SESAR are implemented with a moderate use of speed variation;
* Scenario 4 considers that improvements in the routes derived from SESAR are implemented with a higher use of speed variation allowed.