

SESAR Solution PJ.07-W2-38 SPR-INTEROP/OSED for V3 - Part V - Performance Assessment Report (PAR)

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PJ07-W2 OAUO

OPTIMISED AIRSPACE USERS OPERATIONS

This Performance Assessment Report (PAR) is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 874465 under European Union's Horizon 2020 research and innovation programme.



Abstract

This document provides the Performance Assessment Report for SESAR Solution PJ.07-W2-38 — *Enhanced integration of AU trajectory definition and network management processes*. The PAR consolidates solution performance validation results and estimates where no validation results are present.

The solution focuses on reducing the impact of ATM planning on Airspace Users' costs of operations, by providing them a better access to ATM resource management and allowing them to better cope with ATM constraints. This shall improve Airspace Users flight planning and network management through improved FOC participation into the ATM network collaborative processes.

The main benefits lay in the KPAs of Punctuality (PUN) and Airspace Users Cost Efficiency (AU CEF). Other affected KPAs are Fuel Efficiency (FEFF), Flight Times (TEFF) and Predictability (PRD).

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1 Executive Summary

This document provides the Performance Assessment Report (PAR) for Solution PJ.07-W2-38 – Enhanced integration of AU trajectory definition and network management processes.

The PAR is consolidating solution performance validation results addressing KPIs/PIs and metrics from the SESAR2020 Performance Framework [3].

Description:

The main objective of Solution 38 is to develop requirements and validate procedures and workflows for Flight Operations Centres (FOC), enabling improved interaction with other ATM stakeholders and especially with the NMF (Network Management Function). This with regard to trajectory definition in the planning phase and the amendment of it in execution, by enhancing the integration of AU trajectory definition and network management processes.

The solution addresses the following operational improvements (OIs):

- AUO-0219: Use of Enriched DCB Information and Enhanced What-Ifs to Improve AU Flight Planning,
- AUO-0208: Use of Simple AU Preferences in DCB Processes.

Both OIs are deployable separately. The first OI consists of enriched DCB information that will be available to improve AU decision-making processes when planning or re-planning trajectories. Enriched DCB information is provided either for the trajectory planned by the AU as part of a submitted flight plan, or for alternative trajectories considered in the context of advanced ‘what-if’.

The second OI consists of the provision of new information (Proactive FDCI), provided by the AU to NMF, to indicate the importance of some critical flights progressing on time, or other preferences. Hence, flow management should preferably assign, when possible, no delay or limited ATFCM delay to those flights and adapt the measure to AU preference.

More Information can be found in Chapter 2.

Assessment Results Summary:

The following tables summarise the assessment outcomes per KPI (Table 1), and mandatory PI (Table 2), which puts them side-by-side against Validation Targets where there is a corresponding KPI defined by PJ19 [8]. The impacts of a solution on performance are described by the Benefit Impact Mechanisms. All KPIs and mandatory PIs from the Benefit Mechanism where the solution could potentially impact must be assessed via validation results, expert judgment etc.

There are three cases:

1. An assessment result of 0 with confidence level High, Medium or Low indicates that the solution is expected to have a marginal impact on the KPI or mandatory PI.

2. An assessment result (positive or negative), that is different to 0, with confidence level High, Medium or Low indicates that the solution is expected to impact the KPI or mandatory PI.
3. An assessment result of N/A (Not Applicable) with confidence level N/A indicates that the solution is not expected to impact the KPI or mandatory PI consistently with the Benefit Mechanism.

KPI	Validation Targets – Network Level (ECAC Wide) [8][5]	Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI) ¹	Confidence in Results ²
SAF1: Safety - Total number of estimated accidents with ATM Contribution per year	N/A	N/A	N/A
FEFF1: Fuel Efficiency - Actual average fuel burn per flight	Medium (4.19-14.87 kg/flight)	0.69 kg/flight, 0.01 % (additional fuel)	Medium
CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.	N/A	N/A	N/A
CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time	N/A	N/A	N/A
CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).	N/A	N/A	N/A
TEFF1: Gate-to-gate flight time	Medium (0.05-0.12 min/flight)	Neutral impact	Medium

¹ Negative impacts are indicated in red.

² High – the results might change by +/-10%

Medium – the results might change by +/-25%

Low – the results might change by +/-50% or greater

N/A – not applicable, i.e., the KPI cannot be influenced by the solution

PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations	Medium (0.28-2.49 %)	Neutral impact	High
PUN1: Punctuality – Average departure delay per flight	High (0.11-0.44 min)	0.24 min/flight, 15.37%	High
CEF2: ATCO Productivity – Flights per ATCO -Hour on duty	N/A	N/A	N/A
CEF3: Technology Cost – Cost per flight	N/A	N/A	N/A

Table 1: KPI Assessment Results Summary

Mandatory PI	Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)³	Confidence in Results⁴
SAF1.X: Mid-air collision - En-Route	N/A	N/A
SAF2.X: Mid-air collision - TMA	N/A	N/A
SAF3.X: RWY-collision accident	N/A	N/A
SAF4.X: TWY-collision accident	N/A	N/A
SAF5.X: CFIT accident	N/A	N/A
SAF6.X: Wake related accident	N/A	N/A
SAF7.X: RWY-excursion accident	N/A	N/A
SAF8.X: Other SAF Risks	N/A	N/A
SEC1: A security risk assessment has been carried out	N/A	N/A
SEC2: Risk Treatment has been carried out	N/A	N/A

³ Negative impacts are indicated in red.

⁴ High – the results might change by +/-10%

Medium – the results might change by +/-25%

Low – the results might change by +/-50% or greater

N/A – not applicable, i.e., the KPI cannot be influenced by the solution

SEC3: Residual risk after treatment meets security objective.	N/A	N/A
ENV1: Actual Average CO2 Emission per flight	2.18 kg/flight, 0.01 % (additional CO₂)	High
NOI1: Relative noise scale	N/A	N/A
NOI2: Size and location of noise contours	N/A	N/A
NOI4: Number of people exposed to noise levels exceeding a given threshold	N/A	N/A
LAQ1: Geographic distribution of pollutant concentrations	N/A	N/A
CAP3.1: Peak Departure throughput per hour (Segregated mode)	N/A	N/A
CAP3.2: Peak Arrival throughput per hour (segregated mode)	N/A	N/A
CAP4: Un-accommodated traffic reduction	N/A	N/A
RES1: Loss of Airport Capacity Avoided	N/A	N/A
RES1.1: Airport time to recover from non-nominal to nominal condition	N/A	N/A
RES2: Loss of Airspace Capacity Avoided.	N/A	N/A
RES2.1: Airspace time to recover from non-nominal to nominal condition.	N/A	N/A
RES4: Minutes of delays.	N/A	N/A
RES5: Number of cancellations.	N/A	N/A
TEFF2: Taxi in time	N/A	N/A
TEFF3: Taxi out time	N/A	N/A
TEFF4: TMA arrival time	N/A	N/A
TEFF5: TMA departure time	N/A	N/A
TEFF6: En-Route time	N/A	N/A
PRD2: Variance of Difference in actual & Flight Plan or RBT durations	0.046 min², 0.093 %	Low (based on expert judgements)
PUN2: % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather-related delay causes	N/A	N/A

CEF1: Direct ANS Gate-to-gate cost per flight	N/A	N/A
AUC3: Direct operating costs for an airspace user	191,625,000 EUR/year	Medium
AUC4: Indirect operating costs for an airspace user	N/A	N/A
AUC5: Overhead costs for an airspace user	N/A	N/A
CMC1.1: Allocated vs. Requested ARES duration	N/A	N/A
CMC1.2: Allocated vs. Requested ARES dimension	N/A	N/A
CMC1.3: Deviation of Transit Time to/from airbase to ARES	N/A	N/A
CMC 1.3.1: Allocated ARES duration vs. total mission duration	N/A	N/A
CMC 1.3.2: Deviation of total mission duration by iOAT FPL validation	N/A	N/A
CMC 1.4.1: Rate of iOAT FPLs acceptance by NM systems	N/A	N/A
CMC 1.4.2: Rate of iOAT FPLs acceptance by ATC systems	N/A	N/A
CMC2.1: Fuel and Distance saved by GAT	N/A	N/A
HP1: Consistency of human role with respect to human capabilities and limitations	No change	High
HP2: Suitability of technical system in supporting the tasks of human actors	No change	High
HP3: Adequacy of team structure and team communication in supporting the human actors	No change	High
HP4: Feasibility with regard to HP-related transition factors	No change	High
FLX1: Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request	N/A	N/A

Table 2 Mandatory PIs Assessment Summary

2 Introduction

2.1 Purpose of the document

The Performance Assessment covers the Key Performance Areas (KPA) defined in the SESAR2020 Performance Framework [3]. The minimum assessed factors are the Key Performance Indicators (KPIs) and the mandatory Performance Indicators (PIs), but also additional PIs as needed to capture the performance impacts of the solution. It considers the guidance document on KPIs/PIs [3] for practical considerations, for example on metrics.

The purpose of this document is to present the performance assessment results from the validation exercises at SESAR Solution level. The KPA performance results are used for the performance assessment at strategy level and provide inputs to the SESAR3 Joint Undertaking (S3JU) for decisions on the SESAR2020 Programme.

In addition to the results, this document presents the assumptions and mechanisms (how the validation exercises results have been consolidated) used to achieve this performance assessment result.

One Performance Assessment Report shall be produced or iterated per solution.

2.2 Intended readership

In general, this document provides the ATM stakeholders (e.g. airspace users, ANSPs, airports, airspace industry) and S3JU performance data for the solution addressed.

Produced by the solution project, the main recipient in the SESAR performance management process is PJ19, which will aggregate all the performance assessment results from the SESAR2020 solution projects PJ1-18 and provide the data to PJ20 for considering the performance data for the European ATM Master Plan. The aggregation will be done at higher levels suitable for use at Master Planning Level, such as deployment scenarios.

2.3 Inputs from other projects

The document includes information from the following SESAR 2020 Wave1 projects:

- PAGAR 2019 [4]: Performance Assessment and Gap Analysis Report (2019), where the final benefits from SESAR 2020 Wave1 are collected.

PJ19 will manage and provide:

- SESAR Performance Framework (2019) [3], guidance on KPIs and Data collection support.
- S2020 Common Assumptions, used to aggregate results obtained during validation exercises (and captured into validation reports) into KPIs at the ECAC level, which will in turn be captured in Performance Assessment Reports and used as inputs to the CBAs produced by the solution projects. Also, included are performance aggregation assumptions, with traffic data items.

- For guidance and support PJ19 have put in place the Community of Practice (CoP)⁵ within STELLAR, gathering experts and providing best practices.

2.4 Acronyms and Terminology

Term	Definition
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
ATCO	Air Traffic Control Officer
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Traffic Service
AU	Airspace User
BAD	Benefits Assessment Date
BAER	Benefit Assessment Equipment Rate
BIM	Benefit Impact Mechanism
CBA	Cost Benefit Analysis
CDM	Collaborative Decision Making
CRM	Crew Resource Management
DB	Deployment Baseline
DCB	Demand Capacity Balancing
DOD	Detailed Operational Description
E-ATMS	European Air Traffic Management System
ECAC	European Civil Aviation Conference

⁵ Go to “Advanced Portfolio Manager” on the left navigation menu, and select “Coordination Group – ATM Performance Assessment (APA)” in STELLAR:

https://stellar.sesarju.eu/?link=true&domainName=saas&redirectUrl=%2Fjsp%2Fproject%2Fproject.jsp%3Fobjid%3Dxrn%3Aview%3Axrn%3Adatabase%3Aondb%2Ftable%2FSYS_MESSAGE%402333834.13%40xrn%3AprototypeView%3Adatabase.view.message.private.AllMyMessages

EET	Estimated Elapsed Time
EOBT	Estimated Off-Block Time
FEFF	Fuel Efficiency
FMP	Flow Management Position
FOC	Flight Operation Centre
HIL	Human-In-The-Loop
HP	Human Performance
HPAR	Human Performance Assessment Report
KPA	Key Performance Area
KPI	Key Performance Indicator
N/A	Not Applicable
NM	Network Manager
NMF	Network Management Function
NMOC	Network Manager Operations Centre
OI	Operational Improvement
PAGAR	Performance Assessment and Gap Analysis Report
PAR	Performance Assessment Report
P-FDCI	Proactive Flight Delay Criticality Indicator
PI	Performance Indicator
PRD	Predictability
PRU	Performance Review Unit
QoS	Quality of Service
RAD	Route Availability Documents
RBT	Reference Business / Mission Trajectory
RTS	Real Time Simulation
SAR	Safety Assessment Report
SBT	Shared Business Trajectory
SESAR	Single European Sky ATM Research Programme
S3JU	SESAR3 Joint Undertaking (Agency of the European Commission)

SIIU	Safety Impact of the Intended Use
SRM	Safety Reference Material
SRS	Safety Requirements at Service level
SWIM	System Wide Information Model
TEFF	Time Efficiency
TMA	Terminal Manoeuvring Area
TV	Traffic Volume
VALR	Validation Report

Table 3: Acronyms and terminology

2.5 Glossary of terms

See the AIRM Glossary [1] [7] for a comprehensive glossary of terms.

The following is a list of the concepts, terms or definitions introduced or commonly referred to in this document.

Term	Definition	Source
Airport Capacity Focus Area	Capture the peak runway throughput in the most challenging (or constrained) environments at busy hours, i.e. the capacity at a “maximum observed throughput” airport.	PAGAR
Airspace Capacity Focus Area	Capture the capability of a challenging volume of airspace to handle an increasing number of movements per unit time – through changes to the operational concept and technology.	PAGAR
Airspace Reservation/Restriction (ARES)	Airspace Reservation means a defined volume of airspace temporarily reserved for exclusive or specific use by categories of users (Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), and Cross-Border Area (CBA)) whereas Airspace Restriction designates Danger, Restricted and Prohibited Areas.	EC Regulation No 2150/2005
Airspace User Cost-Efficiency Focus Area	Cost-Efficiency obtained by Airspace Users other than direct gate-to-gate ATS costs (CEF1) or AU cost improvements assessed through other KPIs: Fuel Efficiency, Punctuality, etc. Note: Benefits assessed through other KPIs should not be included in this focus area to avoid double counting of benefits. AU Cost-Efficiency includes reduction of direct (AUC3) and indirect (AUC4) operational costs of the AU, as well as overhead costs (AUC5). In addition there are two specific PIs, Strategic Delay (AUC1) and Sequence Optimisation Benefit (AUC2).	PAGAR
ARES Capacity	The ability of an ATM system to accommodate specific training events which require airspace reservations and/or restrictions during a specific period of time, taking into account the duration of	Performance Framework 2017

	the training events, ATM inefficiency, planning inefficiency and weather impact on training and operations.	
ATM Master Plan	The European ATM Master Plan is the agreed roadmap to bring ATM R&I to the deployment phase, introducing the agreed vision for the future European ATM system. It provides the main direction and principles for SESAR R&I, as well as the deployment planning and an implementation view with agreed deployment objectives. Through the SESAR Key Features, the ATM Master Plan identifies the Essential Operational Changes (both Essential Operational Changes featured in the Pilot Common Project and New Essential Operational Changes) and key R&I activities that support the identified performance ambition. The ATM Master Plan is updated on a regular basis in collaboration and consultation with the entire ATM community. Amendments are submitted to the S3JU Administrative Board for adoption. The content of the European ATM Master Plan is structured in three levels (Level 1 – Executive View, Level 2 – Planning and Architecture View, and Level 3 – Implementation View) to allow stakeholders to access the information at the level of detail that is most relevant to their area of interest. The intended readership for Level 1 is executive-level stakeholders. Levels 2 and 3 of the ATM Master Plan provide more detail on the operational changes and related elements and therefore the target audience is expert-level stakeholders.	SESAR2020 Project Handbook, European ATM Master Plan (9 Edition)
Civil-military coordination and cooperation	The coordination between the civil and military parties authorised to make decisions and agree a course of action.	Performance Framework 2017
Cost-Benefit Analysis	A Cost-Benefit Analysis is a process for quantifying in economic terms the costs and benefits of a project or a programme over a certain period, and those of its alternatives (within the same period), in order to have a single scale of comparison for unbiased evaluation. This process helps decision-makers to compare an investment with other possible investments and/or to make a choice between different options / scenarios and to select the one that offers the best value for money while considering all the key criteria affecting the decision.	PAGAR
Deployment Scenario	Set of SESAR Solutions selected to satisfy the specific Performance Needs of operating environments in the European ATM System and based on the timescales in which their performance contribution is needed in the respective operating environments.	PAGAR
Flexibility KPA	The ability of the ATM System and airports to respond to changes in planned flights and missions. It covers late trajectory modification requests as well as ATFCM measures and departure slot swapping, and it is applicable to military and civil airspace users covering both scheduled and unscheduled flights. In terms of specific military requirements, it also covers the ability of the ATM System to address military requirements related to the use of airspace and reaction to short-notice changes.	Performance Framework 2017

Focus Area	Within each KPA, a number of more specific “Focus Areas” are identified in which there are potential intentions to establish performance management. Focus Areas are typically needed where performance issues have been identified.	ICAO Doc 9883
Fuel Efficiency Focus Area	The SESAR performance Focus Area concerned with fuel efficiency. How much fuel is used by aviation or by extension “Fuel efficiency” (how much fuel can be saved?) is one of the performance aspects. Note: Policy places considerable focus on this. Fuel efficiency contributes to 3 of the 11 KPAs defined by ICAO: Cost-efficiency, Efficiency, and Environment.	PAGAR
Gap Analysis	Difference between the validation targets and the performance assessment. It is used to: 1. Anticipate any deviation from the design performance targets; 2. Identify the underlying reasons; 3. Derive the appropriate recommendations to be taken on board to redirect the R&D activities within the Programme towards the ultimate achievement of SESAR2020’s performance ambitions.	PAGAR
G2G ANS Cost-Efficiency Focus Area	One of the SESAR performance Focus Areas concerned with Cost Efficiency. Direct G2G ANS costs are those costs that are charged to Airspace Users via unit rates, including ATM/CNS costs, regulatory costs, Met costs and EUROCONTROL Agency costs.	Performance Framework new
Human Performance (HP)	Human capabilities and limitations which have an impact on the safety, security and efficiency of aeronautical operations.	EUROCONTROL ATM Lexicon
Key Performance Area	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.	EUROCONTROL ATM Lexicon
Key Performance Indicator	Current/past performance expected future performance (estimated as part of forecasting and performance modelling), as well as actual progress in achieving performance objectives is quantitatively expressed by means of indicators (sometimes called Key Performance Indicators, or KPIs). To be relevant, indicators need to correctly express the intention of the associated performance objective. Since indicators support objectives, they should not be defined without having a specific performance objective in mind. Indicators are not often directly measured. They are calculated from supporting metrics according to clearly defined formulas, e.g. cost-per-flight-indicator = Sum (cost)/Sum (flights). Performance measurement is therefore carried out through the collection of data for the supporting metrics.”	ICAO Doc 9883 Performance Framework

	In SESAR2020 Performance Framework, Key Performance Indicators are those that have a validation target associated derived from the corresponding Performance Ambition.	
Local Air Quality Focus Area	One of the SESAR performance Focus Areas concerned with Environment. Local air quality is a term commonly used to designate the state of the ambient air to which humans and the ecosystem are typically exposed at a specific location. In the case of aviation, local air quality studies are generally conducted near airports.	PAGAR
Noise Focus Area	One of the SESAR performance Focus Areas concerned with Environment. The term Noise is used in this document to designate noise pollution, which is defined as unwanted sound. The impact of unwanted sounds on the recipients (in this case, people living around airports) causes adverse effects.	PAGAR
Operational Environment (OE)	An environment with a consistent type of flight operations.	EUROCONTROL ATM Lexicon
Performance Ambitions	Performance capability that may be achieved if SESAR Solutions are made available through R&D activities, deployed in a timely and, when needed, synchronised way and used to their full potential.	EUROCONTROL ATM Lexicon
Performance assessment	This term relates to the quantitative estimate of the potential performance benefit of an operational improvement based on outputs from validation projects, collected and analysed by PJ19.04.02	ICAO Doc 9883 updated in PAGAR
Performance Framework	1) The overall performance-driven development approach that is applied within the SESAR development programme to ensure that the programme develops the operational concept and technology needed to meet long-term performance expectations. 2) The set of definitions and terminology describing the building blocks used by a group of ATM community members to collaborate on performance management activities. This set of definitions includes the levels in the global ATM performance hierarchy, the eleven Key Performance Areas, a set of process capability areas, focus areas, performance objectives, indicators, targets, supporting metrics, lists of dimension objects, their aggregation hierarchies and classification schemes.	EUROCONTROL ATM Lexicon
Performance Indicator	PIs are defined in the SESAR performance framework and relate to performance benefits in specific KPAs. However, no validation targets are assigned to PIs. SESAR Solutions projects use the results of validation exercises to report performance assessment in terms of the PIs, reporting the expected positive and negative impacts. Certain PIs are mandatory for measurement and reporting by Solution projects.	SESAR2020 Project Handbook

Performance metrics	Sometimes proxies may be used in a validation exercise when it is not possible to measure an impact directly using the specified KPIs and PIs. In these cases, other metrics may be used provided the solution project later converts the results into the reporting KPIs and PIs.	SESAR2020 Project Handbook
Predictability Focus Area	Predictability is focused on in-flight (i.e. off-block to on-block) variability of flight duration compared to the planned duration. It is expected that this area will be extended in the future to reflect the improvement derived from better planning in pre-tactical phase.	Performance Framework 2019
Punctuality Focus Area	Refers to “ATM Punctuality”. It captures ATM issues as well as events related to ATM that cause a temporal perturbation to airspace user schedules.	PAGAR
Resilience Focus Area	Resilience focuses on the ability to withstand and recover from planned and unplanned events and conditions which cause a loss of nominal performance.	Performance Framework updated
Safety	The state to which the possibility of harm to persons or damage to property is reduced, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management .	EUROCONTROL ATM Lexicon
Security	(aviation) Safeguarding civil aviation against acts of unlawful interference . This objective is achieved by a combination of measures and human and material resources. Note: ATM Security is concerned with those threats that are aimed at the ATM System directly, such as attacks on ATM assets, or where ATM plays a key role in the prevention of or response to threats aimed at other parts of the aviation system (or national and international assets of high value). ATM security aims to limit the effects of a threats on the overall ATM Network. ATM Security is a subset of Aviation Security (as defined by ICAO in Annex 17).	EUROCONTROL ATM Lexicon, Notes are from PAGAR
SESAR2020	The Programme for SESAR2020 was created with a clear and agreed need for continuing research and innovation in ATM beyond the SESAR 1 development phase. SESAR2020 is structured into three main research phases, starting with Exploratory Research, which is then further expanded within a Public-Private-Partnership (PPP) to conduct Industrial Research and Validation. Finally, it further exploits the benefits of the PPP in Demonstrating at Large Scale the concepts and technologies in representative environments to firmly establish the performance benefits and risks.	Performance Framework 2017
SESAR Programme	The programme which defines the Research and Development activities and Projects for the S3JU.	EUROCONTROL ATM Lexicon
SESAR Solution	A term used when referring to both SESAR ATM Solution and SESAR Technological Solution.	SESAR2020 Project Handbook
SESAR ATM Solution	SESAR Solutions relate to either an Operational Improvement (OI) step or a group of OI steps with associated Enablers (technical system, procedure or human), which have been designed, developed and validated in response to specific Validation Targets	SESAR2020 Project Handbook

	and that are expected deliver operational and/or performance improvements to European ATM, when translated into their effective realisation. SESAR Technological Solutions relate to verified technologies proven to be feasible and profitable, which may therefore be considered to enable future SESAR Solutions.	
Single European Sky-High Level Goals	The SES High Level Goals are political targets set by the European Commission. Their scope is the full ATM performance outcome resulting from the combined implementation of the SES pillars and instruments, as well as industry developments not driven directly by the EU.	SESAR2020 Project Handbook
Sub-OE	A subcategory of an Operating environment, classified according to its complexity (e.g. high complexity TMA, medium complexity TMA, low complexity TMA).	EUROCONTROL ATM Lexicon
Validation targets	Validation targets are the targets that focus on the development of enhanced capabilities by the SESAR Solutions. They aim to secure from R&D the required performance capability to contribute to the achievement of the Performance Ambitions and, thus, to the SES high-level goals. In SESAR2020 validation targets are associated with a KPI.	EUROCONTROL ATM Lexicon

Table 4: Terminology

3 Solution Scope

3.1 Detailed Description of the Solution

The objective of SESAR Solution PJ.07-W2-38 - *Enhanced integration of AU trajectory definition and network management processes*, is to reduce the impact of ATM planning on Airspace Users' costs of operations, by providing them with better access to ATM resource management and allowing them to better cope with ATM constraints. This shall improve Airspace Users flight planning and network management through improved FOC participation into the ATM network collaborative processes.

This solution analyses the provision of enriched DCB information like Protection Hotspots, which the NMF can declare to protect an airspace from undesired rerouted flights. The Protection Hotspots will follow the same publication rules as the current (resolution) hotspots and have similar attributes. The Protection Hotspot information is provided to the AU, mainly in the context of 'what-if' functions, to be used prior to their decision to change a flight plan. It does not intend to trigger the change of trajectories for flights already planned in the hotspot.

Additionally, to support trajectory negotiation processes, the AU can provide information about really critical flights of the fleet to the NMF before any DCB measure is allocated, and for which DCB delay is particularly costly and should be avoided. The intention is that the NMF considers this information before implementing any measure.

The following OIs belongs to the scope of this solution:

OI Step code	OI Step title (CR 06650 Update AUO-0219 (PJ.07-W2-38))
AUO-0219	Use of Enriched DCB Information and Enhanced What-Ifs to Improve AU Flight Planning

Enriched DCB information will be available to improve AUs decision process when planning or re-planning trajectories. Enriched DCB information encompasses DCB constraints/measures information like ATFCM regulations/CTOT/STAM; and additional DCB information such as hotspots. Enriched DCB information is provided either for the trajectory planned by the AU as part of a submitted flight plan or for alternative trajectories considered in the context of advanced what-if. The information can be used in different use-cases: proactive management of fleet delays by AUs, CDM processes triggered by flow managers (e.g., STAM/Cherry picking measures).

Enriched DCB information and advanced what-if functions can be accessible via SWIM services to enable full integration of flight planning and ATFCM information in AU systems and further automation of AU decisions related to flow management constraints.

OI Step code	OI Step title (CR 06649 Update AUO-0208 (PJ.07-W2-38))
AUO-0208	Use of Simple AU Preferences in DCB Processes

As part of CDM processes, the AU can provide preferences information even before the publication of DCB constraints. This information is considered in the DCB processes to define or refine measures to reduce the impact on the AU costs, when possible. Simple preferences refer more specifically to light information like proactive flight delay criticality indicators that can be considered by NMF human operators and systems - either at regional, sub-regional or local levels - to avoid ATFCM delay (e.g., slot exemption or level capping/re-routing proposal to avoid an ATFCM regulation) for critical flights.

Table 5: SESAR Solution 38 Scope and related OI steps/enablers

More detailed information about the Solution and its goals can be found in the Solution SPR-INTEROP/OSED - Part I [21].

At the beginning of Wave 2, two additional OIs were in the solution scope: AUO-0206 and AUO-0207. Since then, the AUO-0206 is moved to solution PJ.07-W2-38.1. Therefore, this performance assessment does not cover these OIs and related validation targets.

3.2 Detailed Description of Relationship with Other Solutions

The below table is summarising the identified relationships with other Solutions [5].

Solution Number	Solution Title	Relationship	Rational for the relationship
PJ07-W2-38 with PJ07-W2-39	Collaborative framework for managing arrival within an ATFM regulation	Preferable	The solution is linked to PJ07-W2-39, through the provision of FDCIs set-up by the Airspace Users. These inputs are expected to be used in the UDPP measure design (integration to be developed).
PJ07-W2-38 with PJ09-W2-44	Dynamic Airspace Configuration	Preferable	The solution 38 is related to PJ07-W2-44 for the management of protection hotspots since solution 44 is addressing more generally the management of hotspots at local flow management level. However, S38 protection hotspot topic can be implemented independently from S44, and associated benefits have been assessed in that deployment configuration.

Table 6: Relationships with other Solutions

4 Solution Performance Assessment

4.1 Assessment Sources and Summary of Validation Exercise Performance Results

Previous Validation Exercises (pre-SESAR2020 Wave 2, etc.) relevant for this assessment are listed below.

Organisation	Document Title	Publishing Date
SESAR 2020 Wave 1, PJ07.01	SESAR Solution 07.01 – VALR V2 - Part I, Edition 00.01.00	September 2019

Table 7: Pre-SESAR2020 Exercises

SESAR Validation Exercises of this solution [22] are listed below.

Exercise ID	Exercise Title	Release	Maturity	Status
EXE-PJ07W238-01	Network Stability assessment	R12	V3	Completed (Mar 2021)
EXE-PJ07W238-02	Hotspot definition refinement	R12	V3	Completed (Nov 2021)
EXE-PJ07W238-03	Pro-active FDCI definition refinement	R12	V3	Completed (Nov-Dec 2021)
EXE-PJ07W238-04	Full Human in The Loop	R12	V3	Completed (May 2022)

Table 8: SESAR2020 Validation Exercises

Four validation exercises have been performed in Wave 2:

- EXE-PJ07W238-01 and EXE-PJ07W238-02 with focus on Enriched DCB (AUO-0219).
- EXE-PJ07W238-03 with focus on P-FDCI (AUO-0208).
- EXE-PJ07W238-04 integrated both conceptual subjects.

The above exercises have allowed both OIs to reach V3 maturity status.

Table 9 provides a summary of information collected from available performance outcomes. Detailed information on the validation results and particularly their final conclusions and recommendations, are available in the relevant section of the VALR [22].

OI Step	Exercise	Exercise scenario & scope	Performance Results	Notes
AUO-0219	EXE-PJ07W238-01	The EXE performed automated runs using the EUROCONTROL PLANTA prototype (no user involved) simulating AU behaviours to assess the feasibility to automate (fully or partially) AU trajectory re-planning processes taking into account dynamic DCB constraints. It also allowed the obtaining of results at ECAC wide scale, and the ability to have a representable quantitative measure on network stability.	Concerning performance assessment, the validation has provided the following results: Even if greater automation of AU refiling processes increases the number of planned re-routings to avoid regulations, these exercises demonstrated that protection hotspots can avoid significant number of inefficient refilings allowing a fuel burnt decrease. This may have a potential impact on Capacity due to reduced instability.	Objective of EXE: benefit quantification
	EXE-PJ07W238-02	Human-In-The-Loop (HIL) EXE. As the objective was to refine requirements on Protection Hotspot definition and associated procedures, roles and responsibilities, FMPs were involved using the PLANTA prototype. AU behaviours were simulated as in the previous exercise to evaluate the impact of protection hotspots publication on network stability.	The reduction of the number of regulations and the ATFCM delay represents a benefit in terms of departure Punctuality and AU Cost-efficiency. The impact is considered as marginal on other KPAs (Equity, Flight Times).	Objective of EXE: operational feasibility (FMPs)
AUO-0208	EXE-PJ07W238-03	The objective was to refine requirements on P-FDCI definition, associated rules, roles, and responsibilities. Both AUs and FMPs were involved in this Human-In-The-Loop (HIL) activity.	The context of the validation exercises did not allow the measurement of quantitative metrics. Nevertheless, some conclusions have been agreed by the operational experts: The concept allows a reduction to the ATCFM delay which has a positive impact on AU Cost Efficiency and Punctuality. P-FDCI concept will have marginal impact on Predictability, Fuel Efficiency, Flight Times, and Capacity. The impact on Equity will be limited thanks to implementation of quotas. The concept does not have any impact on Safety.	Objective of EXE: operational feasibility

AUO-0219 and AUO-0208	EXE-PJ07W238-04	Human-In-The-Loop (HIL) activity. The objective was to refine requirements on enriched DCB information sharing, P-FDCI definition, associated rules, roles, and responsibilities. Both AUs and FMPs were involved.	See above.	Objective of EXE: process refinement, integration of both concepts, technical feasibility
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Table 9: Summary of Validation Results – Wave 2

In addition to the above validations, results stemming from the V2 exercise EXE-07.01.02/3 performed in the previous Wave of SESAR, Solution 07.01, were used as an input representing AUO-0219 contribution in Winter season.

4.2 Conditions / Assumptions for Applicability

Table 10 summarises the applicable operating environments (OE).

OI Step	OE	Applicable sub-OE	Special characteristics
AUO-0208	En-route, Terminal, Airport	Very High, High, Medium complexity	NIL
AUO-0219	En-Route, Terminal	Very High, High, Medium complexity	NIL

Table 10: Applicable Operating Environments

A list of assumptions used for extrapolation of validation performance into ECAC wide performance results is shown in Table 11 below.

Assumption	ID	Source	Value
Average ECAC flight time	T-0010	SESAR2020_Common_Assumptions 2019_annex1	1.7 hr
Average fuel burn per flight	F-0001	SESAR2020_Common_Assumptions 2019_annex1	5280 kg
CO ₂ /fuel ratio	-	EUROCONTROL Standard Inputs for Cost Benefit Analyses	3.15

Table 11: Other assumptions

There is no specific airborne equipage required to deploy this solution.

4.3 Safety

4.3.1 Safety Design drivers and Performance Mechanism

The safety information in this PAR makes use of the Solution 38 Safety Assessment Report (SAR) [25] and the PJ07-W2-38 validation report VALR [22].

Based on the SESAR2020 SRM guidance update, in order to address the change introduced by PJ07-W2-38 impacting “Other-than-ATS” operational services (e.g. DCB service provided by NMF), a set of SIIU (Safety impact of the Intended Use) have been identified.

The baseline for defining the change for the Other-than-ATS operational services are the services as defined by the regional Network Manager (NM) in the NM Flow and Capacity Management Service Specification[27]. Even though the baseline refers only to regional NM services, the services in the SIIUs defined in this section refer to the NMF. SIIUs were defined only on the services where it was identified that PJ07-W2-38 is introducing a change with safety impact.

SIIUs

Due to the indirect safety impact that the service may have on ATS operations if the service is not properly delivered, a set of SIIU needs to be defined. The following high-level SIIU was derived in order to express the impact on the Short Term DCB service:

SIIU000: The change introduced by PJ07-W2.38 to the NM Flow and capacity management service shall not increase the number of overloads.

This high-level SIIU needs to be further fragmented according to the components of the short term DCB service:

- In order to account for the impact on the “Load and Capacity Monitoring” service (this service includes provision of traffic demand and capacity data to NM users, as well as monitoring of these data to ensure demand does not exceed the declared capacity; it contains two service components: *Demand Data Provision* and *ATC sector load and capacity monitoring*):
 - *SIIU001: The Load and Capacity Monitoring service delivered to ATS, service that is impacted by PJ07-W2.38 with the possibility of publishing Protective Hotspots, provision of Enriched DCB information and AU inputs, shall at least not increase the number of overloads.*
- In order to account for the impact on the *ATFCM measure design* function inside the “Demand and Capacity Balancing” service (purpose of this service is to react when the predicted traffic demand is higher than the available capacity by considering, assessing and implementing adequate solutions - ATFCM measures; it contains, among others, the following functions identified as impacted by the solution: *ATFCM measure design* and *Network cherry-pick regulations*):
 - *SIIU002: The ATFCM measure design service delivered to ATS, service which is modified by PJ07-W2.38 with the AUs inputs and new functionalities (e.g. What-if/What-else) shall not increase the number of overloads.*
 - *SIIU003: The Network cherry-pick regulations service delivered to ATS, service which is modified by PJ07-W2.38 with the AUs inputs and new functionalities (e.g. What-if/What-else) shall not increase the number of overloads.*

4.3.2 Data collection and Assessment

The safety-relevant validation results of the PJ07-W2-38 exercises (documented in the PJ07-W2-38 validation report VALR [22]) are summarised in Table 12 below, whilst indicating for each SRS that has been covered the level of safety evidence that has been obtained.

Validation Objective ID	Success Criterion	Ex 01	Ex 02	Ex 03	Ex 04	Validation Results	Validation Objective Status
OBJ-PJ07W238-V3-VALP-K18 Safety Performance Assessment for AUO-0219	The enriched DCB information exchange does not increase the level of saturation of regulated TVs.	OK	OK	-	N/A	The answers from exercise participants and the quantitative data on occupancy counts reflect that the change in saturation of regulated TVs is not identified as a problem.	OK
	The enriched DCB information exchange does not negatively impact the timely detection of overloads and/or definition of a hotspot.	-	OK	-	N/A	Exercise participants did not detect any impact on the traffic demand.	
	The positive treatment of enriched DCB information exchange does not have a negative impact onloading other TVs	-	OK	-	N/A	No over-demand due to rerouting was detected by the participants.	
OBJ-PJ07W238-V3-VALP-K26 Safety Performance Assessment for AUO-0208	The treatment of Pro-active FDCI requests does not negatively impact the hotspot resolution.	-	-	OK	OK	The NMF considered that they can manage the protection hotspot area containing the P-FDCI flights.	OK
	The treatment of Pro-active FDCI requests does not increase the level of saturation of regulated TVs.	-	-	OK	OK	The NMF considers that the P-FDCI request do not increase the level of saturation of the regulated traffic volumes.	

Table 12: Safety relevant validation results

4.3.2.1 AUO-0219

The solution has shown the traffic trends are slightly redistributed on the TVs, which increases and decreases their demand. In general, no particular impact was detected on overdemand. All EXE-PJ07W238-02 participants assessed that safety would not be impacted.

Table 13 summarises the conclusions made.

Success criteria	Conclusions	Success criteria Status	Objective status
CRT-PJ07W238-V3-VALP-K18-001	The solution demonstrated that the enriched DCB information exchange does not increase the level of saturation of regulated TVs.	OK	OK
CRT-PJ07W238-V3-VALP-K18-002	The solution demonstrated that the enriched DCB information exchange does not negatively impact the timely detection of overloads and/or definition of a hotspot.	OK	
CRT-PJ07W238-V3-VALP-K18-003	The exercise demonstrated that the positive treatment of enriched DCB information exchange does not have a negative impact on-loading other TVs.	OK	

Table 13: AUO-0219 safety impact conclusions

4.3.2.2 AUO-0208

EXE-PJ07W238-03 and EXE-PJ07W238-04 exercise questionnaire answers:

- The NMF considered that they can manage the protection hotspot area containing the P-FDCI flights. They rely on the quota management in order to keep the demand and capacity balance.
- The majority of the NMF actors agreed that accommodating the critical flights will not saturate the regulated traffic volumes.

It is important to note that the accommodation of P-FDCI flights will happen when the NMF decides to do so. There is no commitment from NMF to always improve the P-FDCI flights. Therefore, when they accommodate them, it will be because they have the capacity. Table 14 summarises the conclusion made.

Success criteria	Conclusions	Success criteria Status	Objective status
CRT-PJ07W238-V3-VALP-K26-001	The solution demonstrated that the treatment of Pro-active FDCI requests does not negatively impact the hotspot resolution.	OK	OK
CRT-PJ07W238-V3-VALP-K26-002	The solution demonstrated that the treatment of Pro-active FDCI requests does not increase the level of saturation of regulated TVs.	OK	

Table 14: AUO-0208 safety impact conclusions

4.3.3 Extrapolation to ECAC wide

The four validation exercises performed in PJ07-W2-38 covered all ECAC area with some specific validation scenarios in the French and Italian ACCs, including TMA and Upper sectors, with high, and very high complexity.

Being a network solution, there is no element, which would prevent the extrapolation of the safety-related results from the achieved validation exercises to all the applicable sub-operational environments.

4.3.4 Discussion of Assessment Result

Only qualitative information was collected in the RTS. However, these results together with other safety related activities (e.g. workshops, HAZIDs) enable to conclude that safety is not negatively impacted and the SIIUs can be achieved.

4.3.5 Additional Comments and Notes

There are no additional comments.

4.4 Environment: Fuel Efficiency / CO2 emissions

4.4.1 Performance Mechanism

4.4.1.1 AUO-0219

BIM Figure 1 applicable to AUO-0219 and Stakeholder AU presents that providing accurate and enriched DCB information to AUs will allow them to better plan/re-plan their flights (1a).

By taking into account enriched DCB information, AUs can adapt their planned trajectories to mitigate the impact of DCB delay measures, however, in some cases it could be suboptimal with a tendency to increase fuel burn. On the other hand, some RADs & Scenarios could be avoided which will positively impact Fuel Efficiency (2b).

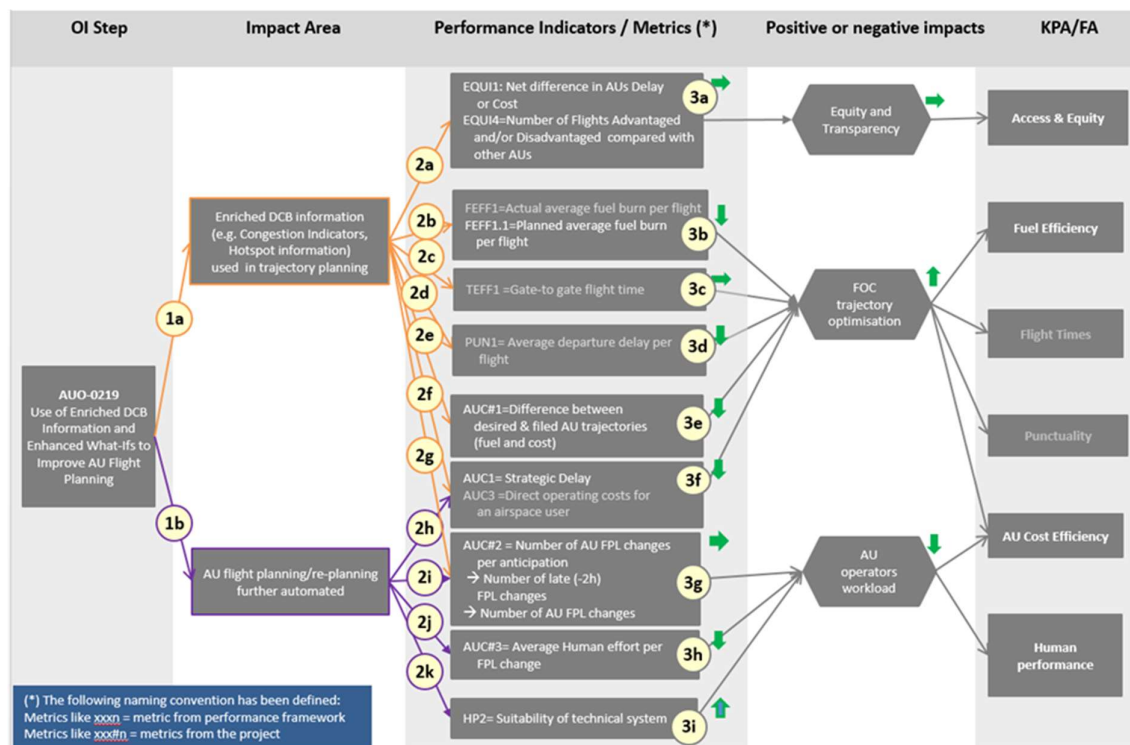


Figure 1: Flight Efficiency - BIM for AUO-0219 and Stakeholder AU [21]

4.4.1.2 AUO-0208

BIM Figure 2 applicable to AUO-0208 and Stakeholder AU presents that by allowing AUs to proactively provide preferences (pro-active FDCI) this will improve DCB processes and allow the NMF to propose DCB measures and/or negotiate trajectories (1a).

Minimising the impact on airline scheduling will allow departure times closer to the optimum and thus FOC trajectory could be considered as optimised. The flight is optimised in terms of time or 3D trajectory (gain on delay or gain on fuel), which is linked to Fuel Efficiency (3d, 3e, 3f).

Reducing the strategic delay and the direct operating costs for AUs will allow more flights to maintain optimised trajectory, which is linked to Fuel Efficiency (3g).

Increasing the percentage of AU preferences respected when SBT is affected by a DCB measure will improve the FOC trajectory optimization, which is linked to Fuel Efficiency (3i).

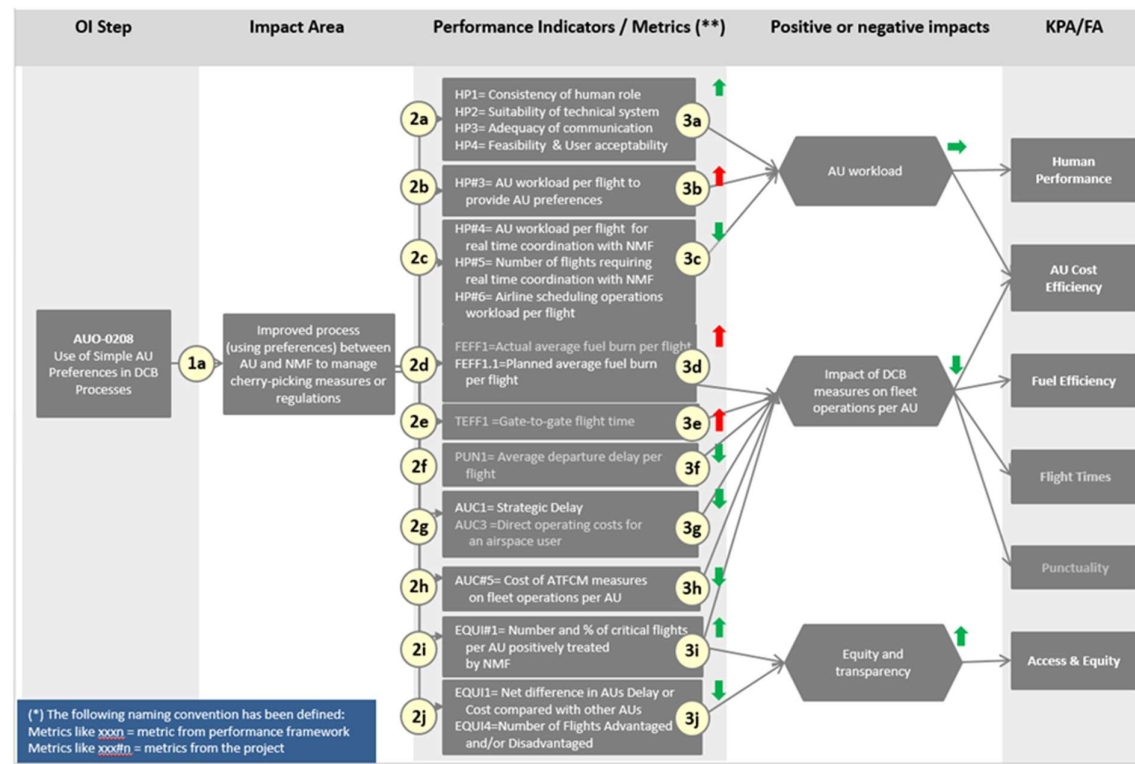


Figure 2: Flight Efficiency - BIM for AUO-0208 and Stakeholder AU [21]

4.4.2 Assessment Data (Exercises and Expectations)

4.4.2.1 AUO-0219

Validation results (OBJ-PJ07W238-V3-VALP-K11) – Summer season

The results of EXE-01 for the five simulation days, covering the whole ECAC traffic and Summer season, are shown in the table below.

	05-07-2019	06-07-2019	07-07-2019	08-07-2019	09-07-2019	Average
Total flights	36139	31903	33431	35077	34474	34205
Rerouted flights	459	516	400	384	372	426
Rerouted flights (%)						1.25%
Delta fuel (kg)	+27938	+48940	+30386	+28564	+18394	+30844.4
Delta fuel per rerouted flight (kg/flight)	+61	+95	+76	+74	+49	+71
Delta fuel per flight (kg/flight) (ECAC wide)						+0.91

Table 15: Fuel efficiency results of EXE-01

The results of EXE-02 are shown in the table below.

	05-07-2019	06-07-2019	Average
Delta fuel (kg)	+7503	+10696	+9099.5
Delta fuel per rerouted flight (kg/flight)	+142	+214	+178

Table 16: Fuel Efficiency results of EXE-02

In case of AUO-0219, only EXE-01 results are taken into account for further assessment of performance as they are considered more accurate and representative than the results of EXE-02. This is due to the fact that EXE-01 was run as full ECAC wide RTS. EXE-02 covered only part of ECAC (two ACCs in France and two in Italy) and included scenarios with more degraded traffic situations.

Therefore, the delta fuel per flight (kg/flight) (ECAC wide) stemming from AUO-0219 and applicable for Summer season is: **+0.91 kg/flight (additional fuel)**.

Validation results on AUO-0219 from SESAR2020 Wave1 (Solution 07.01) - Winter season

In the previous wave of SESAR, Solution 07.01 validated the expected performance benefit for Fuel Efficiency as part of the exercise EXE-07.01.02/3. The results for the nine days of simulations, covering the whole ECAC traffic in Winter season, are shown in the table below.

	18-01	19-01	20-01	21-01	22-01	23-01	24-01	25-01	25-02	Average
Total flights	27554	21299	24427	26363	24179	24534	23918	27142	27347	34205
Rerouted flights	253	195	128	237	79	33	35	427	354	426
Rerouted flights (%)										0.75%
Delta fuel per rerouted flight (kg)										+37.0
Delta fuel per flight (ECAC wide)										+0.31

Table 17: Fuel Efficiency results of EXE-07.01.02/3 (Wave 1)

The delta fuel per flight (kg/flight) (ECAC wide) stemming from AUO-0219 and applicable for Winter season is: **+0.31 kg/flight (additional fuel)**.

4.4.2.2 AUO-0208

In case of AUO-0208 exercises, EXE-03 was intended to validate the impact on Fuel Efficiency (OBJ-PJ07W238-V3-VALP-K21). However, this was not assessed as there was no data available for quantitative analysis. Therefore, it was decided by the Solution team that EXE-01 results will be used in the Performance Assessment, but instead of the number of re-routed flights, the number of 'critical' flights has been estimated by solution experts and in cooperation with the Network Manager Operations Centre (NMOC).

The estimation is shown in the following table.

	Light/medium day (Winter season)	Heavy day (Summer season)
Number of extra critical flights per day treated through RRPs (ECAC wide) = 20% of RRP in current operations	9	13

Table 18: Assumptions on number of critical flights for AUO-0208

The table below provides the calculation of Fuel Efficiency benefits for AUO-0208, using the results from EXE-01 for Summer season and EXE-07.01.02/3 (Wave 1) for Winter season.

	Summer season	Winter season
	Average	
Total flights	34205	25196
Critical flights treated through RRP	13	9
Critical flights (%)	0.04%	0.04%
Delta fuel per critical flight (kg)	+71	+37
Delta fuel per flight (ECAC wide)	+0.03	+0.01

Table 19: Fuel Efficiency benefits of AUO-0208

To summarise, the delta fuel per flight (kg/flight) (ECAC wide) stemming from AUO-0208 and applicable for Summer season is: **+0.03 kg/flight (additional fuel)**. The delta fuel per flight (kg/flight) (ECAC wide) applicable for Winter season is: **+0.01 kg/flight (additional fuel)**.

4.4.3 Extrapolation to ECAC wide

The following inputs are used for the ECAC wide performance calculation:

- EXE-PJ07W238-01 results (Solution PJ07-W2-38)
- EXE-07.01.02/3 results (Solution 07.01 (Wave 1))
- Assumptions on share of traffic (*source: expert judgement, Solution 07.01*):
 - Summer period traffic: 60%
 - Winter period traffic: 40%
- Other assumptions:
 - Average fuel burn per flight (kg) = 5280kg
 - CO₂/Fuel ratio = 3.15

4.4.3.1 AUO-0219

The aggregated results of extrapolation of FEF1 benefits of AUO-0219 are as follows:

- Absolute expected performance benefit in SESAR2020:
0.91 kg/flight * 60% + 0.31 kg/flight * 40% = **0.67 kg/flight (Delta fuel per flight (ECAC wide, whole year)) (additional fuel)**
- % expected performance benefit in SESAR2020:
0.67 kg/flight / 5280 kg = **0.01% (Delta fuel (%) (ECAC wide, whole year)) (additional fuel)**

The aggregated results of extrapolation of ENV1 benefits of AUO-0219 are as follows:

- Absolute expected performance benefit in SESAR2020:
0.67 kg/flight (Delta fuel per flight (ECAC wide)) * 3.15 (CO₂/Fuel ratio) = **2.11 kg/flight (Delta CO₂ per flight (ECAC wide)) (additional CO₂)**
- % expected performance benefit in SESAR2020:
0.01% (Delta CO₂ (%) (ECAC wide)) (additional CO₂)

4.4.3.2 AUO-0208

The aggregated results of extrapolation of FEF1 benefits of AUO-0208 are as follows:

- Absolute expected performance benefit in SESAR2020:
0.03 kg/flight * 60% + 0.01 kg/flight * 40% = **0.02 kg/flight (Delta fuel per flight (ECAC wide, whole year)) (additional fuel)**
- % expected performance benefit in SESAR2020:
0.02 kg/flight / 5280 kg = **0.00% (Delta fuel (%) (ECAC wide, whole year)) (additional fuel)**

The aggregated results of extrapolation of ENV1 benefits of AUO-0208 are as follows:

- Absolute expected performance benefit in SESAR2020:
0.02 kg/flight (Delta fuel per flight (ECAC wide)) * 3.15 (CO₂/Fuel ratio) = **0.07 kg/flight (Delta CO₂ per flight (ECAC wide)) (additional CO₂)**
- % expected performance benefit in SESAR2020:
0.00% (Delta CO₂ (%) (ECAC wide)) (additional CO₂)

4.4.3.3 Summary

The results for FEF1 and ENV1 performance assessment at Solution level are below.

	AUO-0219	AUO-0208	SOLUTION
Absolute expected performance benefit in SESAR2020 (kg/flight)	+0.67	+0.02	+0.69
% expected performance benefit in SESAR2020	+0.01%	+0.00%	+0.01%

Table 20: FEF1 benefit – Solution level

	AUO-0219	AUO-0208	SOLUTION
Absolute expected performance benefit in SESAR2020 (kg/flight)	+2.11	+0.07	+2.18
% expected performance benefit in SESAR2020	+0.01%	+0.00%	+0.01%

Table 21: ENV1 benefit – Solution level

<i>KPIs / Pls</i>	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
FEFF1 Actual Average fuel burn per flight	Kg fuel per movement	Total amount of actual fuel burn divided by the number of movements	YES	0.69 kg/flight (additional fuel)	0.01% (additional fuel)
ENV1 Actual Average CO2 Emission per flight	Kg CO2 per flight	Amount of fuel burnt x 3.15 (CO2 emission index) divided by the number of flights	YES	2.18 kg/flight (additional CO2)	0.01% (additional CO2)

Table 22: Fuel burn and CO2 emissions saving for Mandatory KPIs /Pls

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
FEFF1 Actual Average fuel burn per flight	N/A	N/A	0.69 kg/flight (additional fuel)	N/A	N/A
ENV1 Actual Average CO2 Emission per flight	N/A	N/A	2.18 kg CO2/flight (additional CO2)	N/A	N/A

Table 23: Fuel burn and CO2 emissions saving per flight phase

4.4.4 Discussion of Assessment Result

The assessed performance results are not meeting the assigned Validation Target⁶ for FEFF1: Fuel Efficiency - Actual average fuel burn per flight being at the medium impact level (4.19-14.87 kg/flight) [8][5]. The validations showed a very limited negative impact on fuel efficiency as a consequence of greater automation of AU refueling processes increasing the number of planned re-routings to avoid regulations. On the other hand, the exercises demonstrated that protection hotspots can avoid significant number of 'inefficient' refuelings allowing a fuel burn decrease. There is also potential for protection hotspots to allow the disabling of some RAD constraints. However, this was not measured by the validations.

Few limitations of validations need to be taken into account when evaluating the results:

- Regarding exercises dealing with enriched DCB information, most of the sessions combined two features: sharing of protection hotspot information and the automation of refueling processes. This resulted in difficult interpretation of results, in particular regarding Fuel Efficiency and Predictability KPAs since the two features have opposite effects on the concerned KPAs.

⁶ At the beginning of Wave 2, when the performance targets were setup, two additional OIs were in the solution scope: AUO-0206 and AUO-0207. Since then, the AUO-0206 is moved to solution PJ.07-W2-38.1. Therefore, this performance assessment does not cover these OIs and related validation targets.

- Fuel consumption metric was based on NM calculation, which does not take into account actual aircraft performance.

4.4.5 Additional Comments and Notes

No additional comments.

4.5 Environment / Emissions, Noise and Local Air Quality

There is no impact on Emissions, Noise and Local Air Quality expected from the Solution PJ.07-W2-38.

The reduction of the number of inefficient re-filings may have a potential impact on Capacity due to reduced instability.

4.6.1.1 AUO-0219

AU trajectory planning taking into account enriched DCB information (e.g. Hotspot Information) will allow better management of network effects and utilisation of available capacity, therefore minimising the creation of new hotspots and regulations. Moreover, the impact of DCB measures will be reduced as AUs will have the possibility to adapt their trajectories considering hotspot information. Resulting in fewer flights being affected by DCB measures (2a).

With less DCB measures, fewer flights affected by DCB measures and proposed DCB measures more aligned with business needs it is expected to result in improved Network Performance, which is linked to Network Capacity and Safety (3a).



There is no impact on Airspace Capacity expected from AUO-0208.

4.6.2 Assessment Data (Exercises and Expectations)

4.6.2.1 AUO-0219

Validation results (OBJ-PJ07W238-V3-VALP-K17)

In case of criteria 'The number of ATFCM Regulations is reduced compared to the reference baseline without enriched DCB information', the answers to the questionnaires from the participants show that this objective was successfully met. It is confirmed by the fact that recorded data did not show any transformation from protection hotspot to regulation.

In case of criteria 'The number of flights affected by DCB measures is reduced', the solution demonstrated that there were no additional affected flights as no new regulations due to rerouting flights were needed. The answers to the questionnaires reinforced this quantitative observation.

In the EXE-02, 16 protection hotspots were declared but none of them needed to be transformed into a regulation. From the AUs (automated) point of view, 11 flights found a protection hotspot in the desired rerouting alternative. From those 11 flights, seven renounced to the interesting new route and 4 filed the new flight plan becoming an infringer flight.

That observation in the recorded data is aligned with the participants responses to the questionnaires, which are shown in the figure below.

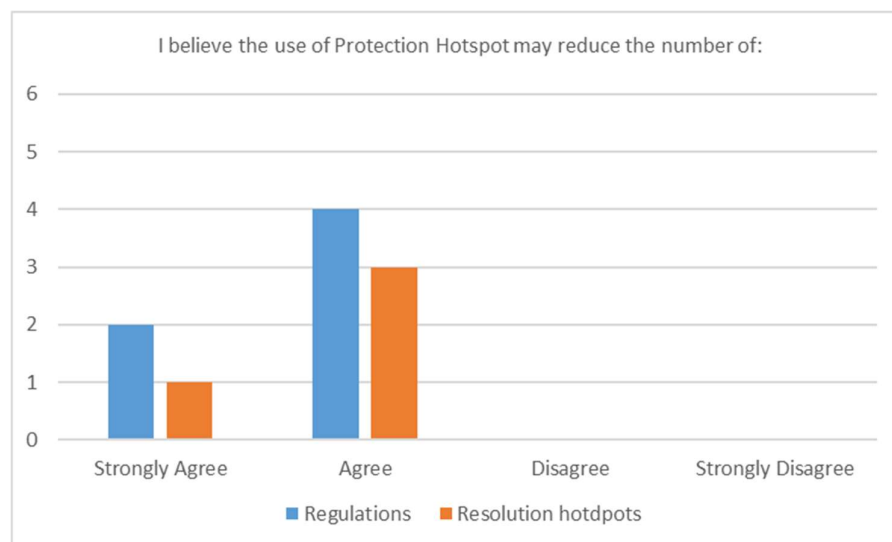


Figure 4: Airspace Capacity – EXE-02 questionnaire results [22]

4.6.2.2 AUO-0208

Not applicable.

4.6.2.3 Summary

In summary, validation activities confirmed potential positive impact of the solution and specifically OI step AUO-0219 on Network Capacity. However, no quantitative data was measured and assessed by this Performance Assessment.

Exercise ID or Expert judgement	Benefits contribution to CAP1	Benefits contribution to CAP2
EXE-01 (AUO-0219)	N/A	N/A
EXE-02 (AUO-0219)	N/A	Not measured - no quantitative data available

Table 24: Airspace Capacity benefits per Exercise

OI step	Relative benefits contribution to CAP1	Relative benefits contribution to CAP2
AUO-0219	N/A	100%
AUO-0208	N/A	0%
TOTAL	N/A	100%

Table 25: Airspace Capacity relative benefits per OI step

KPIs / Pls	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
CAP1 TMA throughput, in challenging airspace, per unit time	Relative change of movements (% and number of movement)	% and also total number of movements per volume of TMA airspace per hour for specific traffic mix and density, for High and Medium Complexity TMAs. TMA at peak demand hours.	YES	N/A	N/A
CAP2 En-route throughput, in challenging airspace, per unit time	Relative change of movements (% and number of movement)	% and also total number of movements, per volume of En-route airspace per hour for specific traffic mix and density, for High and Medium Complexity TMAs airspace at peak demand hours.	YES	Not measured - no quantitative data available	Not measured - no quantitative data available

Table 26: Airspace benefits for Mandatory KPIs /Pls

SESAR2020 Wave1 Solution 07.01 indicated that there is an impact in airspace capacity, but not directly, and that the solution will enable improvement in capacity through more efficient DCB processes. This aspect was addressed by solution 09.03. [23]

4.6.3 Extrapolation to ECAC wide

There are no quantitative results available. There is also no ECAC wide extrapolation required for this KPI in the Performance Assessment Report.

4.6.4 Discussion of Assessment Result

As there were no validation targets assigned by PJ19 to Solution 38, there is no gap between the expected performance and assessment results.

4.6.5 Additional Comments and Notes

There are no additional comments.

4.7 Airport Capacity (Runway Throughput Flights/Hour)

There is no impact on Airport Capacity expected from the Solution PJ.07-W2-38.

4.8 Resilience (% Loss of Airport & Airspace Capacity Avoided)

There is no impact on Resilience expected from the Solution PJ.07-W2-38.

4.9 Flight Times

4.9.1 Performance Mechanism

4.9.1.1 AUO-0219

BIM Figure 5 applicable to AUO-0219 and Stakeholder AU presents the impact area of providing accurate and enriched DCB information (e.g. Hotspot Information) to AUs will allow them to better plan/re-plan their Flights (1a).

Taking into account enriched DCB information (e.g. Hotspot Information), AUs should adapt planned trajectories to mitigate the impact of DCB delay measures, however, in some cases it could be suboptimal with tendency to increase flight time duration. On the other hand, some RADs and Scenarios could be avoided, and it could have a positive impact on flight time duration (2c). As the flight duration will remain stable, no impact is foreseen on Flight Times (3c).

Considering enriched DCB information (e.g. Hotspot Information) for situation awareness and decision making will allow AUs to better align the filed trajectory to their desired one (2e). Reducing the difference between desired & filed trajectories will allow FOC to better optimize trajectories, which is linked to Flight Times (3e).

Due to improved utilisation of available capacity, there will be a reduction of costs for AUs including strategic delay and direct operating costs (2f). Reduction of these costs will allow more flights to maintain their optimised trajectory, which is linked to Flight Times (3f).

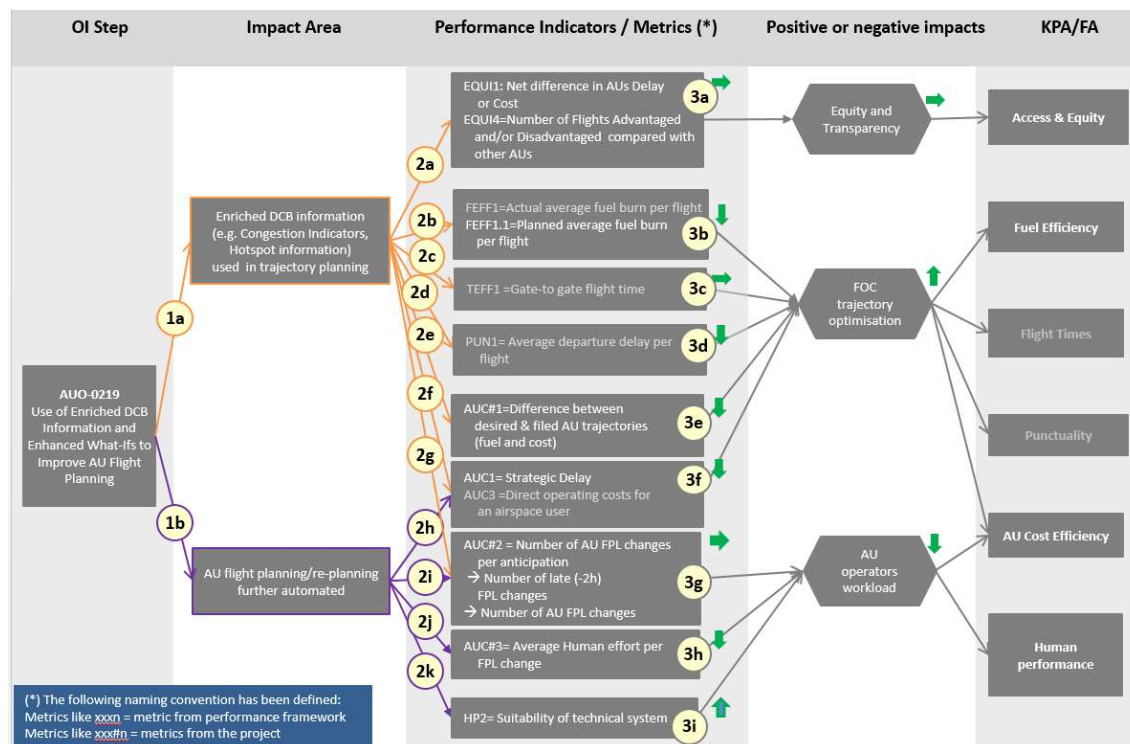


Figure 5: Flight Times - BIM for AUO-0219 and Stakeholder AU [21]

4.9.1.2 AUO-0208

BIM Figure 6 applicable to AUO-0208 and Stakeholder AU reports through the impact area that allowing AUs to proactively provide preferences (pro-active FDCI) will improve DCB processes and allow NMF to propose DCB measures and/or negotiate trajectories (1a).

Taking into account AU preference information, the NMF will propose that AUs adapt planned trajectories to mitigate the impact of DCB measures on departure punctuality. In some cases it could be suboptimal with tendency to increase the flight time duration (only for a very limited number of flights) (2e). Minimising the impact on airline scheduling will allow departure times closer to the optimum, therefore, FOC trajectory could be considered as optimised. The flight is optimised in terms of time or 3D trajectory (gain on delay or gain on fuel), which is linked to Flight Times (3d, 3e, 3f).

Strategic delay will be reduced for critical flights thanks to the reduction or cancellation of ATFCM delay (2g). Reducing the strategic delay and the direct operating costs for AUs will allow more flights to maintain their optimised trajectory, which is linked to Flight Times (3g).

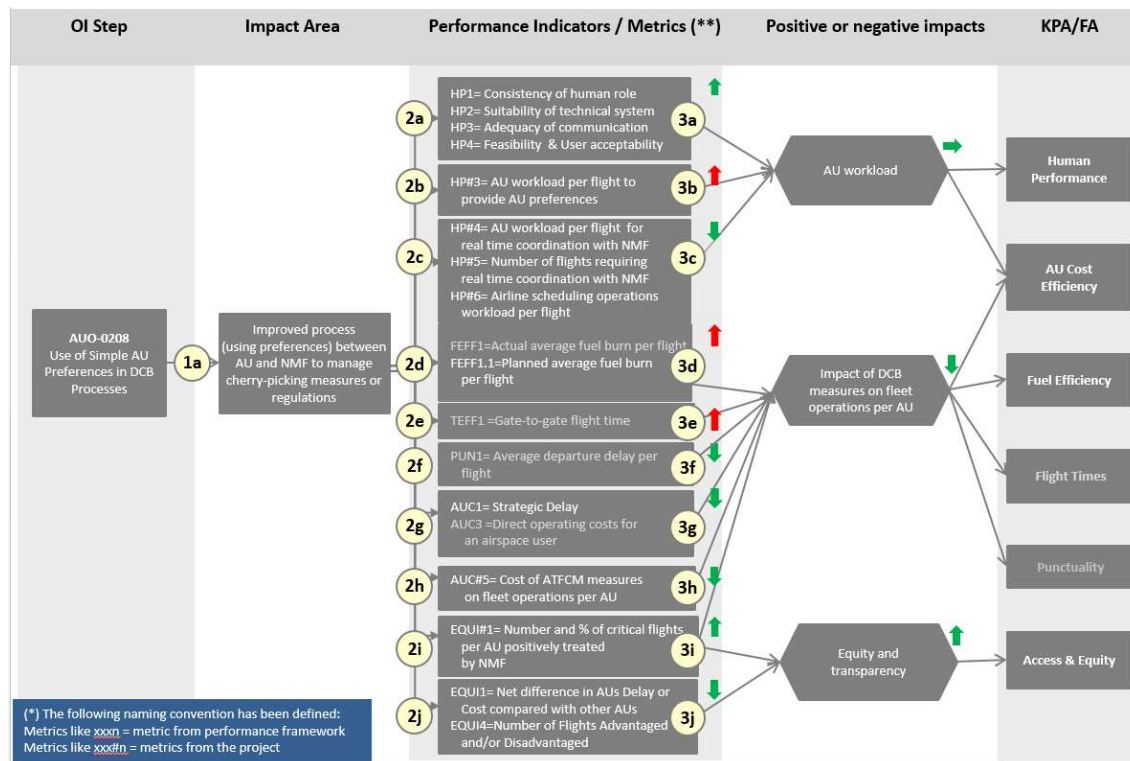


Figure 6: Flight Times - BIM for AUO-0208 and Stakeholder AU [21]

4.9.2 Assessment Data (Exercises and Expectations)

4.9.2.1 AUO-0219

Validation results (OBJ-PJ07W238-V3-VALP-K12) – Summer season

EXE-01 and EXE-02 measured the time duration or Estimated Elapsed Time (EET) for the planning phase as the difference between the original route and the rerouted EET. The results of EXE-01 for the five

simulation days, which cover the whole ECAC traffic and are applicable for the Summer season, are shown in the table below.

	05-07- 2019	06-07- 2019	07-07- 2019	08-07- 2019	09-07- 2019	Average
Total flights	36139	31903	33431	35077	34474	34205
Rerouted flights	459	516	400	384	372	426
Rerouted flights (%)						1.25%
Delta EET (min)	103	+312	+192	227	62	+22.4
Delta EET per rerouted flight (min/flight)	0.2	+0.6	+0.5	0.6	0.2	+0.02
Delta EET per flight (min/flight) (ECAC wide)						+0.00

Table 27: Flight Times results of EXE-01

The results of EXE-02 are shown in the table below.

	05-07-2019	06-07-2019	Average
Delta EET (min)	+7	+90	+48.5
Delta EET per rerouted flight (min/flight)	+0.1	+1.8	+0.95

Table 28: Flight Times results of EXE-02

The results show respectively an almost neutral impact (EXE-01) and approx. 1 minute increase (EXE-02) (very small increase closed to neutral impact) on average flight times for rerouted flights. However, in the case of AUO-0219, only EXE-01 results were taken into account due to being considered more accurate/representative than the ones done during EXE-02. This is due to the fact that EXE-01 was run as full ECAC wide RTS. EXE-02 covered only part of ECAC (two ACCs in France and two in Italy) and included scenarios with more degraded traffic situations.

Therefore, the delta EET per flight (min/flight) (ECAC wide) stemming from AUO-0219 and applicable for Summer season is: **+0.00 min/flight (additional time)**.

Validation results on AUO-0219 from SESAR2020 Wave1 (Solution 07.01) - Winter season

In the previous Wave of SESAR, Solution 07.01 validated the expected performance benefit in terms of reduced flight time as part of the exercise EXE-07.01.02/3. The results for the 9 days of simulations, covering the whole ECAC traffic in Winter season, are shown in the table below.

	18-01	19-01	20-01	21-01	22-01	23-01	24-01	25-01	25-02	Average
Total flights	27554	21299	24427	26363	24179	24534	23918	27142	27347	34205
Rerouted flights	253	195	128	237	79	33	35	427	354	426
Rerouted flights (%)										0.75%
Delta EET per rerouted flight (min)										+1.35
Delta EET per flight (ECAC wide)										+0.01

Table 29: Flight Times results of EXE-07.01.02/3 (Wave 1)

The delta EET per flight (min/flight) (ECAC wide) stemming from AUO-0219 and applicable for Winter season is: **+0.01 min/flight (additional time)**.

4.9.2.2 AUO-0208

In case of AUO-0208 exercises, EXE-03 was supposed to validate the impact on Time Efficiency (OBJ-PJ07W238-V3-VALP-K22). However, this was not assessed as there was no data available for quantitative analysis.

4.9.2.3 Summary

In summary, the flight time remains stable and there is **no clear negative nor positive impact** of the solution.

Exercise ID or Expert judgement	Benefits contribution to TEFF1	Benefits contribution to TEFF2	Benefits contribution to TEFF3	Benefits contribution to TEFF4	Benefits contribution to TEFF5	Benefits contribution to TEFF6
EXE-01	+0.00 min/flight	N/A	N/A	N/A	N/A	N/A
EXE-02	N/A	N/A	N/A	N/A	N/A	N/A
EXE-07.01.02/3	+0.01 min/flight	N/A	N/A	N/A	N/A	N/A
EXE-03	N/A	N/A	N/A	N/A	N/A	N/A

Table 30: Flight Times benefits per Exercise

OI step	Relative benefits contribution to TEFF1	Relative benefits contribution to TEFF2	Relative benefits contribution to TEFF3	Relative benefits contribution to TEFF4	Relative benefits contribution to TEFF5	Relative benefits contribution to TEFF6
AUO-0219	100%	N/A	N/A	N/A	N/A	N/A
AUO-0208	0%	N/A	N/A	N/A	N/A	N/A
TOTAL	100%	N/A	N/A	N/A	N/A	N/A

Table 31: Flight Times relative benefits per OI step

4.9.3 Extrapolation to ECAC wide

4.9.3.1 AUO-0219

There is no extrapolation to ECAC wide performance as the flight time remains stable and there is no clear negative nor positive impact of the solution.

4.9.3.2 AUO-0208

Not applicable.

4.9.3.3 Summary

KPIs / Pls	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
TEFF1 Gate-to gate flight time	Min/flight	Average of the distribution of actual gate-to-gate flight durations	YES	Neutral impact	Neutral impact
TEFF2 Taxi in time	Min/flight	Average of the distribution of actual taxi-in (including ground queuing during taxi-in) durations	When relevant	N/A	N/A
TEFF3 Taxi out time	Min/flight	Average of the distribution of actual taxi-out (including ground queuing during taxi-out) durations	When relevant	N/A	N/A
TEFF4 TMA arrival time	Min/flight	Average of the distribution of actual TMA arrival (including holdings) durations	When relevant	N/A	N/A
TEFF57 TMA departure time	Min/flight	Average of the distribution of actual TMA departure durations	When relevant	N/A	N/A
TEFF6 En-Route time	Min/flight	Average of the distribution of actual en-route durations	When relevant	N/A	N/A

Table 32: Flight Times benefits for Mandatory KPIs /Pls

Table 33 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
TEFF1 Gate-to gate flight time	N/A	N/A	Neutral impact	N/A	N/A
TEFF2 Taxi in time	N/A	N/A	N/A	N/A	N/A
TEFF3 Taxi out time	N/A	N/A	N/A	N/A	N/A
TEFF4 TMA arrival time	N/A	N/A	N/A	N/A	N/A

⁷ Although no major time inefficiencies occur during climb, this phase has been included for consistency.

TEFF5 TMA departure time	N/A	N/A	N/A	N/A	N/A
TEFF6 En-Route time	N/A	N/A	N/A	N/A	N/A

Table 33: Flight times benefit per flight phase

TEFF not assessed in SESAR2020 Wave1.

4.9.4 Discussion of Assessment Result

The assessed performance results did not meet the assigned Validation Target⁸ for TEFF1: Gate-to-gate flight time being at the medium impact level (0.05-0.12 min/flight) [8][5]. The solution observed very marginal increase of the flight duration for rerouted flights, considering the overall resulting impact as neutral without significant effect. On the other hand, the exercises demonstrated that protection hotspots can avoid significant number of 'inefficient' refilings allowing a fuel burn and flight time decrease. Possibly protection hotspots could also allow to disable some RAD constraints. This was however not measured by the validations.

4.9.5 Additional Comments and Notes

There are no additional comments.

⁸ At the beginning of Wave 2, when the performance targets were setup, two additional OIs were in the solution scope: AUO-0206 and AUO-0207. Since then, the AUO-0206 is moved to solution PJ.07-W2-38.1. Therefore, this performance assessment does not cover these OIs and related validation targets.

4.10 Predictability

4.10.1 Performance Mechanism

4.10.1.1 AUO-0219

BIM Figure 7 applicable to AUO-0219 and Stakeholder NMF presents that further automation of AU flight planning/re-planning with standardized information exchanges through B2B services will permit more automation on trajectory planning management in a CDM environment (1b).

Automation of flight planning/re-planning could anticipate the FPL changes due to DCB constraints. Automation allows allocation of rules to optimize timeliness of flight plan changes. Therefore, the number of late FPL changes (in the last two hours) will be reduced (2f). Fewer tactical FPL changes will increase Network traffic predictability, which is linked to Predictability (3f).

AU trajectory planning taking into account enriched DCB information (e.g. Hotspot Information) will produce planned trajectories closer to the actual execution ones (2g). Reducing the difference between actual and flight plan durations will increase traffic predictability which is linked to Predictability (3g).

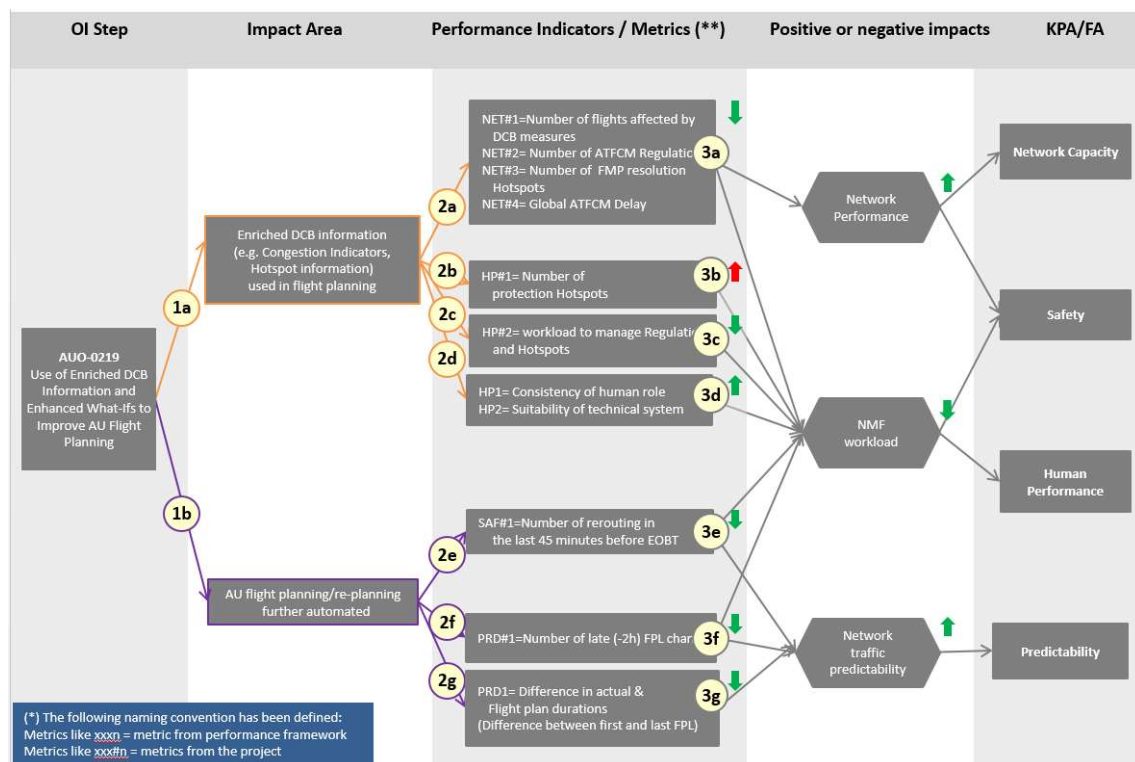


Figure 7: Predictability - BIM for AUO-0219 and Stakeholder NMF [21]

4.10.1.2 AUO-0208

There is no impact on Predictability expected from AUO-0208.

4.10.2 Assessment Data (Exercises and Expectations)

4.10.2.1 AUO-0219

Validation results (OBJ-PJ07W238-V3-VALP-K12)

Predictability was measured during EXE-01 and EXE-02 and addressed through two indicators: the difference between the first and the last Flight Plan durations, and the number of Flight Plan changes in the last two hours before EOBT. The tables below show the difference between the first and the last Flight Plan durations due to the rerouting activity in the planning phase for EXE-01, for the five simulation days, covering the whole ECAC traffic and applicable for Summer season.

	05-07-2019	06-07-2019	07-07-2019	08-07-2019	09-07-2019	Average
Total flights	36139	31903	33431	35077	34474	34205
Rerouted flights	459	516	400	384	372	426
Rerouted flights (%)						1.25%
Delta EET (min)	103	+312	+192	227	62	+22.4
Delta EET per rerouted flight (min/flight)	0.2	+0.6	+0.5	0.6	0.2	+0.02
Delta EET per flight (min/flight) (ECAC wide)						+0.00

Table 34: Predictability results of EXE-01

The results of EXE-02 are shown in the table below.

	05-07-2019	06-07-2019	Average
Delta EET (min)	+7	+90	+48.5
Delta EET per rerouted flight (min/flight)	+0.1	+1.8	+0.95

Table 35: Predictability results of EXE-02

The following tables show the number of Flight Plan changes in the last two hours before EOBT for the rerouted flights for EXE-01 and EXE-02.

	05-07-2019	06-07-2019	07-07-2019	08-07-2019	09-07-2019	Average
N rerouting last 120 min	235	281	241	227	241	245

Table 36: FL changes of EXE-01

	05-07-2019	06-07-2019	Average
N rerouting last 120 min	48	43	46

Table 37: FL changes of EXE-02

In terms of flight time, during EXE-01 and EXE-02, some marginal changes of the flight duration for rerouted flights were observed. Similarly to other KPAs, only EXE-01 results were taken into account due to being considered more accurate/representative than those done during EXE-02. The result is considered neutral without significant effect.

Validation results on AUO-0219 from SESAR2020 Wave1 (Solution 07.01)

In the previous wave of SESAR, Solution 07.01 validated the expected performance benefit in PRD2 as part of the exercise EXE-07.01.02/3. The results covering the whole ECAC are as follows:

- *Absolute expected performance benefit in SESAR2020 (Solution): 0.046 min²*
- *% expected performance benefit in SESAR2020 (Solution): 0.093%*

4.10.2.2 AUO-0208

Not applicable.

4.10.2.3 Summary

Exercise ID or Expert judgement	Benefits contribution to PRD1	Benefits contribution to PRD2
EXE-01	+0.00 min/flight	N/A
EXE-02	N/A	N/A
EXE-07.01.02/3	N/A	0.046 min ²
EXE-03	N/A	N/A

Table 38: Predictability benefits per Exercise

OI step	Relative benefits contribution to PRD1	Relative benefits contribution to PRD2
AUO-0219	100%	N/A
AUO-0208	0%	N/A
TOTAL	100%	N/A

Table 39: Predictability relative benefits per OI step

4.10.3 Extrapolation to ECAC wide

4.10.3.1 AUO-0219

There is no ECAC wide extrapolation as the impact is considered neutral in case of PRD1. In case of PRD2, no data is available from Wave 2 validations, so results from the previous Wave 1 apply.

4.10.3.2 AUO-0208

Not applicable.

4.10.3.3 Summary

KPIs / Pls	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
PRD1 Average of Difference in actual & Flight Plan or RBT durations	Minutes	Average of the distribution of the differences between flown trajectories & Flight Plans or RBT durations	YES	Neutral impact	Neutral impact

KPIs / Pls	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
PRD2 Variance ⁹ of Difference in actual & Flight Plan or RBT durations	Minutes ²	Variance of the distribution of the differences between flown trajectories & Flight Plans or RBT durations	YES	0.046 min ²	0.093 %

Table 40: Predictability benefits for Mandatory KPIs /Pls

Table 41 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
PRD1 Average of Difference in actual & Flight Plan or RBT durations	N/A	N/A	Neutral impact	N/A	N/A
PRD2 Variance of Difference in actual & Flight Plan or RBT durations	N/A	N/A	0.046 min ²	N/A	N/A

Table 41: Predictability benefit per flight phase

4.10.4 Discussion of Assessment Result

The assessed performance results did not meet the assigned Validation Target¹⁰ for PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations being at the medium impact level (0.28-2.49 %) [8][5].

Similarly, as in the case of Flight Times, the solution observed very a marginal increase of the flight duration for rerouted flights, considering the overall resulting impact on Predictability as almost neutral without significant effect.

4.10.5 Additional Comments and Notes

There are no additional comments.

⁹ Standard Deviation is also accepted (in minutes).

¹⁰ At the beginning of Wave 2, when the performance targets were setup, two additional OIs were in the solution scope: AUO-0206 and AUO-0207. Since then, the AUO-0206 is moved to solution PJ.07-W2-38.1. Therefore, this performance assessment does not cover these OIs and related validation targets.

4.11 Punctuality

4.11.1 Performance Mechanism

4.11.1.1 AUO-0219

BIM Figure 8 applicable to AUO-0219 and Stakeholder AU presents providing accurate and enriched DCB information (e.g. Hotspot Information & Congestion Indicators) to AUs will allow them to better plan/re-plan their Flights (1a).

Improved use of the available capacity will reduce departure delay, leading to better departure punctuality (2d). Reducing the average departure delay per flight will impact positively the FOC trajectory optimization which is linked to Punctuality (3d).

Taking into account enriched DCB information (e.g. Hotspot Information & Congestion Indicators) for situation awareness and decision making will allow AUs to better align the filed trajectory to their desired one (2e). Reducing the difference between their desired & filed trajectories will allow FOC to better optimise their trajectories which is linked to Punctuality (3e).

Improved use of the available capacity will reduce costs for AUs (strategic delay, direct operating costs) (2f). Reducing the strategic delay and the direct operating costs for AUs will allow more flights to maintain their optimised trajectory, which is linked to Punctuality (3f).

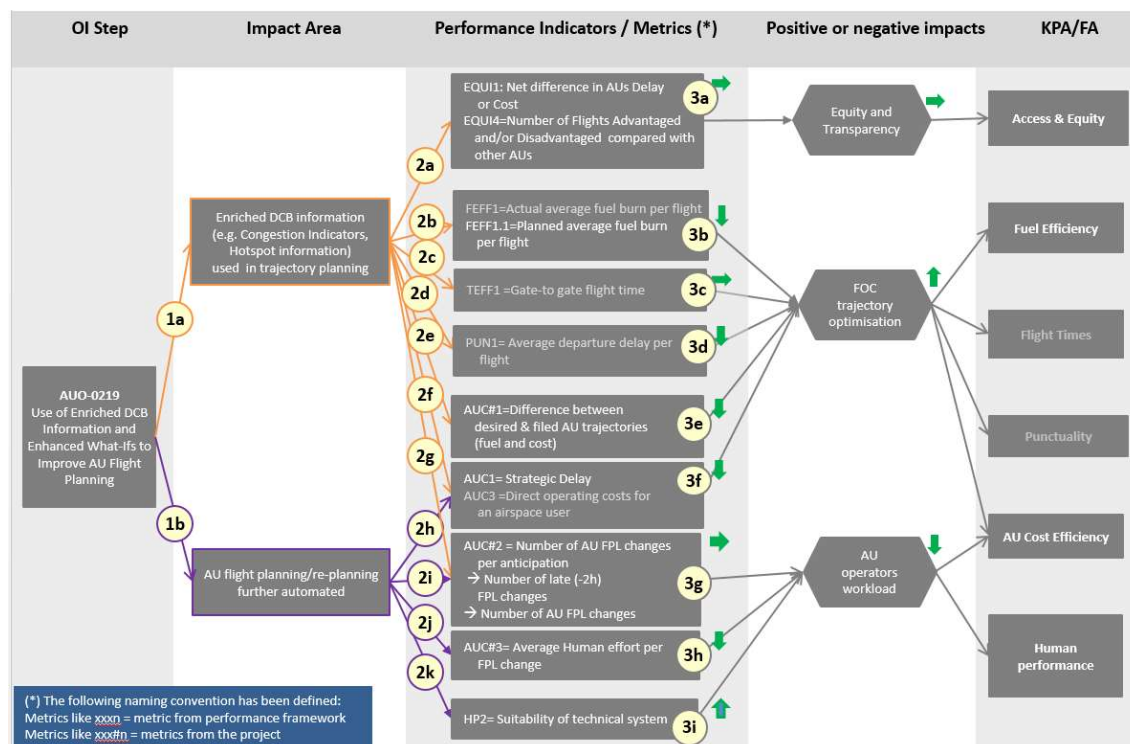


Figure 8: Punctuality - BIM for AUO-0219 and Stakeholder AU [21]

4.11.1.2 AUO-0208

BIM Figure 9 applicable to AUO-0208 and Stakeholder AU presents that by allowing AUs to proactively provide preferences (pro-active FDCI) will improve DCB processes allowing the NMF to propose DCB measures and/or negotiate trajectories (1a).

Taking into account AU preference information, the NMF will propose to AUs to adapt their planned trajectories to mitigate the impact of DCB measures on departure punctuality. In some cases it could be suboptimal with a tendency to increase the fuel burn (but for a very limited number of flights) (2d). Also, it could be suboptimal with a tendency to increase the flight time duration (but for a very limited number of flights) (2e). Punctuality will be increased for critical flights and indirectly for all following flights in the rotation due to the reduction or cancellation of ATFCM delay (2f). Minimising the impact on airline scheduling will enable departure times closer to the optimum and thus FOC trajectory could be considered as optimised. The flight is optimised in terms of time or 3D trajectory (gain on delay or gain on fuel). This is linked to Punctuality (3d, 3e, 3f).

Strategic delay will be reduced for critical flights thanks to the reduction or cancellation of ATFCM delay (2g). Reducing the strategic delay and the direct operating costs for AUs will allow more flights to maintain their optimised trajectory, which is linked to, Fuel Efficiency, Flight Times, Punctuality and AU Cost Efficiency (3g).

Taking into account AU preference information, NMF will propose to AUs to adapt their planned trajectories to mitigate the impact of DCB measures on critical flights and also on following flights in the rotation. Therefore, it will reduce the cost of ATFCM measures on fleet operations (2h). The reduction or cancellation of ATFCM delay will have a positive impact on fleet operations per AU. It will increase Punctuality for critical flights and indirectly for all following flights in the rotation. Therefore, it will have a positive impact on AU Cost Efficiency (3h).

Increasing the percentage of AU preferences respected when SBT is affected by a DCB measure will improve the FOC trajectory optimization which is linked to Punctuality (3i).

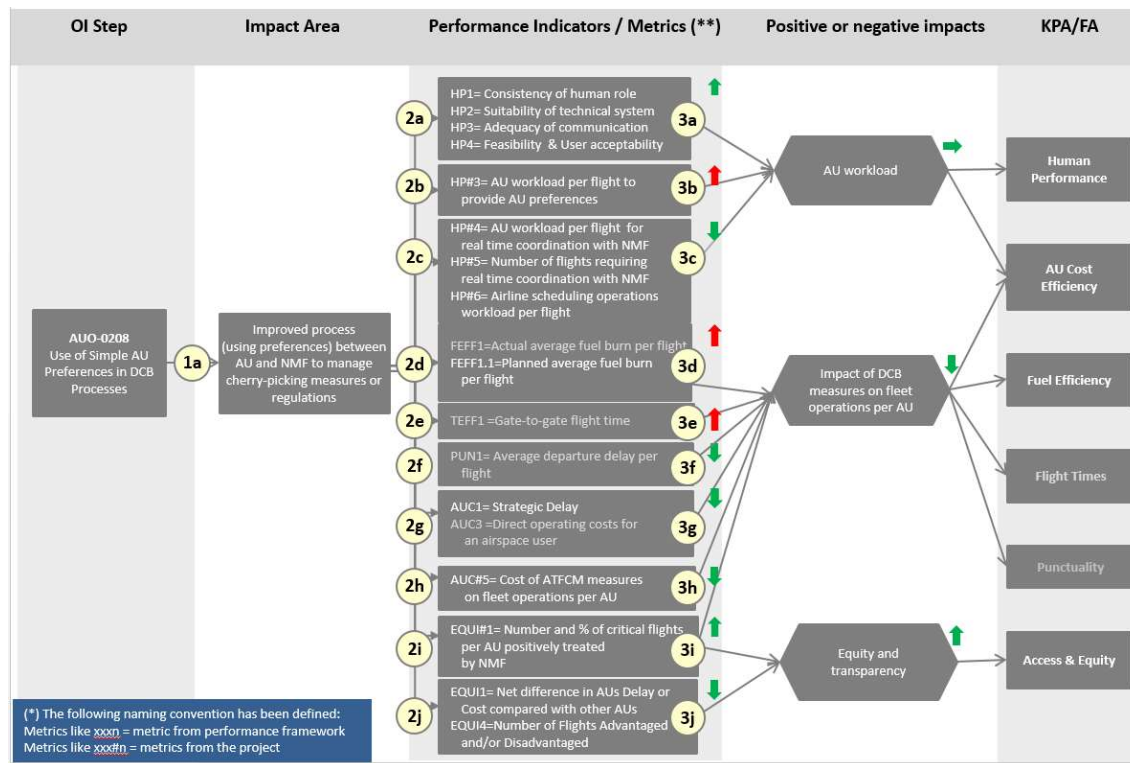


Figure 9: Punctuality - BIM for AUO-0208 and Stakeholder AU [21]

4.11.2 Assessment Data (Exercises and Expectations)

4.11.2.1 AUO-0219

Validation results (OBJ-PJ07W238-V3-VALP-K13) – Summer season

In terms of Punctuality, EXE-PJ07W238-01 and EXE-PJ07W238-02 were performed as part of Solution PJ07-W2-38 during Wave 2 and measured the reduction on ATFCM delay at the time the alternative route is filed. The instantaneous reduction on ATFCM delay at the rerouting time expressed in minutes is shown in the table below for the five days of simulations, covering the whole ECAC traffic in Summer season, done as part of EXE-01.

	05-07- 2019	06-07- 2019	07-07- 2019	08-07- 2019	09-07- 2019	Average
Total flights	36139	31903	33431	35077	34474	34205
Rerouted flights	459	516	400	384	372	426
Rerouted flights (%)						1.25%
Delta delay (min)	10787	15747	10633	6503	7092	10152.4
Delta delay per rerouted flight (min/flight)	24	31	27	17	19	23.6
Delta delay per flight (min/flight) (ECAC wide)						0.29
Total delay (min) (source: PRU dashboard)	107763	154791	172609	84743	86796	121340.4

Average delay per flight (min/flight) (ECAC wide)		3.55
Delta delay (%) (ECAC wide)		8.29%

Table 42: Punctuality results of EXE-01

The results of EXE-02 are shown in the following table.

	05-07-2019	06-07-2019	Average
Delta delay (min)	1263	1204	1234.5
Delta delay per rerouted flight (min/flight)	24	24	24.0

Table 43: Punctuality results of EXE-02

In case of AU0-0219, only EXE-01 results are taken into account for further assessment of performance due to being considered more accurate and representative than the results of EXE-02. This is due to the fact that EXE-01 was run as full ECAC wide RTS. EXE-02 covered only part of ECAC (two ACCs in France and two in Italy) and included scenarios with more degraded traffic situations.

Therefore, the delta delay per flight (min/flight) (ECAC wide) stemming from Solution PJ07-W2-38 and applicable for Summer season is: 0.29 min/flight, representing 8.29% of total delay.

Validation results on AU0-0219 from SESAR2020 Wave1 (Solution 07.01) - Winter season

In the previous Wave of SESAR, Solution 07.01 validated the expected performance benefit for Punctuality as part of the exercise EXE-07.01.02/3. The instantaneous reduction on ATFCM delay at the rerouting time expressed in minutes is shown in the table below for the nine days of simulations, covering the whole ECAC traffic in Winter season.

	18-01	19-01	20-01	21-01	22-01	23-01	24-01	25-01	25-02	Average
Total flights	27554	21299	24427	26363	24179	24534	23918	27142	27347	34205
Rerouted flights	253	195	128	237	79	33	35	427	354	426
Rerouted flights (%)										0.75%
Delta delay per rerouted flight (min/flight)										20.0
Delta delay per flight (min/flight) (ECAC wide)										0.15
Delta delay (%) (ECAC wide)										26.0%

Table 44: Punctuality results of EXE-07.01.02/3 (Wave 1)

The delta delay per flight (min/flight) (ECAC wide) stemming from Solution 07.01 and applicable for Winter season is: 0.15 min/flight. This represents 26% of total delay.

4.11.2.2 AU0-0208

Validation results (OBJ-PJ07W238-V3-VALP-K23)

EXE-03 exercise generally demonstrated that the strategical delay is cancelled in the planning phase for most of the P-FDCI flights. That was achieved by exemptions from Regulations or Level Capping, which then allowed timely operation of the flights as planned. Therefore, the true results strongly depend on working organisations (NMOC, ANSPs) in operations.

The following quantitative elements were estimated based on expert judgement.

	Light/medium day (Winter season)	Heavy day (Summer season)
Number of extra critical flights per day treated through regulation exclusion/force slots (ECAC wide)	12	36
Number of extra critical flights per day treated through RRP (ECAC wide)	9	13

Table 45: Assumptions on number of critical flights for AUO-0208

For this OI, the benefit is not expressed in terms of Punctuality but in terms of AU Cost Efficiency (Section 4.15) as the main objective of this OI is not to increase Punctuality in general but to reduce the cost of ATFCM delays for critical flights.

4.11.2.3 Summary

Exercise ID or Expert judgement	Solution	Benefits contribution to PUN1	Benefits contribution to PUN2
EXE-01	Solution PJ07-W2-38	0.29 min/flight	N/A
EXE-02	Solution PJ07-W2-38	N/A	N/A
EXE-07.01.02/3	Solution 07.01 (Wave 1)	0.15 min/flight	N/A
EXE-03	Solution PJ07-W2-38	N/A	N/A

Table 46: Punctuality benefit per Exercise

As a reminder, the table below gives an estimation of benefit repartition provided with the validation targets.

OI step	Relative benefits contribution to PUN1	Relative benefits contribution to PUN2
AUO-0219	90%	N/A
AUO-0208	10%	N/A
TOTAL	100%	N/A

Table 47: Punctuality relative benefit per OI step

4.11.3 Extrapolation to ECAC wide

4.11.3.1 AUO-0219

The following inputs are used for the ECAC wide performance aggregation:

- EXE-PJ07W238-01 results (Solution PJ07-W2-38)
- EXE-07.01.02/3 results (Solution 07.01 (Wave 1))
- Assumptions on share of traffic (*source: expert judgement, Solution 07.01*):

- Summer period traffic: 60%
- Winter period traffic: 40%

The aggregated results of extrapolation of PUN1 benefits of AUO-0219 are as follows:

- Absolute expected performance benefit in SESAR2020:
 $0.29 \text{ min/flight} * 60\% + 0.15 \text{ min/flight} * 40\% = \underline{\underline{0.24 \text{ min/flight (Delta delay per flight (ECAC wide, whole year))}}}$
- % expected performance benefit in SESAR2020:
 $8.29\% * 60\% + 26.0\% * 40\% = \underline{\underline{15.37\% (Delta delay (\%) (ECAC wide, whole year))}}$

4.11.3.2 AUO-0208

Not applicable.

4.11.3.3 Summary

	AUO-0219	AUO-0208	SOLUTION
Absolute expected performance benefit in SESAR2020 (min/flight)	0.24	N/A	0.24
% expected performance benefit in SESAR2020	15.37%	N/A	15.37%

Table 48: Punctuality benefit – Solution level

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
PUN1 Average departure delay per flight	min/flight	Average delay (AOBT – SOBT) per flight due to reactionary delays, ATM and weather-related delay causes.	YES	0.24 min/flight	15.37%
PUN2 % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather-related delay causes	%	% Departures so that AOBT – SOBT < +/- 3 min. Difference in Actual Departure Time vs. Scheduled Time due to ATM and weather-related delay causes.	YES	N/A	N/A

Table 49: Punctuality benefit for Mandatory KPIs /PIs

Table 50 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
PUN1 Average departure delay per flight	N/A	N/A	0.24 min/flight, 15.37%	N/A	N/A
PUN2 % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather-related delay causes	N/A	N/A	N/A	N/A	N/A

Table 50: Punctuality benefit per flight phase

4.11.4 Discussion of Assessment Result

The assessed performance results are in line with the assigned Validation Target¹¹ for PUN1: Punctuality – Average departure delay per flight being at the high impact level (0.11-0.44 min) [8][5].

4.11.5 Additional Comments and Notes

There are no additional comments.

¹¹ At the beginning of Wave 2, when the performance targets were setup, two additional OIs were in the solution scope: AUO-0206 and AUO-0207. Since then, the AUO-0206 is moved to solution PJ.07-W2-38.1. Therefore, this performance assessment does not cover these OIs and related validation targets.

4.12 Civil-Military Cooperation and Coordination (Distance and Fuel)

There is no impact on Civil-Military Cooperation and Coordination expected from the Solution PJ.07-W2-38.

4.13 Flexibility

There is no impact on Flexibility expected from the Solution PJ.07-W2-38.

4.14 Cost Efficiency

There is no impact on Cost Efficiency expected from the Solution PJ.07-W2-38.

4.15 Airspace User Cost Efficiency

The Airspace User Cost Efficiency metrics capture monetised operational and non-operational airspace user benefits that are not already assessed through the other KPIs, meaning, benefits other than ANS cost improvements, fuel efficiency improvements, etc.

4.15.1 Performance Mechanism

4.15.1.1 AUO-0219

BIM Figure 10 applicable to AUO-0219 and Stakeholder AU presents the following which are all linked to AU Cost Efficiency:

- Reducing the difference between their desired & filed trajectories will allow FOC to better optimise trajectories (3e).
- Reducing the strategic delay and the direct operating costs for AUs will allow more flights to maintain optimised trajectory (3f).
- Increased number of automatic FPL changes will positively contribute to optimisation of the planned trajectory without additional AU operator workload. Fewer late (-2H) FPL changes will reduce AU operators workload as the nature of this change requires coordination with the flight crew (3g).
- Reducing the human effort per Flight Plan change will reduce AU operators workload (3h).
- Improving task allocation between human and machine and supporting human by technical systems will allow a reduction in AU operators workload (3i).

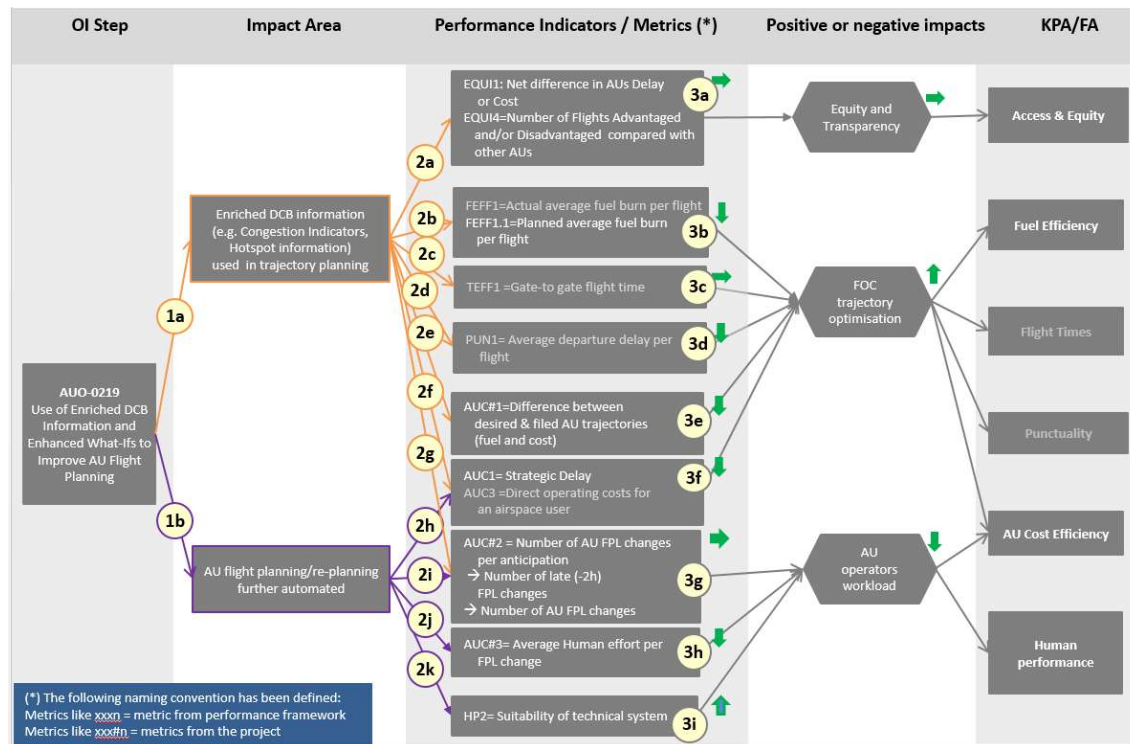


Figure 10: AU Cost Efficiency - BIM for AUO-0219 and Stakeholder AU [21]

4.15.1.2 AUO-0208

BIM Figure 11 applicable to AUO-0208 and Stakeholder AU presents the following which are all linked to AU Cost Efficiency:

- AU workload will remain stable or will not increase significantly (i.e. remain acceptable). This is because the workload to provide AU preferences will be balanced by time saving in coordination. Furthermore, minimising the impact on airline scheduling will also reduce AU workload. In future AU workload could reduce depending on the level of automation to generate preferences (3b & 3c).
- Minimising the impact on airline scheduling will allow departure times closer to the optimum. Therefore, FOC trajectory could be considered as optimised. The flight is optimised in terms of time or 3D trajectory (gain on delay or gain on fuel) (3d, 3e, 3f).
- Reducing the strategic delay and the direct operating costs for AUs will allow more flights to maintain their optimised trajectory (3g).
- The reduction or cancellation of ATFCM delay will have a positive impact on fleet operations per AU. It will increase punctuality for critical flights, and indirectly for all following flights in the rotation. Therefore, it will have a positive impact on AU Cost Efficiency (3h).
- Increasing the percentage of AU preferences respected when SBT is affected by a DCB measure will improve the FOC trajectory optimisation (3i).

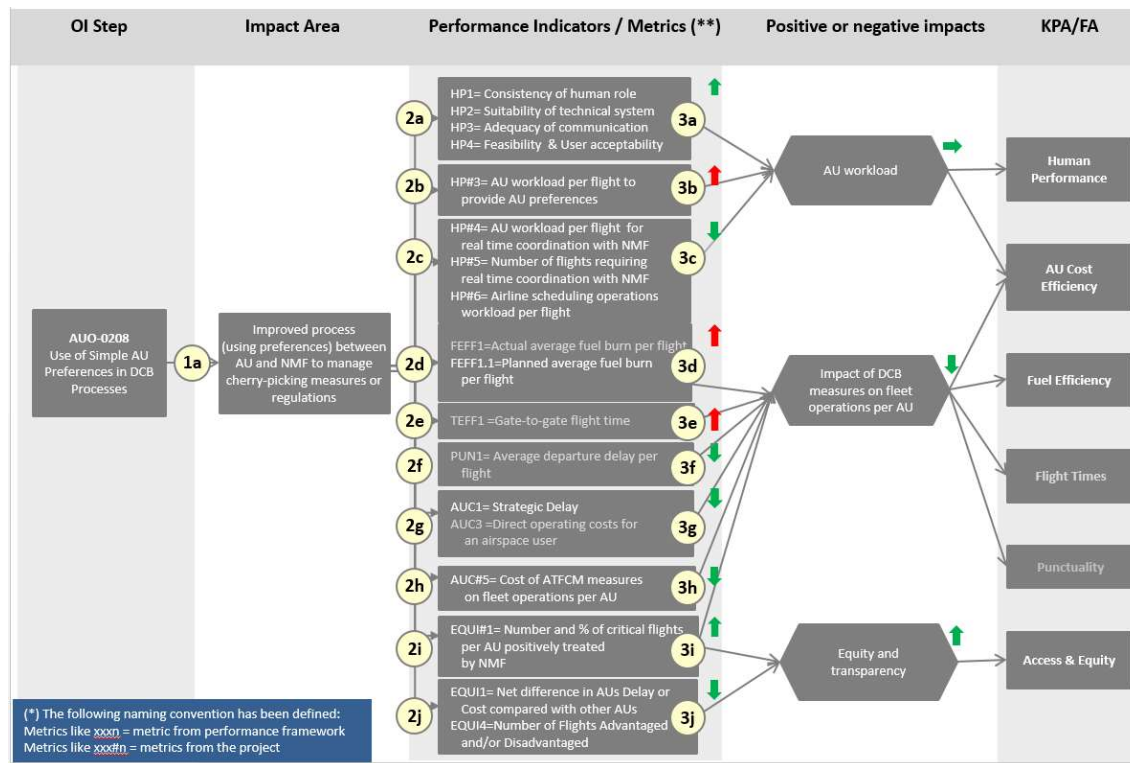


Figure 11: AU Cost Efficiency - BIM for AUO-0208 and Stakeholder AU [21]

4.15.2 Assessment Data (Exercises and Expectations)

4.15.2.1 AUO-0219

Validation results (OBJ-PJ07W238-V3-VALP-K1)

In case of AUO-0219, the contribution to AU Cost efficiency was measured in EXE-01 and EXE-02. As in other KPAs, only EXE-01 results should be taken into account due to being considered more accurate/representative than the those undertaken during EXE-02. For the rerouted flights, EXE-01 confirmed a significant improvement of delay (Punctuality) and marginal impact in the areas of fuel burn (FEFF) and flight times (TEFF). In addition to these results, which are already included in dedicated KPAs, impact on navigation charges was measured. The results are shown in the table below, before and after rerouting for the five simulation days, covering the whole ECAC traffic.

	05-07-2019	06-07-2019	07-07-2019	08-07-2019	09-07-2019	Average
Total flights	36139	31903	33431	35077	34474	34205
Rerouted flights	459	516	400	384	372	426
Rerouted flights (%)						1.25%
Delta charges per rerouted flight (EUR/flight)	+2.8	-0.2	-9.6	-5.2	+9.8	-0.48
Delta charges per flight (EUR/flight) (ECAC wide)						-0.01

Table 51: Impact on navigation charges - AUO-0219

As can be seen in the table above, the delta charges per flight (ECAC wide) are neutral (benefit of 0.01 EUR per flight).

*It is therefore considered that AUO-0219 has **no quantifiable impact on the Airspace User Cost Efficiency KPA beyond the benefits already counted (PUN, FEFF, TEFF)**, which should not be included in this area to avoid double counting of benefits. Please, refer to applicable sections of this report for further details about the performance results of other KPAs.*

4.15.2.2 AUO-0208

Validation results (OBJ-PJ07W238-V3-VALP-K24)

In case of AUO-0208 exercises, EXE-03 was supposed to validate the criteria that 'Direct operating costs for Airspace Users are reduced' and 'The cost of ATFCM measure on fleet operations is reduced'. These were not directly assessed as there was no or insufficient data available for quantitative analysis from simulations. However, EXE-03 exercise generally demonstrated that the strategic delay is cancelled in the planning phase for most of the P-FDCI flights. That was achieved by exemptions from Regulations or Level Capping, which then allowed to timely operate the flights as planned. The true results therefore strongly depend on working organisations (NMOC, ANSPs) in operations.

The following quantitative elements were estimated based on expert judgement.

	Light/medium day (Winter season)	Heavy day (Summer season)
Number of extra critical flights per day treated through regulation exclusion/force slots (ECAC wide) = 75% of implemented critical flight requests in current operations	12	36
Number of extra critical flights per day treated through RRP (ECAC wide) = 20% of RRP in current operations	9	13

Table 52: Assumptions on number of critical flights for AUO-0208

4.15.2.3 Summary

Exercise ID or Expert judgement	Benefits contribution to AU3	Benefits contribution to AU4	Benefits contribution to AU5
EXE-01	0.01 EUR/flight in charges	N/A	N/A
EXE-02	N/A	N/A	N/A
EXE-03	No strategic delay for critical flights	N/A	N/A
EXE-04	N/A	N/A	N/A

Table 53: Airspace User Cost Efficiency benefit per Exercise

OI step	Relative contribution to AU3	Relative benefits contribution to AU4	Relative benefits contribution to AU5
AUO-0219	10%	N/A	N/A
AUO-0208	90%	N/A	N/A
TOTAL	100%	N/A	N/A

Table 54: Airspace User Cost Efficiency relative benefit per OI step

4.15.3 Extrapolation to ECAC wide

4.15.3.1 AUO-0219

Not applicable. There is no quantifiable impact on the Airspace User Cost Efficiency KPA beyond the benefits already counted (PUN, FEFF, TEFF).

4.15.3.2 AUO-0208

In case of AUO-0208, the impact on reduction of AUC3 Direct operating costs for an airspace user is calculated, using the assumptions on number of critical flights for AUO-0208 (see Table 52) and assumption on ATFCM delay cost saving per rerouted critical flight (EUR): 15,000 EUR/flight (source: expert judgement (value from Wave 1 and UDPP study)).

- Absolute expected performance benefit in SESAR2020 is:
 $(9+12 \text{ flights}) * 15,000 \text{ EUR/flight} * 365/2 + (13+36 \text{ flights}) * 15,000 \text{ EUR/flight} * 365/2 =$
191,625,000 EUR/year (Direct operating costs for an airspace user, ECAC wide)

4.15.3.3 Summary

The results at solution level are below.

	AUO-0219	AUO-0208	SOLUTION
Absolute expected performance benefit in SESAR2020 (EUR/year)	N/A	191,625,000	191,625,000

Table 55: AUC3 benefit – Solution level

PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
AUC1 Strategic Delay	min	Determine the minutes of strategic delay saved with the solution. The strategic delay shall be in line with the definition from the Standard Inputs for EUROCONTROL Cost-Benefit Analyses.	NO	N/A	N/A
AUC3 Direct operating costs for an airspace user	EUR	Impact on direct costs related to the aeroplane and passengers. Examples: fuel, staff expenses, passenger service costs, maintenance and repairs, navigation charges, strategic delay, landing fees, catering.	Yes, where an impact is foreseen on AU cost efficiency	191,625,000 EUR/year	N/A
AUC4 Indirect operating costs for an airspace user	EUR	Impact on operating costs that don't relate to a specific flight. Examples: parking charges, crew and cabin salary, handling prices at Base Stations.	Yes, where an impact is foreseen on AU cost efficiency	N/A	N/A

AUC5 Overhead costs for an airspace user	EUR	Impact on overhead costs. Examples: dispatchers, training, IT infrastructure, sales.	Yes, where an impact is foreseen on AU cost efficiency	N/A	N/A
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Table 56: Airspace User Cost Efficiency benefit for Mandatory KPIs /PIs

SESAR2020 Wave1 Solution 07.01 indicated that there is an impact in AU cost efficiency but did not provide quantitative performance results.

4.15.4 Discussion of Assessment Result

As there were no validation targets assigned by PJ19 to Solution 38, there is no gap between the expected performance and assessment results.

4.15.5 Additional Comments and Notes

There are no additional comments.

4.16 Security

Solution PJ.07-W2-38 maintains current security levels while not contributing to further benefits.

4.17 Human Performance

4.17.1 HP arguments, activities and metrics

The HP Assessment Report [26] is built on the structure of the HP Arguments which are “HP claims that need to be proven”. In the step - scoping and change assessment - the arguments that are relevant for the concept were identified.

From the SESAR HP Assessment Process four arguments were considered with a need to be satisfied in the HP assessment, these are as follows:

- **Argument 1:** The role of the human is considered consistent with human capabilities and limitations.
- **Argument 2:** Technical systems support the human actors in performing their tasks.
- **Argument 3:** Team structures and team communication support the human actors in performing their tasks.
- **Argument 4:** Human Performance related transition factors are considered.

In the next steps HP objectives and HP activities were identified for the purpose of assessing feasibility of the concepts. Most of the identified Human Performance Issues and Benefits are not related to a particular event or scenario. Moreover, the assessed OIs are not expected to have a major impact on Human Performance (e.g. workload, situation awareness, fatigue, social factors / CRM). Therefore, the majority of HP recommended activities are standards and could be summarised into three activities, which have been identified for the Protection Hotspot and P-FDCI concepts:

- Design of working method, Mock-up, and prototyping with quick user testing throughout the design process
- Task analysis (current operations and with new OI implemented)
- RTS with observation, questionnaire, and debriefing

These three activities have been conducted and contributed to all HP issues and benefits. Furthermore, they have been performed according to the Validation Objectives, which comprise Human Performance aspects taken from the current HP Assessment Plan.

Please see Part IV of the OSED (HP Assessment Report) [26] for a detailed description of the HP results of the validation.

PIs	Activities & Metrics	Second level indicators	Covered
HP1 Consistency of human role with respect to human capabilities and limitations	Real Time Simulation	HP1.1 Clarity and completeness of role and responsibilities of human actors	Open
		HP1.2 Adequacy of operating methods (procedures) in supporting human performance	Open
		HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level	Open

PIs	Activities & Metrics	Second level indicators	Covered
HP2 Suitability of technical system in supporting the tasks of human actors	Real Time Simulation	HP2.1 Adequacy of allocation of tasks between the human and the machine (i.e. level of automation)	Open
		HP2.2 Adequacy of technical systems in supporting Human Performance with respect to timeliness of system responses and accuracy of information provided	Open
		HP2.3 Adequacy of the human machine interface in supporting the human in carrying out their tasks	Open
HP3 Adequacy of team structure and team communication in supporting the human actors	Real Time Simulation	HP3.1 Adequacy of team composition in terms of identified roles	Open
		HP3.2 Adequacy of task allocation among human actors	Open
		HP3.3 Adequacy of team communication with regard to information type, technical enablers and impact on situation awareness/workload	Open
HP4 Feasibility with regard to HP-related transition factors	Real Time Simulation	HP4.1 User acceptability of the proposed solution	Open
		HP4.2 Feasibility in relation to changes in competence requirements	Open
		HP4.3 Feasibility in relation to changes in staffing levels, shift organization and workforce relocation.	Open
		HP4.4 Feasibility in relation to changes in recruitment and selection requirements	Open
		HP4.5 Feasibility in terms of changes in training needs with regard to its contents, duration and modality	Open

Table 57: HP arguments, activities and metrics

4.17.2 Extrapolation to ECAC wide

Not applicable.

4.17.3 Open HP issues/ recommendations and requirements

An indication of the number of HP issues that are still open and HP benefits identified following the solution validation exercises, as well as the number of recommendations and requirements defined. For the detailed description, please consult the HP Plan/ HP Log and the HP Assessment Report [26].

Based on the Change and Argument Identification section, 52 issues / benefits have been identified, covering all 4 HP arguments. These benefits / issues have been dispatched between the two operational concepts:

- Enriched DCB information and Advanced What-If functionalities for AUs including “Protection Hotspot” (AUO-0219): 29 issues / benefits.
- Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P-FDCI) (AUO-0208): 23 issues / benefits.

The number of recommendations and/or requirements generated between the two operational concepts:

- Enriched DCB information and Advanced What-If functionalities for AUs including “Protection Hotspot” (AUO-0219): 10 recommendations. 3 requirements.
- Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P-FDCI) (AUO-0208): 11 recommendations. 8 requirements.

PIs	AUO-0219			AUO-0208		
	Number of open issues/ benefits	Number of recommendations	Number of requirements	Number of open issues/ benefits	Number of recommendations	Number of requirements
HP1 Consistency of human role with respect to human capabilities and limitations	18*	10	3	14*	11	8
HP2 Suitability of technical system in supporting the tasks of human actors	8			5		
HP3 Adequacy of team structure and team communication in supporting the human actors	2			3		
HP4 Feasibility with regard to HP-related transition factors	1			1		

Table 58: Open HP issues/ recommendations and requirements

*Two issues/ benefits are common to both AUO-0219 and AUO-0208 and included in this count.

4.17.4 Concept interaction

Not applicable.

4.17.5 Most important HP issues

The most important issues that might have an impact on the performance of the solution are listed below.

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
HP1 Consistency of human role with respect to human capabilities and limitations	N/A	N/A
HP2 Suitability of technical system in supporting the tasks of human actors	N/A	N/A
HP3 Adequacy of team structure and team communication in supporting the human actors	N/A	N/A
HP4 Feasibility with regard to HP-related transition factors	N/A	N/A

Table 59: Most important HP issues

4.17.6 Additional Comments and Notes

There are no additional comments.

4.18 Other PIs

No other PIs are applicable or were measured for Solution PJ.07-W2-38.

4.19 Gap Analysis

At the beginning of Wave 2, when the performance targets were setup, two additional OIs were in the solution scope: AUO-0206 and AUO-0207. Since then, the AUO-0206 is moved to solution PJ.07-W2-38.1. Therefore, this performance assessment does not cover these OIs and related validation targets.

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI) ¹²	Rationale ¹³
SAF1: Safety - Total number of estimated accidents with ATM Contribution per year	N/A	N/A	N/A
FEFF1: Fuel Efficiency - Actual average fuel burn per flight	Medium (4.19-14.87 kg/flight)	0.69 kg/flight (additional fuel)	The validations showed a very limited negative impact on Fuel Efficiency as a consequence of greater automation of AU refilling processes increasing the number of planned re-routings to avoid regulations. On the other hand, the exercises demonstrated that protection hotspots can avoid significant number of 'inefficient' refilling's allowing a fuel burn decrease. Possibly protection hotspots could also allow to disable some RAD constraints. This was however not measured by the validations.
CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.	N/A	N/A	N/A
CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time	N/A	N/A	N/A

¹² Negative impacts are indicated in red.

¹³ Discuss the outcome if the gap indicates a different understanding of the contribution of the solution (for example, the solution is enabling other solutions and therefore is not contributing a direct benefit). **Please contact your PJ19.04 Solution Champion to clarify when the Gap Rational is needed.**

CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).	N/A	N/A	N/A
TEFF1: Gate-to-gate flight time	Medium (0.05-0.12 min/flight)	Neutral impact	The validations showed a very marginal increase of the flight duration for rerouted flights, considering the overall resulting impact on Flight Time as almost neutral without significant effect. On the other hand, the exercises demonstrated that protection hotspots can avoid significant number of 'inefficient' refilings allowing a fuel burn and flight time decrease. Possibly protection hotspots could also allow to disable some RAD constraints. This was however not measured by the validations.
PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations	Medium (0.28-2.49 %)	Neutral impact	Similarly as in case of Flight Times, the solution observed very marginal increase of the flight duration for rerouted flights, considering the overall resulting impact on Predictability as almost neutral without significant effect.
PUN1: Punctuality – Average departure delay per flight	High (0.11-0.44 min)	0.24 min/flight, 15.37%	The assessed performance results are in line with the assigned Validation Target for PUN1.
CEF2: ATCO Productivity – Flights per ATCO -Hour on duty	N/A	N/A	N/A
CEF3: Technology Cost – Cost per flight	N/A	N/A	N/A

Table 60: Gap analysis Summary

5 References

This PAR complies with the requirements set out in the following documents:

- [1] 08.01.03 D47: AIRM v4.1.0
- [2] B05 Performance Assessment Methodology for Step 1 PJ19.04.01 Methodology for Performance Assessment Results Consolidation (2020)¹⁴
- [3] SESAR Performance Framework (2019), Edition 01.00.01, Dec 2019
- [4] Performance Assessment and Gap Analysis Report (2019), Edition 00.01.02, Dec 2019
- [5] SESAR Solution PJ.07-W2-38 SPR/INTEROP-OSED for V3 - Part V - Performance Assessment Report (PAR) Performance Assessment and Gap Analysis Report (2021), ed. 00.01.01, 09 July 2021
- [6] Methodology for the Performance Planning and Master Plan Maintenance, Edition 0.13, Dec 2017

Content Integration

- [7] SESAR ATM Lexicon

Performance Management

- [8] PJ19.04 D4.1 Validation Targets - Wave 2 (2020)¹⁵

Validation

- [9] European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

Safety

- [10] SESAR, Safety Reference Material, Edition 4.0, April 2016
<https://stellar.sesarju.eu/jsp/project/qproject.jsp?objId=1795089.13&resetHistory=true&statsInfo=Ogp&domainName=saas>
- [11] SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016
<https://stellar.sesarju.eu/jsp/project/qproject.jsp?objId=1795102.13&resetHistory=true&statsInfo=Ogp&domainName=saas>
- [12] SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

¹⁴ At the time of the creation of the PAR template, the Methodology (PJ19.04 Internal Document) is foreseen to be update in 2020.

¹⁵ At the time of the creation of the PAR template the Validation Target is foreseen to be delivered in June 2020

[13]Accident Incident Models – AIM, release 2017

https://stellar.sesarju.eu/servlet/dl/ShowDocumentContent?doc_id=3658775.13&att=attachment&statEvent=Download

Human Performance

[14]16.06.05 D 27 HP Reference Material D27

[15]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[16]SESAR, Environment Assessment Process (2019), PJ19.4.2, Deliverable D4.0.080, Sep 2019.

<https://stellar.sesarju.eu/servlet/dl/DownloadServlet?downloadKey=xrn%3Adatabase%3Aondb%2Frecord%2F14665451&resuming=true&zip=true&disposition=attachment&domainName=saas&domainName=saas>

[17]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

<https://www.icao.int/publications/pages/publication.aspx?docnum=10031>

Security

[18]16.06.02 D103 SESAR Security Ref Material Level

[19]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[20]16.06.02 D131 Security Database Application (CTRL_S)

Other documents

[21] SESAR Solution 38 SPR-INTEROP/OSED for V3 - Part I. Edition 00.01.00. 13 January 2023

[22] SESAR Solution PJ.07-W2-38: Validation Report (VALR), ed. 00.01.00, 02 December 2022

[23] SESAR Solution PJ07.01 SPR/INTEROP-OSED - Part V - Performance Assessment Report (PAR), ed. 00.00.06, 24 October 2019

[24] SESAR SOLUTION PJ.07-01: COST BENEFIT ANALYSIS (CBA) FOR V2, ed. 00.01.01, 06 November 2019

[25] SESAR Solution 38 SPR-INTEROP/OSED for V3 - Part II - Safety Assessment Report, ed. 00.00.03, 28 November 2022

[26] SESAR Solution 38 SPR-INTEROP/OSED - Part IV - Human Performance Assessment Report, ed. 01.00.00, 14 October 2022

[27]NM Flow and Capacity Management Service Specification – EUROCONTROL, Ed. 1.0, 24th September 2020

Appendix A Detailed Description and Issues of the OI Steps

OI Step ID	Title	Consistency with latest Dataset
AUO-0208	Use of Simple AU Preferences in DCB Processes	DS-22, DS-23 Draft
AUO-0219	Use of Enriched DCB Information and Enhanced What-Ifs to Improve AU Flight Planning	DS-22, DS-23 Draft

Table 61: OI Steps allocated to the Solution

The two OI steps covered by Solution PJ.07-W2-38 are consistent with Dataset 22 (and also Dataset 23 Draft). The estimated performance contribution of each of the OIs is indicated in the appropriate section of applicable KPAs (see section 4).

Appendix B Calculation sheet



D2.1.008 –
PJ.07-W2-38-V3 – Fir

