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Copyright Statement

COSER

COMMON SERVICES

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Abstract

The present document is the first *Cost Benefit Analysis (TRL6)* document to be delivered, as part of the *TRL6 Data Pack* under the task *T.15-10.1 Business Modelling development for Work Package WP6 Aeronautical Information Common Service* of PJ.15. The CBA aims to capture and reflect the expectations from the stakeholders regarding the provision of a Aeronautical Information Common Service. It highlights the proposed value, the potential consumers and customers and a detailed analysis of performance and cost benefits, among others.

This document builds upon the Deliverable *D.15-10.VN.9 Business Model* (TRL4). A CBA deliverable is only contractually due in 2019 as part of the TRL6 Data Pack, nevertheless substantial efforts were performed already for TRL4. Major updates have been performed in TRL6, in order to achieve an accurate CBA model, to adequately monetise the potential benefits of the solution.

A fundamental aim of the SES programme is the overall reduction of cost through service harmonisation. A Common Service is the provision of a service to consumers that provides a capability in the same form that they would otherwise provide themselves. The advent of service orientation and the use of open standards create opportunities for identifying such common capabilities amongst certain stakeholder groups and encourage their use in the de-fragmentation of ATM.

Table of Contents

List of Tables

List of Figures

1 Executive Summary

The Aeronautical Information Common Service provides capabilities necessary to provide static and dynamic aeronautical data in digital form to be used by different ATM systems. The output is an AIXM-compliant dataset whose subsets can be retrieved by individual requests demanding specific geographical areas, attributes or functional features.

PJ.15-10 explores ways of improving overall cost efficiency for delivering the necessary capability to the interested stakeholders under a COSER pattern. This document describes the first complete CBA for the Aeronautical Information COSER.

The business case for Aeronautical Information COSER has a strong link with the Pilot Common Project [15] which mandates among others, "*Aeronautical information feature on request. Filtering possible by feature type, name and an advanced filter with spatial, temporal and logical operators*" using the yellow SWIM TI Profile in a series of ATSUs in Europe.

Assuming that users could consume the capability from a series of competing providers available within Europe, provision of Aeronautical Information deploying a COSER could result in:

- the requirement to deploy fewer engineered capabilities - ANSPs will only bear a cost consistent with the services they receive,
- service improvement roadmap across Europe is consistent and the associated costs are spread across common service ANSP consumers,
- facilitation of the extension of the PCP requirements to other States not originally addressed by the Implementing Rule.

Consequently, the benefit relates to:

- cost reduction through lower number of system deployments and technical systems to be securely maintained in operation,
- synchronisation of the evolutionary roadmap enabling consistency of concept and
- increased geographical coverage of the Solution because new incentives,
- increased safety due to increased data consistency within and amongst stakeholders due to harmonisation and consistent application of identical quality standards

The benefits, however, should grow incrementally according to the spread of deployment of the common service: a local deployment will offer less benefits especially in terms of costs than a wider deployment at European or Worldwide level.

The primary SESAR KPI addressed is cost-efficiency via CEF3. However, through the availability of a cost-efficient and validated COSER, additional ANSPs to those obliged by the PCP are encouraged to consume the service and a quicker implementation of Aeronautical Information capabilities could be envisaged. This would have temporary benefits on other SESAR KPIs additional to cost reduction, which have not been monetised at this stage.

These KPIs would mainly benefit the ANSP costs (and, therefore, the air navigation charges). The calculated NPV values for the solution scenario is 51.7 M€ in 2040. Therefore, the business case is expected to be positive and reaches the payback year in 2024, which is close enough to take into consideration the potential deployment of the solution.

2 Introduction

2.1 Purpose of the document

This chapter presents the TRL6 CBA for Solution PJ15-10. The analysis has concentrated on updating where possible the CBA presented in TRL4 and it follows the structure proposed in the SESAR2020 CBA Template for enabling projects as a guideline [19].

For TRL6, the costs and benefits of the Solution have been refined and monetised for each impacted stakeholder. Nevertheless, the main change with respect to the CBA chapter within the TRL4 Business Model is the elimination of the *Sub-regional* and *By industry tool* Solution Scenarios, since their implementation resulted on very negative business cases, thus, they have been discarded.

2.2 Scope

The concept of a Common Service was introduced in SESAR to address the need to reduce the cost of European Air Traffic Management (ATM). ATM is highly fragmented with each State having their own Air Navigation Service Providers (ANSP). Cross border provision of Air Traffic Services being limited to only a few local examples. As each ANSP provides much the same type of service, they all have similar capabilities and deployed systems. Common Services can potentially reduce the overall cost of ATM by making it possible for similar organisations to consume a service from one provider by giving them the same capability they would normally have provided themselves, but at a lower cost. This benefit can either be realised by the direct consumer, in many cases the ANSPs, or by their customers by broadening their choice of supplier.

2.3 Intended readership

The intended audience for this document is the SESAR Joint Undertaking, the partners in the SESAR 2020 programme, the ATM stakeholders (e.g. airspace users, ANSPs, airports, airspace industry) with those third parties directly affected by its findings and the contributors having possible dependencies with the solution such as PJ.11 and PJ.18 or PJ19 as Content Integration Project and PJ 20 as Master Plan Maintenance Project..

Other ATM projects and/or architectural projects and solutions within the SESAR 2020 programme may also have an interest.

2.4 Structure of the document

This CBA document is structured in the following chapters:

1. Executive summary
2. Introduction, providing with an overall view of both this document and the solution
3. Objectives and scope of the CBA, where the CBA reference and solution scenarios are defined
4. Benefits, where the main benefit mechanisms of the solution are shown
5. Cost assessment, including the values derived from the stakeholders' analysis
6. CBA model, where the attached Excel CBA model is widely described

7. CBA results, where the main outcomes of the CBA model are shown and described
8. Sensitivity and risk analysis, of the main uncertain parameters affecting the CBA results
9. Recommendations and next steps

2.5 Background

The function of the "Aeronautical Information Service" is to provide static and dynamic aeronautical data in digital form to be used by different ATM systems. The output is an AIXM-compliant dataset whose subsets can be retrieved by individual requests demanding specific geographical areas, attributes or functional features.

The main task of the Aeronautical Information Service is to provide static and dynamic information like the last operational status of airspace or route activation, and to deal with permanent or long term data. This service will provide static information traditionally available in the AIP. This includes the PERM NOTAMs as static data changes. PERM NOTAMs are in fact Static Data that are published by NOTAM only because they do not fit into the traditional publication cycle. Such changes are usually incorporated in the sequent AIP amendment. Using a digital service would allow to include such information as far as it is available.

The Service has evolved in the TRL-6 phase to provide also dynamic information in the AIXM format (Digital NOTAM).

The new ICAO PANS-AIM allows replacing part of the AIP by the access to data sets:

- Aeronautical data set (AIP)
- Terrain and obstacle data set
- Aerodrome mapping data set
- Instrument flight procedure design data set

Those data sets could be provided by this service.

2.6 Glossary of terms

Term	Definition	Source
Business case	A tool to provide decision makers with the information they need to make a fully informed decision on whether funding should be provided and/or whether an investment should proceed	SESAR P16.06.06
Business model	A framework for creating economic, social, and/or other forms of value. The term' business model' is thus used for a broad range of informal and formal descriptions to represent core aspects of a business, including purpose, offerings, strategies, infrastructure, organizational structures, trading practices, and operational processes and policies.	EUROCONTROL ATM Lexicon

Capability	The ability of one or more of the enterprise's resources to deliver a specified type of effect or a specified course of action to the enterprise stakeholders.	SESAR2020 PJ19.05 EATMA Guidance Material Version 10.0
Centralised (service) - a particular type of Common Service	A Centralised Service is an ANS support service exercised at pan-European and central network level for harmonisation and cost-efficiency purpose avoiding multiplication of investments, leading to reduced infrastructure costs, supporting the ANSPs and the Member States of the EU to come closer or actually achieving the EU cost efficiency performance targets.	EUROCONTROL
Common Service	A service providing a capability in the same form to consumers that might otherwise have been undertaken by themselves'	SESAR B04.05 D02
Consumer	A user of a service	SESAR B04.05 D02
Cost Benefit Analysis	A Cost Benefit Analysis is a process of quantifying in economic terms the costs and benefits of a project or a program 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. A CBA is a neutral financial tool that 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 for the decision. A CBA is a tool used within the Business Case Process to provide financial inputs	16.06.06-D68-New CBA Model and Methods 2015-Part 1 of 2
Customer	A consumer of a service under a specific contract.	SESAR B04.05 D02
Deployment Package	Deployment Packages comprise Operational Improvement Steps and Enablers selected to satisfy Performance Needs of Operating Environments in the European ATM System by providing performance benefits confirmed by validation results.	SESAR WP C, though un-reviewed
Node	A logical entity that performs activities. Note: nodes are specified independently of any physical realisation.	SESAR2020 PJ19.05 EATMA Guidance Material Version 10.0
Security and safety in the context of a Common Service	Non-Functional Requirements (NFR) and Quality of service (QoS) requirements can be specified at various levels of maturity and from different viewpoints such as from the collaborative enterprise, the logical level, technology and engineering perspectives. Conceptually, NFR and QoS are not always distinguishable. Common Services will focus at the first two viewpoints	ISRM – Modelling guidelines
Service	The contractual provision of something (a non-physical object), by one, for the use of one or more others. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or	SESAR2020 PJ19.05 EATMA Guidance Material Version 10.0

	through voice communication or written processes and procedures.	
Service contract (SLA)	A service contract represents an agreement between the stakeholders involved for how a service is to be provided and consumed. A service contract is specified through the service interface, the QoS and Service policies.	SESAR B.04.03 – Working method on service
Service instance	Service which has been implemented in accordance with its specification in the service catalogue (during the SESAR Development Phase, the service definitions are available in the ISRM) by a service provider (by itself or contracted to a third party).	SESAR B.04.03 – Working method on service
Service Provider	An organisation supplying services to one or more internal or external consumers.	SESAR B.04.05 – D02
Service taxonomy	The service taxonomy describes the categorisation of services provided between ATM stakeholders. It is used to organise the responsibilities of the service design as well as to provide a means of identifying services in the run-time environment.	SESAR B.04.03 – Working method on service
Stakeholder	A stakeholder is an individual, team, or organization (or classes thereof) with interest in, or concerns relative to, an enterprise (e.g. the European ATM). Concerns are those interests, which pertain to the enterprise's development, its operation or any other aspect that is critical or otherwise important to one or more stakeholders.	SESAR2020 PJ19.05 EATMA Guidance Material Version 10.0
Net Present Value	Net Present Value (NPV) is the sum of all discounted cash inflows and outflows during the time horizon period.	Investopedia

Table 1: Glossary of terms

2.7 List of Acronyms

Term	Definition
ACC	Area Control Centre
AIC	Aeronautical Information Circular
AIFS	Aeronautical Information Feature Service
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIRM	ATM Information Reference Model
AIS	Aeronautical Information Services
AIXM	Aeronautical Information Exchange Model
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider

AMDT	Amendment
APT	Airport
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSU	Air Traffic Service Unit
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CEF	Connecting Europe Facility
COP	Coordination Point
COSER	Common Service
CR	Common Requirement
DS	Data source
EAD	European AIS database
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
ECAC	European Civil Aviation Conference
EN	Enabler
FAB	Functional Airspace Block
FOC	Full Operational Capability
HC	High complexity (airport)
ICAO	International Civil Aviation Organisation
IOC	Initial Operational Capability
ISRM	Information Service Reference Model
iSWIM	Initial System-Wide Information Management
KPA	Key Performance Area
KPI	Key Performance Indicator

LC	Low complexity (airport)
LSSIP	Local Single Sky Implementation
N/A	Not Applicable
NM	Network Manager
NOTAM	Notice to Airmen
NPV	Net Present Value
OI	Operational Improvement
OPEX	Operational Expenditure
OSED	Operational Service Environment Description
PAMS	Published AIP Management System
PAR	Performance Assessment Report
PCP	Pilot Common Project
PIRM	Programme Information Reference Model
PJ	Project
QoS	Quality of Service
RBT	Reference Business / Mission Trajectory
SAD	Static Aeronautical Data
SESAR	Single European Sky ATM Research Programme
SDM	SESAR Deployment Manager
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme, which addresses all activities of the SESAR Joint Undertaking Agency.
SESAR Programme	The programme, which defines the Research and Development activities and Projects for the SJU.
SOD	Start of deployment
SUP	Supervisor
SWIM	System-Wide Information Management
TMA	Terminal Manoeuvring Area

TRL	Technology Readiness Level
TWR	Tower
WP	Work Package

Table 2: List of acronyms

3 Objectives and scope of the CBA

3.1 Problem addressed by the solution

The Common Service does not address operational improvements itself. It is aiming at the improved cost efficiency of the provision of a necessary capability. The following section reflects this fact.

3.2 SESAR Solution description

The Aeronautical Information Service function is to provide static and dynamic aeronautical data in digital form to be used by different ATM systems (e.g. Safety Nets). The output is an AIXM-compliant dataset whose subsets can be retrieved by individual requests demanding specific geographical areas, attributes or functional features.

One OI has been created for this SESAR solution. It reflects the fact that this solution is only aiming at improving cost efficiency. This OI is not linked to any EN. *(Text taken from EATMA)*

3.2.1 SDM-0405 Aeronautical Information Common Service (Business Improvement)

The concept of Common Services (COSER) aims at addressing the high costs caused by European ATM fragmentation, by sharing common capabilities and offer it to different interested consumers in order to reduce the costs of ATM provision. The Common Service can be provided at different levels, ranging from local to sub regional level, depending on the underlying business model.

The function of the Aeronautical Information Common Service is to provide static and dynamic aeronautical data in digital form to be used by different ATM systems (e.g. Safety Nets).

The output is an AIXM-compliant dataset whose subsets can be retrieved by individual requests demanding specific geographical areas, attributes or functional features.

The scope of the service is linked to the two elements already existing in EATMA:

- *The Service Aeronautical Information Feature.*
- *Aeronautical information exchange on iSWIM over the yellow profile as requested in the PCP Sub-Functionality AF5.3.*

The Aeronautical Information Common Service can be provided at different levels, ranging from local to regional level, depending on the underlying business model

3.3 Objectives of the CBA

Following the SESAR2020 Project Handbook [21], the CBA for TRL6 will include:

- All the evidence gathered in terms of impacts, benefits and costs of a solution.
- The NPV overall and per stakeholder group.
- A sensitivity analysis identifying most critical variables to the value of the project and a risk analysis.

- The CBA model and report.
- Recommendations.

3.4 Stakeholders[1] identification

Table 3 identifies the stakeholder categories that are affected by implementing, operating and benefitting from the PJ.15-10 Solution.

Scenario	Stakeholder	The type of stakeholder and/or applicable sub-OE	Type of Impact	Involvement in the analysis	Quantitative results available in the current CBA version
Solution Scenario	Network Manager	Flow Management, En-route	Minimal development of current standards	No	No
	Flow Manager ANSP	ANSP Service Provider	Minimal development of current standards	No	No
	COSER Consumer	SAD service consumer	Avoided cost of SAD service self-provision	Yes	Yes
	COSER Provider	SAD service provider	Development of SAD COSER tool. Operating costs.	Yes	Yes
	ACCs (Local and Adjacent)	ACC	Not identified	No	Not applicable
	Airport Operators	TMA, APP			
	Airspace Users	Airspace User			
	MIL	Military airspace			

Table 3: SESAR Solution PJ.15-10 CBA Stakeholders and impacts

3.5 CBA Scenarios and Assumptions

This section describes the scenarios that have been compared in the CBA.

[1] Note that the terminology used to describe AU stakeholders in the CBA differs from that associated with Enablers in the dataset. This is due to costing being provided for different types of aircraft regardless of the operations they perform.

3.5.1 Reference Scenario

The so-called Reference Scenario represents the possible situation at the start of implementation of the Solution with assumptions on how deployment is likely to evolve without Solution PJ.15-10.

By definition, a Common Service is "*a service providing a capability in the same form to consumers that might otherwise have been undertaken by themselves*" [4]. So the Reference Scenario will consider that consumers (ANSPs) will have to undertake (develop) the capability AIFS (Aeronautical Information Feature on request - AIFS) by themselves.

Without AIFS being deployed as a Common Service (Solution Scenario) but by consumers themselves (Reference Scenario), the CBA has identified mainly four uncertainties for the definition of the Reference Scenario:

1. AIFS capability provision.
2. Number of ANSPs that will have AIFS capabilities by 2040.
3. Degree of collaboration among ANSPs for AIFS capabilities.
4. Time to deploy IOC/FOC.

These four uncertainties are studied in the following headings in order to define the Reference Scenario.

3.5.1.1 AIFS capability provision

To take a pragmatic approach and following the scope defined in section 2.2, the main assumption of the PJ.15-10 CBA is that the purpose of the service is identical to:

- The "*AeronauticalInformationFeature*" (AIFS) service in EATMA.
- *"Aeronautical information exchange"* on iSWIM over the yellow profile as requested in the PCP IR [15].

Without implementation of AIFS under a Common Service (PJ.15-10), consumers would have to provide themselves the means to comply with the PCP requirements. Additionally, consumers would need to evolve the concepts to be able to have exactly the same capacity proposed by PJ.15-10.

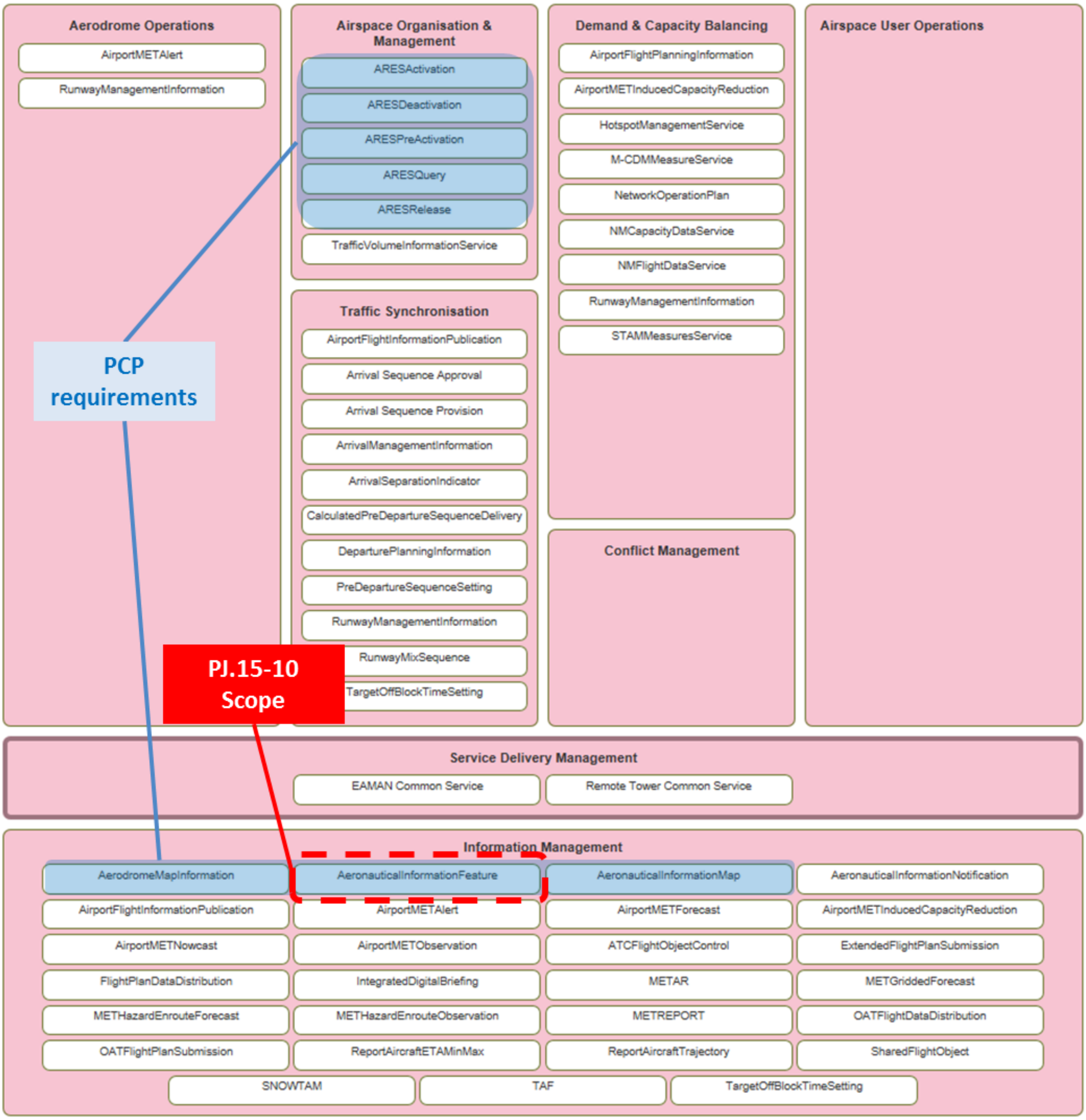

Figure 1: Reference Scenario – Services Overview

For the Reference Scenario proposal is presented in Figure 1, extracted from the Services Overview of the R&D View of Draft Dataset 7 in the eATM Portal [22].

- Services shaded in light blue represent the information exchanges required by Article 5 of the PCP [15] and defining iSWIM.
- The service Aeronautical Information Feature defined in the PCP and circled under red dotted lines is assumed to be the baseline for the CBA Reference Scenario.

The PCP Regulation defines a roadmap and binds those States in the applicability area to achieve a series of Implementation Objectives. Consequently, the PCP requirements can be considered as a good approximation for the evolution of the Reference Scenario. The PJ.15-10 CBA considers all States will adhere to the Implementing Rule.

To further refine the CBA, the analysis of the Implementation Objectives that PJ.15-10 contributes to fulfil helps to make projections on the future expected evolution of the Reference Scenario. The logic is described in Figure 2 below extracted from the eATM Portal [22]:

- The PCP defines a set of Implementation Objectives.
- Implementation Objectives are achieved when a series of OIs are fulfilled.
- SESAR1 or SESAR2020 Solutions address different OIs.
- SESAR2020 Solution PJ.15-10 (Enabling Solution) being deployed would implement the same Implementation Objectives required by the PCP than other comparable SESAR1 or SESAR2020 (ATM Solutions) could satisfy.

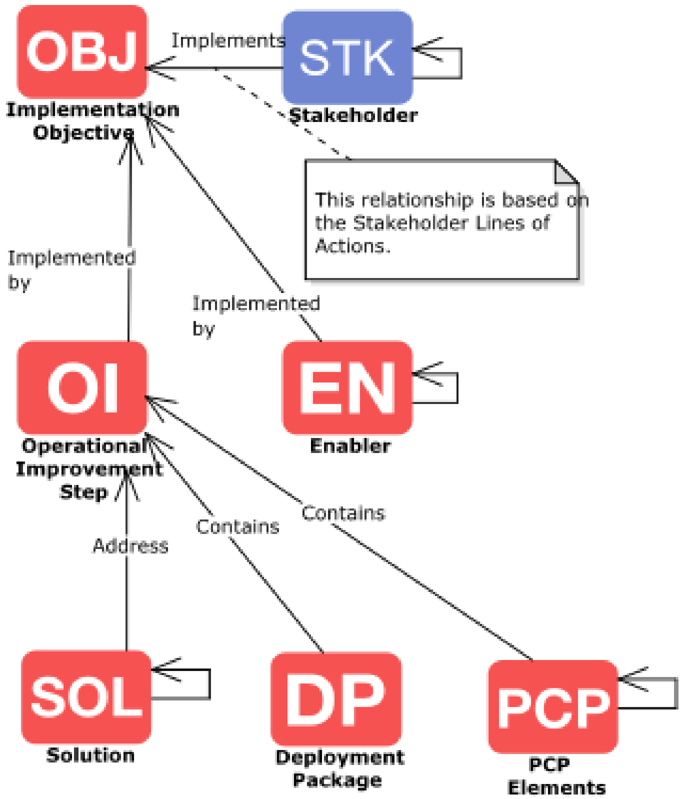

Figure 2: Reference Scenario – Linking Enablers with Implementation Objectives

The CBA Reference Scenario will be characterised by the expected deployment evolution of those other SESAR1 or SESAR 2020 ATM Solutions (alternative to PJ.15-10) that could be implemented by consumers to achieve the same capabilities as PJ.15-10 could provide.

Table 4 below reviews the relation between Implementation Objectives, SESAR Solutions and OI Steps relevant for the formulation of the Reference Scenario. It links with the PCP sub-functionalities when applicable.

PCP element	Implementation Objective	OI Step	SESAR Solution
No	-	**SDM-0405**	**SESAR2020 PJ.15-10** –Aeronautical Information
	ITY-ADQ — Ensure quality of aeronautical data and aeronautical information	**IS-0204** — Facilitated Aeronautical Data Exchanges through Digitalised/Electronic Information	-
S-AF5.3 — Aeronautical information exchange	**INF08.1:** Initial SWIM – Yellow TI profile	**IS-0901-A** — SWIM for Step 1	**SESAR1 #46** – SWIM Yellow Profile

Table 4: Reference Scenario: OI steps and links with PCP sub-functionalities

Based on expert judgement, it is assumed that not all OI Steps and SESAR Solutions satisfy the capability provided by PJ.15-10. Only IS-0901-A and SESAR1 #46 will be considered for characterising the CBA Reference Scenario. This is explained by Table 5 below.

OI Step	SESAR Solutions	Considered for characterising the CBA Reference Scenario?
SDM-0405	PJ.15-10	**Yes**. SDM-0405 Aeronautical Information Common Service (Business Improvement)
IS-0204	-	**No**. IS-0204 is the predecessor of IS-0901-A – SWIM for Step 1. Its associated Implementation Objective **ITY-ADQ** will be FOC by 2020 according to the Local Implementation (LSSIP) Map Tool. The PJ.15-10 CBA considers it will be implemented according to the data projected in the LSSIP and is not affecting the characterisation of the Reference Scenario.
IS-0901-A	#46	**Yes**. It has been explained that for the purpose of the CBA, PJ.15-10 is identical to the “Aeronautical information exchange” on iSWIM over the yellow profile as requested in the PCP IR [2]. The associated SESAR Solution to OI **IS-0901-A** is **#46 SWIM Yellow Profile**.

Table 5: Reference Scenario: OI steps considered and/or disregarded for Reference Scenario

For all the above, it can be summarised that SESAR1 #46 – SWIM Yellow Profile is considered to be a necessary prior development for those ANSPs that would like to have Aeronautical Information capabilities without using the Common Service Business Model. AIFS capabilities will not be ready in any case before full deployment of #46. In other words, it’s a *sine qua non* condition.

To conclude, the CBA Reference Scenario will be evolving in time according to the expected evolution of SESAR1 #46 and will be characterised by the Services Overview in Figure 1.

3.5.1.2 Number of ANSPs that have AIFS capabilities by 2040

This section explains the assumptions considered for estimating the number of ANSPs that will have an AIFS capability in 2040 – the end of the CBA reference period.

The geographical scope has been defined as the ECAC area. However, it is not realistic to assume that all the 44 States within will operate AIFS systems. There are different factors that can contribute to this assumption, some of them being reflected in the latest reports prepared by the Performance Review Body (PRB) of the Single European Sky [30]:

- **Different departing ATM assets**: In general, ATM capabilities for states within the Eastern regions are not as developed as those within the Core Area of the Network. It can be expected that not all Eastern ANSPs find among their priorities to invest in AIFS systems.
- **Different incentives for different ANSPs**: the PCP considers *"Aeronautical information exchange"* on iSWIM over the yellow profile among the ATM sub-functionalities that need to be implemented by a selected set of European ANSPs. This is imposing a requirement on a reduced number of European Core Area (and Turkey) ANSPs to be ready in 2025. Only 13 out 44 ECAC States must implement the AIFS.
- **Cross-boundary coordination**: RP2 Monitoring reports [30] show the deployment of some SESAR1 Solutions has been progressing slowly until now partially due to complex cross-border coordination needs.
- **Financial availability**: Another reason for delayed investment is investor's desire to position such service upgrades within the CEF funded projects. ANSPs out of the EU28 cannot benefit from this financial support.
- **Opportunistic behaviour**: some ANSPs might behave opportunistically and wait for investing in AIFS capabilities by themselves and wait until SESAR PJ.15 – Common Service Solutions prove eventually their cost-efficiency.

All the above factors being clarified, the CBA proposes to classify ANSPs according to their expected behaviour in terms of AIFS readiness. Three different categories have been assumed:

1. ***ANSP PCP:*** 19 ANSPs in ECAC are obliged to implement the "Aeronautical information exchange" on Initial SWIM over the yellow profile in one of their ATSUs. This means they have at least one ACC, TMA, TWR and/or APT falling under PCP.
2. ***ANSP Late:*** some of the ANSPs outside the PCP might not have an urgency to implement AIFS capabilities but still might consider interesting to have AIFS capabilities after the PCP deadline. It could be also the case that a future EU Regulation would extend the scope or create a *"PCP 2"* requesting additional EU-28 States to deploy AIFS systems.
3. ***ANSP Indifferent:*** the remaining ANSPs that are either outside the PCP scope or do not have operational needs that justify the investment are assumed not to implement any AIFS capability at all during the CBA Reference Period.

Table 6 below summarises the ANSPs/States considered under each category. Following expert judgement it has been decided to analyse ATSUs and do not further refine by ACC, TMA, TWR and/or APT as classified in the PCP. The reason is that according to expert judgement, it has been considered that from a technical and cost point of view, AIFS development is not so different from one type to the other.

The 19 States falling under the PCP are expected to implement AIFS capabilities. Additionally, the CBA assumes 7 additional States outside the PCP scope deploy AIFS systems.

ANSP Category	Pattern	ANSPs/States considered	ANSPs	ATSUs
PCP	ANSPs with at least one ATSU addressed by PCP	Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, MUAC[2], Netherlands, Norway, Romania, Serbia & Montenegro[3], Spain, Sweden, Switzerland, Turkey and United Kingdom.	19	68
Late	ANSPs outside the PCP scope but interested to have AIFS	Bulgaria, Czech Republic, Greece, Lithuania, Poland, Portugal and Slovakia	7	7
Indifferent	ANSPs outside the PCP scope and not interested to have AIFS	Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Cyprus, Estonia, Georgia, Iceland Latvia, Luxembourg, Malta, Moldavia, Monaco, San Marino, Slovenia, The Republic of North Macedonia, and Ukraine.	18	-
Total		**Data available only for EUROCONTROL Area**	**44**	**-**
ANSPs/States implementing AIFS capabilities			**26**	**75**

Table 6: Reference Scenario – Number and categorisation of ANSP/States with an ATSU falling under PCP

Table 7 below provides the same information at FAB level.

FAB Category	Pattern	FABs considered	FABs
PCP	FABs with at least one ATSU addressed by the PCP	BLUEMED, DANUBE, DE-SE, FABCE, FABEC, NEFAB, SW-FAB, UK-Ireland	8
Late	FABs outside the PCP scope but interested to have AIFS	Baltic	1
Indifferent	FABs outside the PCP scope and not interested to have AIFS	All existing FABs fall either on the PCP or the Late categories.	N/A
FABs with at least an ATSU required to implement AIFS capabilities by the PCP			**8**

Table 7: Reference Scenario – Number and categorisation of FABs with an ATSU falling under PCP

[2] MUAC is not “a State” but it is considered as 1 ANSP

[3] Serbia and Montenegro are 2 different States for States consideration but for ANSP purposes are only 1. SMATSA is providing ANS for both countries. In this case ACC Belgrade falls under PCP so here they are counted as 1.

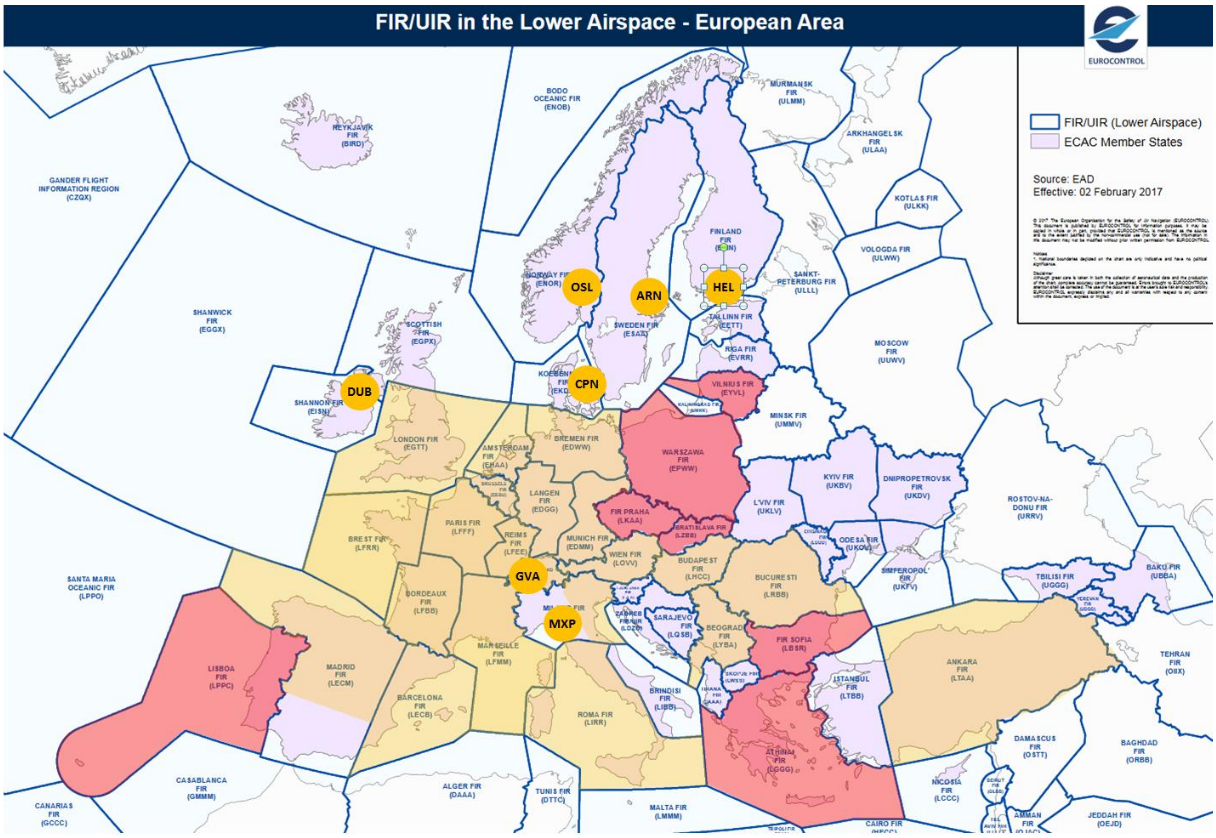

Figure 3: Reference Scenario – ANSPs implementing AIFS

Figure 3 represents graphically the ANSPs implementing AIFS capabilities in the Reference Scenario:

- ANSPs implementing AIFS in an ACC centre are depicted with their corresponding FIR[4] coloured.
- ANSPs implementing AIFS in a TMA and/or an Airport only are depicted with a circle.
- ANSPs under the ***PCP*** category are coloured in light orange.
- ANSPs under the ***Late*** category are coloured in light red.

3.5.1.3 **Degree of collaboration among ANSPs for the Aeronautical Information Feature on request capabilities**

This section describes the degree of collaboration among aeronautical information providers (mostly ANSPs) for Aeronautical Data creation, maintenance and distribution. 2 differentiate patterns exist.

On the one hand, today the exchange of data is still based on the distribution of AIPs on an AIRAC cycle basis, mostly through the EAD service. However, EAD current service is not able to offer the same

[4] Figure 3 depicts FIRs. This is an approximation considering no graph at ACC level is available.

AIFS/SAD capabilities that PJ.15-10 is proposing. A possible way ahead for provision of Aeronautical Data would be that ANSPs would collaborate to evolve the EAD service with the necessary upgrades.

On the other hand, ANSPs might choose to develop themselves at local level the capability. Up to PJ.15-10 partners' knowledge, there is also no coordination between ANSPs in terms of Aeronautical Information and/or AIFS joint developments.

For these reasons, the PJ.15-10 CBA for TRL4 proposed to consider 2 alternative Reference Sub-Scenarios. The two alternative options considered were:

1. ***EAD+:*** A sub-scenario considering ANSPs collaborate to evolve the current EAD service into a system matching exactly the same AIFS/SAD capabilities of PJ.15-10.
2. ***Local:*** A sub-scenario considering ANSP develop local individual AIFS solutions.

Hereafter, for the TRL6 CBA document the EAD+ reference scenario is no longer applicable. During the TRL4 Maturity Gate it was agreed that the EAD+ and the COSER concepts are equivalent, being both an evolution of the current EAD service (following a common service approach in both cases). It was, therefore, concluded that the CBA analysis should only keep the comparison between multiple individual services (Local AIFS reference scenario) compared to one common service (SAD COSER solution scenario).

3.5.1.4 Time to deploy and reach FOC

The time when ANSPs will have fully operational AIFS capabilities in the ATSUs required by the PCP is associated to some degree of uncertainty.

It has been explained that *SESAR1 #46 – SWIM Yellow Profile* is a pre-requisite for implementation of AIFS capabilities. The suggested approach will be to consider that AIFS capability can only be achieved once the OBJ *INF08.1: Initial SWIM – Yellow TI* profile associated to *#46* and implemented by Sub-AF 5.3 is fully deployed.

The latest estimations in the eATM Portal [35] are for SESAR1 #46 – SWIM Yellow Profile achievement are as follow:

- Deployment start date: 31-12-2018
- Benefits start date (IOC): 31-12-2023
- Full benefit date (FOC): 31-12-2029

The CBA approach is to consider that the latest estimation on the eATM Portal will be valid, thus:

- ***Local****:* Same deployment timeline as per the SESAR1 #46 – SWIM Yellow Profile, including a two-years delay, since the SWIM Yellow Profile is prerequisite for the Local AIFS service.

3.5.1.5 Summary of Reference Scenario

Table 8 summarises the assumptions proposed for the Reference Scenario.

No.	Uncertainty	Sub-Scenario Local	Source
1	AIFS capability provision	• For building up the Reference Scenario, the SESAR1 Service “Aeronautical Information Feature” mainly is considered as the best alternative to PJ.15-10. • Full deployment of OBJ *INFO8.1: Initial SWIM – Yellow TI profile* is considered as a necessary prerequisite. • ANSPs would need to provide themselves the extra features provided by PJ.15-10.	SESAR1 + expert judgement
2	# ANSPs with AIFS by 2040	• 26 ANSPs implement AIFS capabilities. • 75 ATSUs benefit from the capability. • 15 ANSPs do not have AIFS capabilities.	PCP + expert judgement
3	Degree of collaboration among ANSPs	• No collaboration among ANSPs.	Expert judgement
4	Time to deploy IOC/FOC	• SOD: 01-01-2024. • IOC: 01-01-2026. • FOC: 01-01-2032.	PCP + LSSIP + expert judgement

Table 8: Reference Scenario – Summary of assumptions

3.5.2 Solution Scenario

Following the SESAR2020 CBA template [17] the following points need to be clarified:

1. **Time-horizon of the CBA:**

The Solution Scenario considers the same time-horizon (2019-2040) as the Reference Scenario.

2. **Geographical scope:**

The Solution Scenario considers the same geographical scope (ECAC area) as the Reference Scenario.

3. **Discount rate**

Based on the SESAR2020 Common Assumptions [20], the CBA for PJ.15-10 will consider a discount rate of 8% for all stakeholders in calculating the preliminary NPV of this CBA for TRL6.

3.5.2.1 CBA Solution Scenario definition

This section describes the scenarios that have been compared in the CBA. In terms of CBA analysis, the Solution Scenario represents a fundamental departure from the Reference Scenario. A big difference is the increased level of cooperation that is transformed into a "Generic" Aeronautical Information Common Service (SAD COSER[5]) that can service many users at the time.

For TRL4, up to three possible Solution Scenarios were envisaged, one per Business Model Scenario. These options were:

1. SAD COSER at Regional level.
2. SAD COSER at Sub-Regional FAB level.
3. SAD COSER by Industry Tool.

For the present TRL6 CBA version, only the SAD COSER at Regional level Solution Scenario has been kept, since the other two resulted on very negative business cases that were disregarded for further consideration.

A fundamental advantage for the Network is that with a SAD COSER, ANSPs who have PCP obligations in the Reference Scenario but also those that are not obliged by the Regulation (ANSP categories *Late* and *Indifferent*) can benefit from a shared SAD capability. Additionally, faster deployment of the capability can be expected.

3.5.2.1.1 **SAD COSER at Regional level: ECAC**

The deployment option considered assumes the degree of collaboration between ANSPs is maximum and overall for all countries at ECAC-Region level. All ANSPs share a unique SAD capability.

Similarly, to the Reference Scenario, ANSPs can be classified according to their assumed behaviour in case of a SAD COSER is available. The difference with the Reference Scenario is that in the Solution Scenario, *ANSP PCP* upgrade more ATSUs and a new category of ANSP appears in addition to the three identified in Table 6:

- ***ANSP PCP***: those ANSPs obliged by PCP to equip only in some of their TMAs/APTs now can extend the capability to their ACCs (blue shaded)
- ***ANSP Indifferent – join SAD:*** there are now ANSPs that in the Reference Scenario were *Indifferent* and did not develop an AIFS system but now – provided there is a cost-efficient and demonstrated SAD COSER – will opt to use the service (green shaded).

Table 9 summarises the ANSPs considered under each category using the same code of colours presented in Figure 4.

Reference Scenario	Solution Scenario ECAC	Pattern	ANSPs/States considered	ANSPs	ATSUs	SAD tools

[5] Hereafter, the term SAD COSER will be used for the Aeronautical Information Common Service. The equivalent capability in the Reference Scenario will be the term AIFS.

	PCP	ANSPs with at least one ATSU addressed by PCP	Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, MUAC, Netherlands, Norway, Romania, Serbia & Montenegro, Spain, Sweden, Switzerland, Turkey and United Kingdom.	19	68	
	PCP	ANSPs PCP now cover also full ACCs airspace	Denmark, Finland, Ireland, Italy, Norway, Sweden, Switzerland, Turkey	Counted above	8[6]	
	Late	ANSPs outside the PCP but joining the SAD	Bulgaria, Czech Republic, Greece, Lithuania, Poland, Portugal and Slovakia	7	7	1
Indifferent	Indifferent - join SAD	ANSPs outside the PCP scope and originally not interested for AIFS but now join the SAD	Croatia, Estonia, Latvia, Malta, Moldavia and Slovenia	6	6 [7]	
	Indifferent - no capability	ANSPs outside the PCP scope and not interested to have SAD	Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Cyprus, Georgia, Iceland, Luxembourg, Monaco, San Marino, The Republic of North Macedonia, and Ukraine	12	-	
	ANSPs/States implementing SAD capabilities			**32**	**89**	

Table 9: Solution Scenario Regional – Categorisation of ANSPs

Figure 4 depicts graphically a possible deployment example of the SAD at Region level. It highlights the main two advantages offered by this scenario.

1. **Extended implementation.** A high collaborative momentum can facilitate SAD capabilities for ANSPs where it is not economically viable to run such a service locally in isolation. Figure 4 returns a higher number of States outside the PCP scope but joining the COSER (green shaded) than in the Reference Scenario in Figure 3. Overall, for the ECAC area, this is where the highest cost-efficiency could be expected. The result is that we can imagine a higher number of ANSPs/FABs/Airports enjoying the benefits of a SAD capability.

2. **Faster deployment.** Those *ANSPs Late* (red area) or *ANSP Indifferent – join SAD)* (green area) joining the COSER would benefit from FOC SAD capabilities in a closer time-horizon that would otherwise require investing and developing in their own AIFS capabilities in a Reference Scenario. Their time to FOC can be considerably reduced.

[6] ACC Copenhagen, ACC Prestwick, ACC Milan, ACC Brindisi, ACC Tampere, ACC Stockholm, ACC Geneva, ACC Istanbul

[7] 1 ACC Zagreb, 1 ACC Tallinn, 1 ACC Riga, 1 ACC Malta, 1 ACC Chisinau, 1 ACC Ljubljana

3. **Additional benefits in different PERF areas**. This creates additional benefits compared to the Reference Scenario. During the years where the SAD COSER is already implemented, PJ.15-10 could deliver additional benefits to just cost-efficiency in other KPAs/KPIs related to interoperability, safety, predictability, flexibility and human performance.

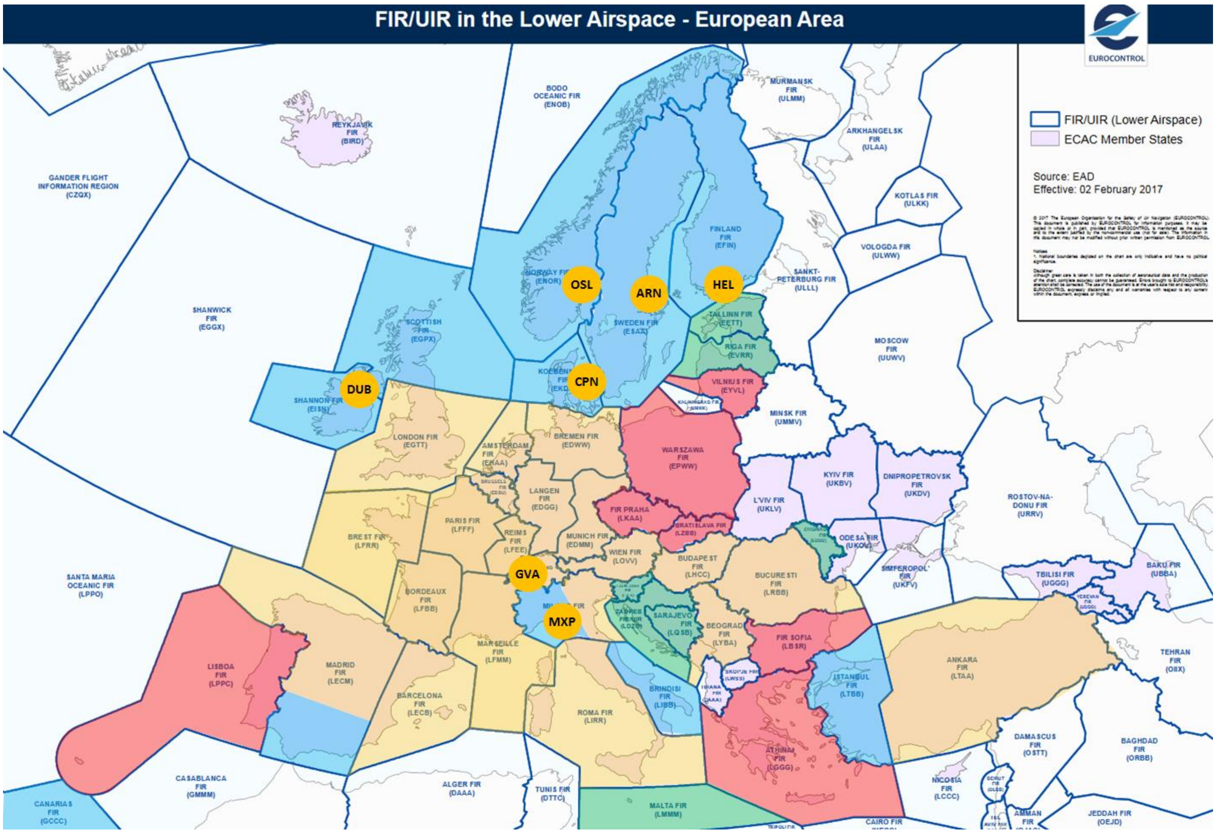

Figure 4: Solution Scenario: SAD at Regional level

3.5.2.1.2 Deployment rate for Europe

In TRL2 and TRL4, SAD COSER was agreed to meet the PCP deadline of 1st January 2025 as for SWIM Yellow Profile. SWIM Yellow Profile is now expected to reach FOC in 2030 (eATM Portal).

PJ.15-10 has no deployment dates published on eATM but PJ.15-11 Aeronautical Digital Map, solution that is being developed in parallel, shows the following:

- Start of deployment: 20th December 2023
- IOC: 20th December 2025
- FOC: 20th December 2029

Therefore, for consistency reasons, PJ.15-10 has decided to perform the CBA establishing the above-indicated dates for the Solution Scenario.

3.5.3 Summary of differences between the Solution and the Reference Scenario

Table 10 synthetises the main differences between the Reference Scenario and the SAD COSER at Regional Level.

No.	Uncertainty	Reference Local	SAD COSER Regional
1	AIFS capability provision	• ANSPs would need to provide themselves the AIFS capabilities.	• ANSPs use the SAD COSER.
2	# ANSPs with AIFS by 2040	• 26 ANSPs / 75 ATSUs with AIFS. • 15 ANSPs without AIFS.	• 32 ANSPs / 89 ATSUs with SAD COSER. • 9 ANSPs without AIFS.
3	Degree of collaboration among ANSPs	• No collaboration.	• Joint use of the SAD COSER.
4	Time to deploy IOC/FOC	• SOD: 01-01-2024 • IOC: 01-01-2026 • FOC: 01-01-2032	• SOD: 01-01-2024 • IOC: 01-01-2026 • FOC: 01-01-2030
ANSPs equipped		**26 ANSPs**	**32 ANSPs**
ATSUs equipped		**75 ATSUs**	**89 ATSUs**
AIFS/SAD systems deployed		**26 local AIFS systems**	**1 SAD COSER**

Table 10: Solution Scenario – Comparison Reference vs SAD COSER at Regional Level

4 Benefits

The benefits of the Solution Scenario compared to the Reference that are foreseen are the following:

1. Cost-efficiency due to lower investment and operating costs under a Common Service pattern.
2. Reduction of unnecessary local AIFS toolkits development.

Mainly, the benefits in the CBA come from the improved cost-efficiency of the Solution Scenario in comparison with the Reference Scenario.

5 Cost assessment

PJ.15-10 performed the first cost assessment in TRL4 according to SESAR 2020 CBA methodology. For TRL6, this cost assessment has been reviewed and updated since the progress in the project has allowed performing a more accurate cost estimation.

This section provides a detailed cost categorisation following the main cost drivers identified along with the project and consolidated with the partners and stakeholders that could be consulted.

The SESAR 2020 CBA Template [17] recommends using *"only the differential (or delta) value implied by the Solution Scenario over the Reference one".* This might be a useful approach for SESAR2020 projects contributing to Performance Areas different than Cost-Efficiency. However, PJ.15-10 would like to challenge the suitability of this method for Aeronautical Information Common Services. The cost assessment includes the absolute costs of the systems.

5.1 SAD COSER toolkit costs

Table 11 identifies the basic costs, identified per type, applying to the solution scenario.

ANSP costs	Type of cost	Main costs
CAPEX	Pre-implementation costs:	• Software development • Operational procedures • Testing and validation activities • Safety case
	One-off costs:	• Project Management • Administrative costs • Certification • Installation/Commissioning (Infrastructure replacement activities) • Integration in specific ATS System (release planning) • Initial Training
	Capital implementation costs:	• Dedicated infrastructure (equipment, computer storage, network) • Physical connections • Logical/Operational connections • Software (Interfaces)
	Transition implementation costs:	• Operational and technical trials for entry into operation • Project management during trials • Human and material resources
OPEX	Maintenance costs:	• Yearly toolkit equipment maintenance • Training

	Administration costs	• Communication costs • Energy, Supplies, Utilities, Property Taxes • Rent & Lease • Furniture & equipment

Table 11: SAD COSER toolkit basic costs

5.1.1 SAD COSER toolkit cost approach

During TRL6, the consortium has dedicated significant effort into obtaining information for a dedicated cost analysis and cost inputs evidence.

The CBA team has undergone through a process of consultation with partners following SESAR CBA methodology. The consultation process was performed through various discussions that allowed reviewing the cost structure and categorisation, in order to facilitate the work to find estimates figures or range of values. These figures were then aggregated to build total CAPEX and OPEX values.

The approach to evaluating the costs was to provide an Excel template to the ANSP stakeholders with the cost categorisation and a table to be filled, related to the Enabler of the solution. Since it is widely known that companies are reluctant to give a good degree of detail on numbers and specific costs, the table to be filled only contained the intermediate level of cost groups. Hence, the CBA is able to have estimates of pre-implementation, one-off, capital implementation, transition implementation, maintenance, and administration costs.

This is useful to check the order of magnitude of the values and one could eventually compare among the different categories and sub-categories in each group.

5.1.2 SAD COSER toolkit cost assessment

After reviewing the stakeholders, it has been identified that costs are largely the same as for the reference scenario, but slightly more as training would be increased and also there would be a need to implement network connections to sub-regional actors and develop a client system suitable for deployment at sub-regional locations.

Maintenance costs are likely to be larger than the reference scenario to maintain and support all associated links across the network to third parties.

During TRL4 a first cost estimation was performed to obtain information for dedicated cost analyses or cost inputs evidence. AT TRL6, this cost estimation has been reviewed and improved. This work has allowed incorporating more accurate unit cost figures for the individual toolkits that need to be developed.

Scenario	Detailed unit costs						Overall costs	
	Pre-impl. (€)	One-off impl. (€)	Capital impl. (€)	Transition impl. (€)	Maintenance (€/year)	Administration (€/year)	**CAPEX (€)**	**OPEX (€/year)**
SAD COSER	15.000.000	5.000.000	2.000.000	3.000.000	3.000.000	5.000.000	**25.000.000**	**8.000.000**

Table 12: Detailed unit costs for the SAD COSER (Solution scenario)

5.2 Local AIFS toolkit costs

No cost estimation on the Local AIFS Reference Scenario has been received from the PJ.15-10 partners. Therefore, the CBA team has performed a cost estimation based on iSWIM, a technical pre-requisite for the deployment of the aforementioned Reference Scenario.

Based on the PCP CBA [37], the iSWIM deployment cost for the ANSP is built as follows:

iSWIM unit	CAPEX (€/unit)	Number of instances	Total CAPEX (€)
ACC	800,000	22	17,600,00
TMA	800,000	20	16,000,000
TWR	300,000	23	6,900,000
Total Cost	-	-	40,500,000

Table 13: iSWIM cost for ANSPs (PCP CBA [37])

Based on the above table, and taking into consideration that 19 ANSPs falls into the PCP applicability area for the implementation of iSWIM, an average CAPEX for an ANSP of 2,131,579€ has been estimated. From Table 12, the SAD COSER OPEX to CAPEX ratio can be calculated as 32%. Thus, since no OPEX values for iSWIM have been found available, the same ratio has been applied to it. Therefore, the "average" OPEX for an ANSP, deploying iSWIM has been estimated to be 682,105€/year (32% of 2,131,579€).

Main uncertainty in the cost estimation of an AIFS service is the next: the cost of it will be equal to the cost of iSWIM, thus, obtaining the following table:

System	CAPEX (€)	OPEX (€/year)
AIFS	2,131,579	682,105

Table 14: AIFS cost for an ANSP

The above values have been used in the present CBA.

5.3 Number of investment instances (units)

Based on the scenarios explained in section 3.5, the number of instances is represented in the Table 15.

Scenario	Area	ANSPs	Instances (toolkits/systems)
Reference – Local AIFS	ECAC	26	26
Solution – SAD COSER	ECAC	32	1

Table 15: Number of investment instances

6 CBA Model

The CBA model has been built in Excel. This Excel file is a deliverable at TRL6. Therefore, the present document and the aforementioned Excel file complement each other and must be studied together in order to have a complete view of the work that has been undertaken.

As a summary, it must be highlighted that the only KPA that is monetised is Cost Efficiency. Therefore, the main inputs to the model are the solution and reference scenario CAPEX and OPEX costs for the SAD COSER toolkit, as indicated in section 5. In addition to this, implementation timelines for the solution and reference scenario have been assumed (described in the sections below).

6.1 Summary of scenarios costs

Cost assessment results are summarised in the table below. This table builds the major input of the CBA model.

Scenario	Overall scenario costs			Deployment period		
	Number of toolkits	CAPEX (€)	OPEX (€/year)	SOD	IOC	FOC
Local AIFS	26	2,131.579	682,105	2024	2026	2032
SAD COSER	1	25,000,000	8,000,000	2024	2026	2030

Table 16: Summary of overall costs for the PJ.15-10 CBA scenarios

6.2 Implementation timeline

Solution Scenario and Reference Scenario adoption curve have been calculated using the same Gaussian distribution (same standard deviation) but selecting different deployment periods to match the different FOC year.

First CAPEX applies in 2024, start of deployment year for the two scenarios, whereas last one applies in 2029 for SAD COSER and 2031 for Local AIFS (one year before the FOC).

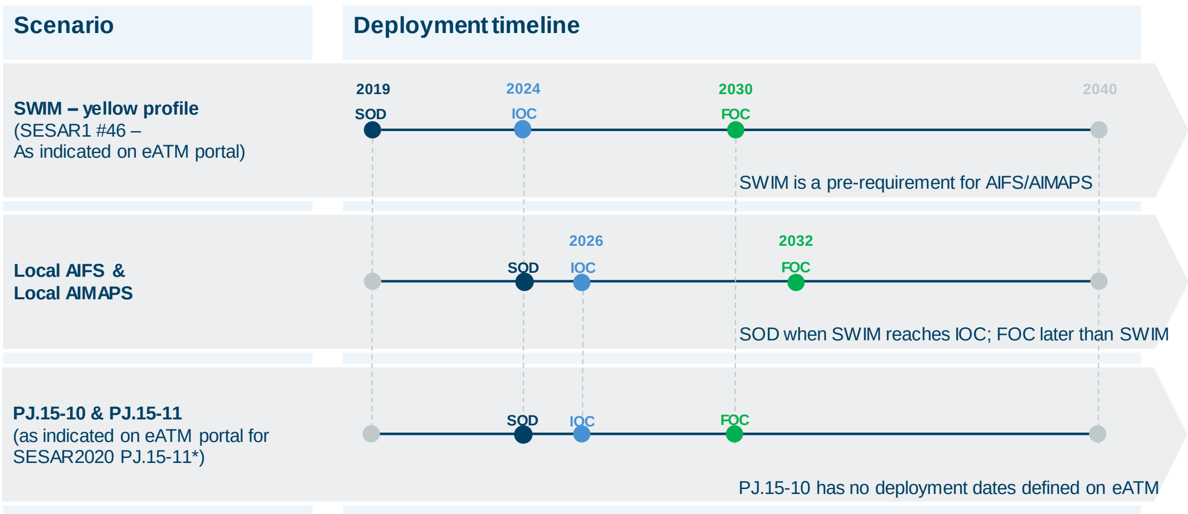

Figure 5: Deployment timeline for PJ.15-10/11 CBAs

6.3 Data sources

The data sources have been specified along with the document. All sources are listed in section 10.

Since the CBA only assesses the Cost Efficiency KPA, the main data source for the cost figures is the consultation of the stakeholders. This consultation resulted in the estimated values in section 5.

Regarding complementary parameters for the NPV calculation, the model takes into account an 8% discount rate [20] and a timeframe that goes from 2019 to 2040 [20]. The start of deployment year for the solution scenario is assumed to be 2026 [35]. Nevertheless, the NPV calculation takes into account from 2019 to 2040, being unity the discount factor in 2019 [35]. Finally, the payback year has been calculated using the discounted cumulative cash flow.

6.4 CBA Excel Model

PJ15-10_Static_Aero
nautical_Data_Servic

7 CBA Results

The CBA results are provided in the present section CBA for TRL6. Results could be produced thanks to the cost assessment exercise after the stakeholders' consultation. The results presented are partial and cannot be conclusive. The CBA has been built gathering the following information:

- The impact of PJ.15-10 on the Operating Expenditures (OPEX) and on the Capital Implementation (CAPEX) are derived from the installation of the COSER-capable SAD toolkit, instead of the de-localised one (Local AIFS Reference Scenario). This impact is difficult to assess and, therefore, has been taken into account in the Sensitivity Analysis.
- No other benefits, rather than Cost Efficiency, are provided since they cannot be demonstrated or validated.

Results of the defined Solution Scenario are described next, including cash flow analysis, NPV and payback year calculation.

7.1 SAD COSER at regional level vs Local AIFS

Costs and benefits are presented in the table below:

- Total cumulated undiscounted savings over the period 2019-2040 add a total of 153.8 M€, split between CAPEX saving (30.4 M€) and OPEX saving (123.4 M€). These savings are coming only from the Cost-Efficiency KPA. Note that, since the Solution Scenario provides service to a higher number of ANSPs, further benefits than Cost-Efficiency only should be expected.
- At the end of the time horizon, the overall net discounted savings are 51.7 M€, with an 8% discount rate.

	Concept	Value	Units
SAD COSER at regional level	**Number of ANSPs**	32	ANSPs
	Number of ACCs	89	ATSUs
	Number of toolkits	1	Instance
Local AIFS	**Number of ANSPs**	26	ANSPs
	Number of ACCs	75	ATSUs
	Number of toolkits	26	Instances
Total savings and costs	**Total cumulated CAPEX saving**	30.4	M€
	Total cumulated OPEX saving	123.4	M€
Balance	**Total cumulated saving**	**153.8**	**M€**
	Payback year	**2024**	**year**
	NPV	**51.7**	**M€**

Table 17 CBA inputs and results for the 2019-2040 timeframe

Figure 6 provides an overview of the level of investment, expected benefits (cost savings) and cash flow evolution over the period 2020-2040:

- The CAPEX savings rise up to 30.4 M€. The corresponding OPEX savings increases according to the implementation of the Solution and Reference Scenario.

- At the start of the deployment, the OPEX saving is estimated at 0.5 M€/year, that grows progressively till the FOC year.
- Once the implementation is finished, the OPEX saving is estimated at 9.7 M€/year, remaining constant until the end of the timeframe (2040).
- The breakeven point is achieved in 2024, coincident with the start of the deployment. This is due to the fact that both Reference and Solution Scenario begin their deployment the same year and that the Solution Scenario CAPEX is lower.

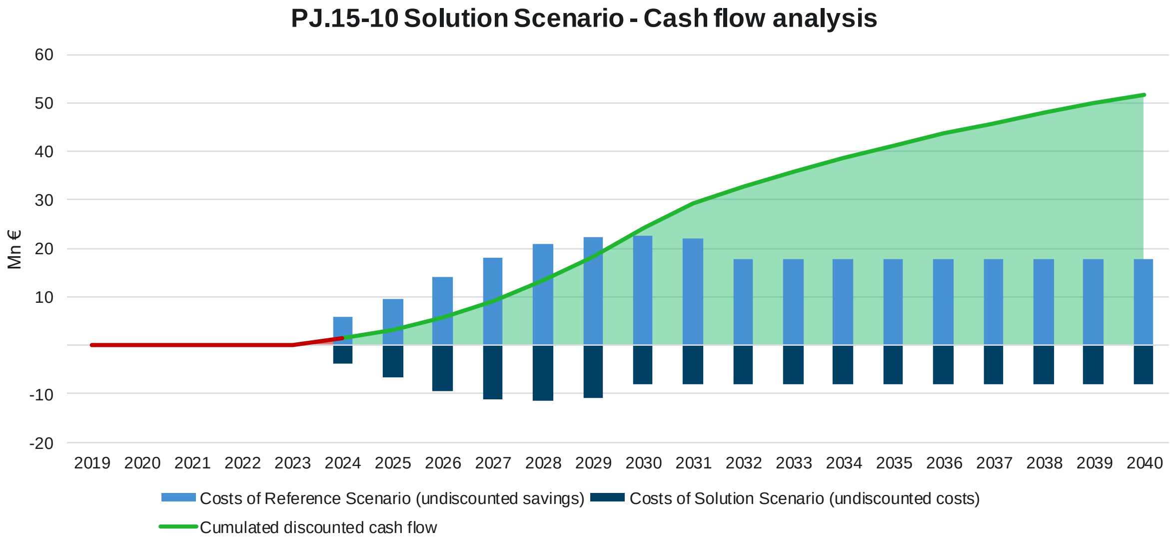

Figure 6: Cash flow analysis (2019-2040) for the SAD COSER at regional level vs Local AIFS

8 Sensitivity and risk analysis

The following section provides an analysis of the impact of the main uncertainties identified when designing the PJ.15-10 CBA Model and calculating the final NPV.

These uncertainties come mainly from the internal cost estimation, based on stakeholder expert judgement, on cost savings and entry into service date of the Solution Scenario. The rest of the parameters of the CBA assessment have been gathered from external inputs that seem to be well established and reasonably reliable.

All the analysis presented in this section is "*ceteris paribus*" meaning changing one variable at the time and leaving the others constant.

8.1 SAD COSER at regional level vs Local AIFS

8.1.1 Variables analysed and associated uncertainties

Table 18 shows the most sensitives variables regarding the uncertainty that every cost assessment or entry into operation estimation implies.

	Concept	Description	Decrement	Baseline	Increment
Cost estimation	**SAD COSER CAPEX**	CAPEX cost of the Solution Scenario	-10%	See Table 16	+10%
	SAD COSER OPEX	OPEX cost of the Solution Scenario	-10%	See Table 16	+10%
	Local AIFS CAPEX	CAPEX cost of the Reference Scenario	-10%	See Table 16	+10%
	Local AIFS OPEX	OPEX cost of the Reference Scenario	-10%	See Table 16	+10%
Deployment	**SAD COSER IOC year**	Initial operational capability year	-1 year	2026	+1 year
	SAD COSER FOC year	Full operational capability year	-1 year	2030	+1 year

Table 18 Variable analysed in the sensitivity analysis for the SAD COSER vs Local AIFS

8.1.2 Sensitivity and risk analysis

Figure 7 shows the results of the sensitivity analysis on the NPV value. The major conclusions are highlighted below:

- Regarding the cost estimation, the OPEX values have a greater effect on the CBA model than the CAPEX values, highlighting that the main saving of the Solution Scenario would happen once fully deployed.
- AIFS OPEX is the most sensitive parameter, since the number of toolkits in the Local AIFS Scenario is 26, increasing the importance of the aforementioned OPEX value.
- Finally, the IOC and FOC years do not show a high impact on the CBA model (both of them change the NPV value by less than 5% for a one year increment) due to the late IOC/FOC years

within the model scope (the discount factor is already low for the deployment period so that reduces the effect on the overall NPV)

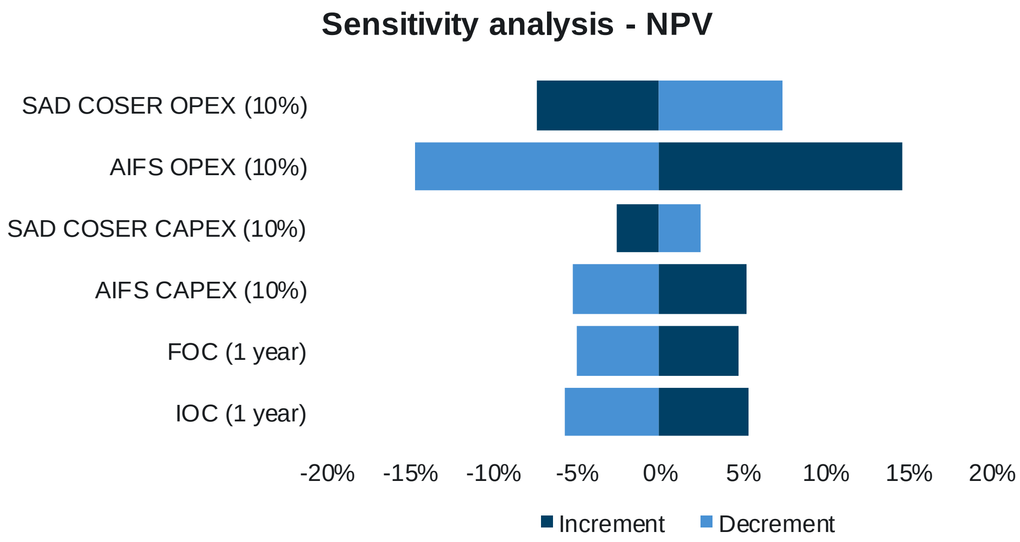

Figure 7: Sensitivity analysis for the SAD COSER at regional level vs Local AIFS

It must be noticed that for all the analysed variables the NPV remains positive.

9 Recommendations and next steps

The PJ.15-10 partners, representing the main stakeholders for the solution (ANSPs and industry), have made a considerable effort on the CBA assessment for the TRL6. The cost and benefit estimation has resulted in the production of the cash flow analyses, payback year estimation and NPV calculation for the Solution Scenario, ending up in the first version of the CBA document.

The progress done guarantees mature enough results for TRL6 version of the solution scenario cost assessment. A further round of stakeholders' review for the cost assessment would be advisable to keep updated the cost figures if the project is to be continued in the future to achieve higher maturity levels.

In this sense, further discussion on the baseline value for the Reference Scenario of the CAPEX/OPEX costs would be advisable, to avoid underestimating the potential savings of the Solution Scenario. Based on the current Reference Scenario cost estimation, implementation at Sub-regional level and By industry tool were discarded, due to negative business cases. These negative NPV values could change if the Reference Scenario cost is higher than estimated. Although, the regional level joint implementation will bring always a greater cost-efficiency, it also implies a higher complexity at the operational, organisational and political level, which could prevent this closer collaboration. Therefore, SESAR is considered a necessary initiative to foster this cooperation and unlock the potential benefits of the Common Service.

10 References and Applicable Documents

10.1Applicable Documents

[1] SESAR PJ.15-10, Business Model (TRL4) for Aeronautical Data Common Service, v01.00.00

[2] SESAR PJ.15-10, Business Model (TRL6) for Aeronautical Data Common Service, v01.00.00

[3] EU IR 716/2014: Pilot Common Project

[4] Foundation Method on Common Services

[5] Working Method on Services (S2020 edition)

[6] SESAR 2020 Transition ConOps

[7] SESAR B4.5, D02 Options Of Common Services 00.01.00

[8] Business Model Generation: Alexander Osterwalder & Yves Pigneur, www.businesmodelgeneration.com

[9] ICAO Global Operating Concept Doc 9854

[10]SESAR 2020 Multi Annual Work Programme

[11]SESAR 2020 Project Handbook

[12]SESAR 16.06.06-D26_04, Guidelines for Producing Benefit and Impact Mechanisms, Edition 03.00.01

[13]SESAR 16.06.06-D26_03, Methods to Assess Costs and Monetise Benefits for CBAs, Edition 00.02.02

[14]SESAR 2020 Multi Annual Work Programme, edition 1.0, 2015

[15]EU IR 716/2014: Pilot Common Project

[16]SESAR1 B04.02 – Update and maintenance of the development of the Concept of Operations (CONOPS) and associated ATM Services

10.2 Reference Documents

[17]EUROCONTROL: Challenges of Growth 2018, European Aviation in 2040

[18]EUROCONTROL – Standard Inputs for EUROCONTROL Cost-Benefit Analyses, Ed. 8.0, 2018

[19]SESAR2020 CBA Template for EN projects

[20]SESAR 2020 Common assumptions, Edition 01.00.00 (17 May 2018)

[21]SESAR2020 Project Handbook

[22]eATM Portal – Working view. OBJ FCM04.2 – Short Term ATFCM Measures (STAM) – phase 2. Accessed on 16-04-2019 via: https://www.eatmportal.eu/working/depl/essip_objectives/1000103

[23] European ATM Master Plan Level 3 – Implementation View. Report 2018. Updated version of July 2018.

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[25]ATM Cost-Effectiveness (ACE) 2016 Benchmarking Report with 2017-2021 outlook. Accessed on 21-12-2018 via: http://www.eurocontrol.int/press-releases/eurocontrol-issues-its-latest-atm-cost-effectiveness

[26]EUROCONTROL: Seven-year forecast February 2017, Flight Movements and Service Units 2017-2023.

[27]SESAR1 B.04.05 - T3 Service Identification

[28]PRR 2016 – Performance Review Report – Draft Final Report for consultation with stakeholders (17 March – 07 April 2017).

[29]PRR 2017 – Performance Review Report.

[30]PRB RP2 Annual Monitoring Report 2015. Volume 3 – CAPEX. Version 2.2 from 20/12/2016. Accessed on 11/04/2017 via: https://ec.europa.eu/transport/sites/transport/files/prb_annual_monitoring_report_2015_vol_3_capital_expenditures.pdf

[31]EATMA, European ATM Architecture baseline 10.0 applicable to this document.

[32]ICAO Service Delivery Management (ATM SDM), Circular 335

[33]Validation Targets (2018) Edition 01.00.00

[34]07.02 Step 2 Release 4 Detailed Operational Description (DOD)

[35]eATM Portal: Research & Deployment view (Dataset 20 Draft, EATMA V13.0 Draft, MP L3 Plan 2018). Accessed on 18/06/2019: https://www.eatmportal.eu/working/data/sesar_solutions/15877135

[36]SESAR Stellar – Boards – Cost Benefit Analysis – Start year discussion (Marco Gibellini, 3rd April 2019). Accessed on 19-06-2019: https://stellar.sesarju.eu/

[37]Proposal on the content of a Pilot Common Project (SESAR, 6th May 2013)

Appendix A Performance assessment report (PAR)

PJ15-10 is improving the Cost Efficiency KPA by improving the KPI CEF3 Technology cost. PJ15-10 does not influence CEF2 ATCO Productivity.

Support costs – considered on the side of support personnel – would reduce. By reducing the number of instances / systems to maintain in operation, the Common Service Business Model is expected to reduce proportionally the costs associated to support personnel as less effort will be needed. Please, note support personnel costs are indirectly considered in the OPEX savings accounted for in the TRL6 CBA.

10.2.1Performance Mechanism

PJ15-10 is a Technological Solution and as such does not need to provide an OSED. As the BIMs are required in the OSED, PJ15-10 does not have prepared any BIM.

In short, the Common Service Business Model is reducing the costs of provision of a given capability meaning the capability is improving the Cost Efficiency.

The reduced cost of provision is translated into lower Direct Cost of G2G ATM.

10.2.2Assessment Data (Exercises and Expectations)

PJ15-10 is a Technological Solution and as such we have not performed Validation Exercises leading to VALR. Similarly to other Enabling Projects, we have performed Technical Validation Exercises which only allows us to prepare TVALR.

The TVALR cannot demonstrate the Operational Performance of a Solution but rather its technical feasibility. In other words, the TVALR can only answer to the question “is it feasible technically” with a yes or no answer. The TVALR performed cannot answer the question “how much is the performance of the Solution?”.

To circumvent this limitation we propose to use a CBA as an alternative way to “validate” our Performance. The CBA is the right tool to study cost savings. This approach was agreed with SJU since TRL4 and we believe it should provide enough confidence in our results.

10.2.3Extrapolation to ECAC wide

The PJ15-10 TRL6 CBA studies one Reference Scenario to benchmark against the Solution.

The reference scenario considers a geographical area composed of 32 ANSPs which is basically an extension of the ANSPs. We have extrapolated the expected performance results to ECAC level. The logic we have followed for the extrapolation is:

- The PJ15-10 TRL6 CBA provides the cost savings expected for 32 ANSPs. We assume that an additional number of States outside the PCP would use the COSER.
- We have assumed a “unit” cost saving value per ANSP when implementing PJ15-10.

- Then we extrapolate that unitary cost to the full ECAC area where we assume 42 ANSPs (ESRA08 area).

KPIs / PIs	Unit	Calculation	Mandatory	Benefit in SESAR1 (if applicable)	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
CEF2[8] Flights per ATCO-Hour on duty	Nb	Count of Flights handled divided by the number of ATCO-Hours applied by ATCOs on duty.	YES	*Not applicable*	*Not applicable as PJ15-01 does not influence CEF2.*	*Not applicable*
CEF3 Technology cost per flight	EUR / flight	G2G ANS cost changes related to technology and equipment.	YES	*No. PJ15-01 did not exist in SESAR1.*	***<u>Vs Local AIFS</u>:*** *Reduction of EUR (-) 0.84 per flight.*	• ***<u>Vs Local AIFS</u>:*** *Reduction of (-) 0.09% of G2G ANS Cost per flight compared to 2012 value of EUR 960.*
CEF1 Direct ANS Gate-to-gate cost per flight	EUR / flight	Derived by PJ19, taking into account results for the other two KPIs as contributing factors.	Yes but Derived From the other two KPIs below	*To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)* *If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?*	*To be completed with a single or a range of values if easier*	*To be completed with a single or a range of values if easier (%)*

10.2.4 Discussion of Assessment Result

- **Outcome**: We believe the CBA is robust notwithstanding the difficulty in making cost projections and forecasts up to 2040. We believe we demonstrate that there is a very strong business case for the Common Service Business Model.
- **Main issues**: the main issues we went through came at the time of defining the scenario. We started as open as possible in TRL2 and were able to increase precision in TRL4. TRL6 concentrated in building up the cost model and analysing possible deviations (sensitivity

[8] The benefits are determined by converting workload reduction to a productivity improvement, and then scale it to peak traffic in the applicable sub-OE category. It has to be peak traffic because there must be demand for the additional capacity (note that in this case the assumption is that the additional capacity is used for additional traffic).

analysis). Different to ATM Solutions, we did not perform VAL and as such, our main issues were different. The most relevant challenges were two:

  - **Extrapolation to ECAC**. The PJ15-10 TRL6 CBA considers the cost savings for 32 ANSPs as the geographical scope. To provide an ECAC value, we needed to extrapolate the benefits. We calculated a "per ANSP" cost savings value and we enlarged to the 42 ANSPs considered for ECAC.

  - **Time to deploy and reach FOC**: another difficulty we faced was to establish an approximate timeline for deployment and full operations for PJ15-10. We based our assumption on a list of Operational Improvements (OIs) related to PCP Solutions that we considered pre-requisites for the implementation of PJ15-10. By using the reporting information contained in the Master Plan Level 3 documentation, we could study the approximate date of completion of the SESAR 1 Implementation Objectives. In that sense, this was a "not-before year X" approach.
    Contrary to other PJ15 Solutions, PJ20 does not yet propose IOC-FOC dates for DS19 in the eATM Portal.

- **Confidence in the estimates**: We have benefitted from real cost figures from participating ANSPs. Additionally, it must be noted that we have provided a detailed sensitivity analysis. For all the analysed variables (cost variation, delay in deployment and a reduced degree of cooperation), the NPV remains positive.