

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

**POLICY DEPARTMENT**  
STRUCTURAL AND COHESION POLICIES **B**

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**Research for  
TRAN Committee -  
Status report on the  
deployment of SESAR**

**STUDY**





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**POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES**

**TRANSPORT**

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This document was requested by the European Parliament's Committee on Transport and Tourism (TRAN).

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Original: EN

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To contact the Policy Department or to subscribe to its monthly newsletter please write to:  
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Manuscript completed in May 2016.  
© European Union, 2016.

Print	ISBN 978-92-823-9110-5	doi:10.2861/876285	QA-01-16-391-EN-1
PDF	ISBN 978-92-823-9111-2	doi:10.2861/372871	QA-01-16-391-EN-2

This document is available on the Internet at:  
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**POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES**

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**Abstract**

This report captures the status of deployment of SESAR through the Pilot Common Project (PCP) in terms of state of play, costs and timeliness. It is concluded that the PCP implementation is on time and underpinned by a credible management structure. The expenditure to date through the Connecting Europe Facility (CEF) mechanism is EUR 325.4 million, out of EUR 3 billion planned for the 2014-2020 period. However, as the PCP implementation is at an early stage, the benefits are still to be quantified.



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## LIST OF ABBREVIATIONS

<b>4D</b>	Four dimensional
<b>A-CDM</b>	Airport Collaborative Decision Making
<b>A-SMGCS</b>	Advanced Surface Movement Guidance and Control System
<b>A/A</b>	Air/Air
<b>A/G</b>	Air/Ground
<b>ADS-C</b>	Automatic Dependent Surveillance-Contract
<b>AF</b>	ATM functionality
<b>ANSP</b>	Air Navigation Service Provider
<b>AOP</b>	Airport Operations Plan
<b>ASBU</b>	Aviation Systems Block Upgrades
<b>ATC</b>	Air Traffic Control
<b>ATFCM</b>	Air Traffic Flow and Capacity Management
<b>ATM</b>	Air Traffic Management
<b>ATS</b>	Automatic Train Supervision
<b>AU</b>	Airspace User
<b>bn</b>	Billion
<b>CBA</b>	Cost Benefit Analysis
<b>CEF</b>	Connecting Europe Facility
<b>TRAN</b>	Committee on Transport and Tourism
<b>ConOps</b>	Concept of Operations
<b>DCT</b>	Direct Routing
<b>DFS</b>	Deutsche Flugsicherung GmbH
<b>DP</b>	Deployment Programme
<b>DP2015</b>	Deployment Programme 2015
<b>DP2016</b>	Deployment Programme 2016
<b>DG MOVE</b>	Directorate General for Mobility and Transport
<b>E-OCVM</b>	European Operational Concept Validation Methodology
<b>EASA</b>	European Aviation Safety Agency
<b>EC</b>	European Commission
<b>ECAC</b>	European Civil Aviation Conference
<b>EDA</b>	European Defence Agency
<b>EFTA</b>	European Free Trade Association
<b>EOC</b>	Expected Operational Capability
<b>EPP</b>	Extended Project Profile
<b>ESSIP</b>	European Single Sky ImPlementation
<b>EU</b>	European Union
<b>EUR</b>	Euro
<b>EUROCAE</b>	European Organisation for Civil Aviation Equipment
<b>EUROCONTROL</b>	European Organisation for the Safety of Air Navigation
<b>FDP</b>	Flight Data Processing

<b>FOC</b>	Full Operational Capability
<b>FPA</b>	Framework Partnership Agreement
<b>FRA</b>	Free Route Airspace
<b>G/G</b>	Ground/Ground
<b>H2020</b>	Horizon 2020
<b>i4D</b>	Initial Four Dimensional aircraft trajectory
<b>IC</b>	Imperial College
<b>ICAO</b>	International Civil Aviation Organisation
<b>INEA</b>	Innovation and Networks Executive Agency
<b>IOC</b>	Initial Operational Capability
<b>IP</b>	Implementation Project
<b>IR</b>	Implementing Rule
<b>GANP</b>	Global Air Navigation Plan
<b>KPA</b>	Key Performance Area
<b>LSSIP</b>	Local Single Sky ImPlementation
<b>mn</b>	Million
<b>MP</b>	Master Plan
<b>MUAC</b>	Maastricht Upper Area Control Centre
<b>NM</b>	Network Manager
<b>NOP</b>	Network Operations Plan
<b>NSA</b>	National Supervisory Authorities
<b>NPV</b>	Net Present Value
<b>OI</b>	Operational Improvement
<b>PENS</b>	Pan-European Network Service
<b>PBN</b>	Performance Based Navigation
<b>PCP</b>	Pilot Common Project
<b>PRB</b>	Performance Review Body
<b>PSA</b>	Programme Support Action
<b>R&amp;D</b>	Research and Development
<b>RNP</b>	Required Navigation Performance
<b>RPAS</b>	Remotely-Piloted Aircraft Systems
<b>SCP</b>	Stakeholders Consultation Platform
<b>SDM</b>	SESAR Deployment Manager
<b>SESAR</b>	Single European Sky ATM Research
<b>SGA</b>	Specific Grant Agreement
<b>SJU</b>	SESAR Joint Undertaking
<b>SME</b>	Subject Matter Expert
<b>SWIM</b>	System Wide Information Management
<b>TEN-T</b>	Trans-European Transport Networks
<b>TEN-T EA</b>	Trans-European Transport Networks Executive Agency
<b>TMA</b>	Terminal Manoeuvring Area
<b>TSS</b>	Tool Support System

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## EXECUTIVE SUMMARY

The Air Traffic Management (ATM) system ensures safe, orderly and expeditious flow of air traffic on the ground and in the air. Over the years many initiatives have aimed to improve the ATM's physical infrastructure, increasing the levels of automation and making operational changes to improve air traffic flow.

Despite these efforts, it was found that these changes are not sufficient to cope with the predicted growth in air traffic in both the short- and long-term. To cope with the increasing demand for air travel, a new global Concept of Operations (ConOps) was developed by the International Civil Aviation Organisation (ICAO) to improve user flexibility and maximise operational efficiency in order to increase capacity, improve safety and reduce the impact of aviation on the environment.

The European Union's (EU) application of this ConOps started in 2004 through the Single European Sky ATM Research (SESAR) programme. Since its establishment, SESAR has gone through the Definition phase (2005-08) and the Development phase (2008-13), and is currently in the final Deployment phase (2014-20), which is the focus of this report.

In summary, the main findings are that:

- Significant effort has been made to create an integrated management structure for SESAR Deployment (Figure 1) with a clear assignment of responsibilities and interfaces/interactions (details in Section 2). This structure should facilitate the removal of potentially unnecessary duplication of effort and wastage of resources. Within the context of this structure, the following issues should be addressed to achieve maximum cohesion and integration:
  - Coordination between the ATM Master Plan (in particular the Implementation View of the Master Plan which includes the European Single Sky ImPlementation (ESSIP) Plan) and the Deployment Programme (DP) (for Pilot Common Project (PCP) related elements);
  - Ensuring complementarity between the ATM Master Plan planning and implementation reporting mechanism (ESSIP/Local Single Sky ImPlementation (LSSIP)), and the SESAR Deployment Manager (SDM) reporting mechanism.
- As the implementation of the PCP started in 2014, it is too early to quantify the benefits of the SESAR Deployment to date in terms of the SESAR Key Performance Areas (KPA's). The initial cost benefit analysis determined the overall benefit to be accrued from the PCP as EUR 2.4 billion for the period 2014-2030.
- There is in place a monitoring and reporting structure, with the task of quantifying the actual operational benefits embedded in it. However, potential conflict of interest in this function should be avoided through a wholly independent process.
- From the information provided by the Innovation and Networks Executive Agency (INEA), the expenditure on PCP via the Connecting Europe Facility (CEF) funding mechanism was EUR 325.4 million in 2014 (Table 2), with a further indicative EUR 446.9 million for the Call for Proposals issued in 2015. This is out of a total of EUR 3 billion investment expected for the period 2014-2020 for the PCP. The expenditure to date in terms of the proposals funded in the CEF Call 2014, identifying the coordinating applicants and the participating EU Member States, is presented in Table 2. However, the breakdown at stakeholder and State levels were not provided by INEA for reasons of confidentiality.

- To date, the implementation of the PCP is on time, although there are delays anticipated in the ESSIP Report for a number of the PCP pre-requisites. For these delays, the SDM is looking at ways of accelerating the implementations to deviate as little as possible from the original target end dates. Information on the consequences of the delays in terms of cost is still to be determined.
- The Stakeholder's Consultation Platform (SCP) appears effective: results based on the data from 2014 and 2015 show a significant increase not only in the project allocation but also in the stakeholder participation. In order to increase further the level of engagement of the operational stakeholders, during the DP2016 updating process, the Stakeholders' Consultation process will be expanded from three to over six months allowing for two rounds of consultation prior to submission of the DP2016 draft to the EC (SESAR Deployment Manager, 2015a).
- To achieve the full potential of the PCP, countries that do not belong to the EU but are a part of the European Free Trade Association (EFTA) or neighbouring States (third countries) are expected to implement parts of the PCP. Their involvement is either as formal partners or as third parties whose air transport activities have close links with those of the EU.
- Risk management is a critical element of the SDM's responsibility. The 2015 Deployment Programme (DP2015) contains a detailed analysis of risks together with the ways to mitigate them. These are reviewed on a continuous basis and updates are made. In addition to these risks, further limitations in the SESAR Deployment have been identified in this report (Section 2.9) and should be incorporated into DP2016 together with their mitigations.
- The SESAR Deployment Governance has three levels: Implementation, Management and Policy levels. However, the highest level (the Policy level) is not yet in place. This is required urgently in order to ensure a better involvement of State Authorities in the process, because ultimately States are responsible for the implementation of the PCP, as declared in the National Safety Authority (NSA) guidance for SESAR Deployment.

## KEY FINDINGS

- The implementation of the Pilot Common Project (PCP) is on time and underpinned by a credible management structure with a clear assignment of responsibilities and interactions/interfaces.
- Although there are delays anticipated for a number of the PCP pre-requisites, the SESAR Deployment Manager (SDM) is looking at ways of accelerating the implementations to deviate as little as possible from the original target end dates. Information on the consequences of the delays in terms of cost is still to be determined.
- The expenditure to date through the Connecting Europe Facility (CEF) mechanism is EUR 325.4 million, out of EUR 3 billion planned for 2014-2020 for the PCP.
- The implementation of the PCP is at an early stage. Hence, the benefits in terms of the Key Performance Areas (KPA) are still to be quantified.

# 1. INTRODUCTION

## 1.1. Context

Over the years, the evolution of the Air Traffic Management (ATM) Concept of Operations (ConOps) has been driven largely by traffic growth, congestion and delays. In turn, many initiatives have been made, aimed at improving the ATM's physical infrastructure both on the ground and in the air, increasing the levels of automation and making operational changes to improve air traffic flow. Despite these efforts, in 2005, the International Civil Aviation Organisation (ICAO), the European Organisation for the Safety of Air Navigation (EUROCONTROL) and the European Commission (EC) determined that the situation would get worse in both the short- and long-term and that further significant changes to the current ATM system were required.

In response, the ICAO developed the first official Global ATM Operational Concept (also known as ICAO ConOps) designed to cater for the long-term needs of the ATM community (ICAO, 2005). This new ConOps encapsulates an integrated and global ATM system and additional operational elements such as performance-based and collaborative ATM (ICAO, 2005). The main purpose of the ICAO ConOps is to increase user flexibility and maximise operational efficiency in order to increase capacity, improve safety and reduce the impact of aviation on the environment.

As of 2004, the European Union (EU) started applying the ICAO ConOps by launching the Single European Sky ATM Research (SESAR) programme (SESAR Joint Undertaking, 2007a, 2012b, 2013). SESAR is a performance-driven research, development and deployment programme with the aim to ensure sustainable air transport development across the European continent by enabling improvement in capacity, safety, cost and environmental impact (SESAR Joint Undertaking, 2007b). The SESAR programme is organised in three phases:

- **Definition phase (2005-08)** on the planning roadmap to SESAR development and implementation. The main outcome was the development of the first edition of the ATM Master Plan (henceforth "Master Plan");
- **Development phase (2008-13)**, including all the activities related to research, standardisation, validation, business case and performance assessment of new ConOps and technologies. To manage the SESAR development phase, the SESAR Joint Undertaking (SJU), a European ATM public private partnership comprising 16 members and over 70 other organisations, was established in 2007 (Council of the EU, 2007, 2008, 2014);
- **Deployment phase (2014-20)**, including all the activities on large-scale production, procurement and implementation (SESAR Joint Undertaking, 2008b) of the new ATM system infrastructure and ConOps.

The implementation of the elements of the SESAR programme may start only after the fitness for purpose of a particular Operational Improvement (OI) is validated according to the European Operational Concept Validation Methodology (E-OCVM) (EUROCONTROL, 2010). Some of these OIs started early in the SESAR implementation as seen in the Master Plan (SESAR Joint Undertaking, 2012a). However, the non-legal status of the Master Plan resulted in the early Deployment activities being predominantly local, uncoordinated and not always timely (i.e. the non-binding status of the Master Plan has impacted the speed of the SESAR Deployment and the delivery of full benefits).

Following a lengthy consultation process involving the EC's Directorate-General for Mobility and Transport (DG MOVE), EUROCONTROL, the European Aviation Safety Agency (EASA) and the SJU, it was determined that the anticipated performance and economic benefits from ATM modernisation could only be achieved through a timely, synchronised and coordinated deployment of SESAR (European Commission, 2010, 2011b). This would be particularly important for network (regional) level initiatives/projects. In order to achieve this, four requirements were derived to:

- set legally binding incentive mechanisms;
- establish the SESAR Deployment Programme (DP), governance, monitoring and reporting;
- create EU support funding mechanisms;
- assure the commitment and coordination of the implementing stakeholders.

## **1.2. Objectives and research questions**

It is within the scope of the four requirements in Section 1.1 above, that this report has the objective to analyse and capture the status of the SESAR Deployment within the context of the Pilot Common Project (PCP) in terms of its state of play, costs and timeliness.

Specifically the following research questions are addressed:

- The alignment between the relevant plans: the ATM Master Plan (in particular the Implementation View of the Master Plan which includes the European Single Sky ImPlementation (ESSIP) Plan) and the Deployment Programme (DP);
- The status of the PCP as the main deployment pathway;
- The roles and effectiveness of the relevant entities and instruments: the SESAR Deployment Manager (SDM), the SESAR Deployment Framework Partnership Agreement (FPA), the Innovation and Networks Executive Agency (INEA), the Stakeholders Consultation Platform (SCP) and the Connecting Europe Facility (CEF) funding mechanism.

The analysis in this report has been designed to:

- (i) identify delays and their reasons including associated economic consequences,
- (ii) identify the stakeholders and the consultation processes,
- (iii) examine the role of neighbouring countries,
- (iv) make reference to the original SESAR pilot programmes,
- (v) calculate the extent of the financial investment up until now (including research and development) and what is expected still to come,
- (vi) evaluate the individual progress and commitment of EU Member States, the industry and the SESAR Joint Undertaking (SJU).

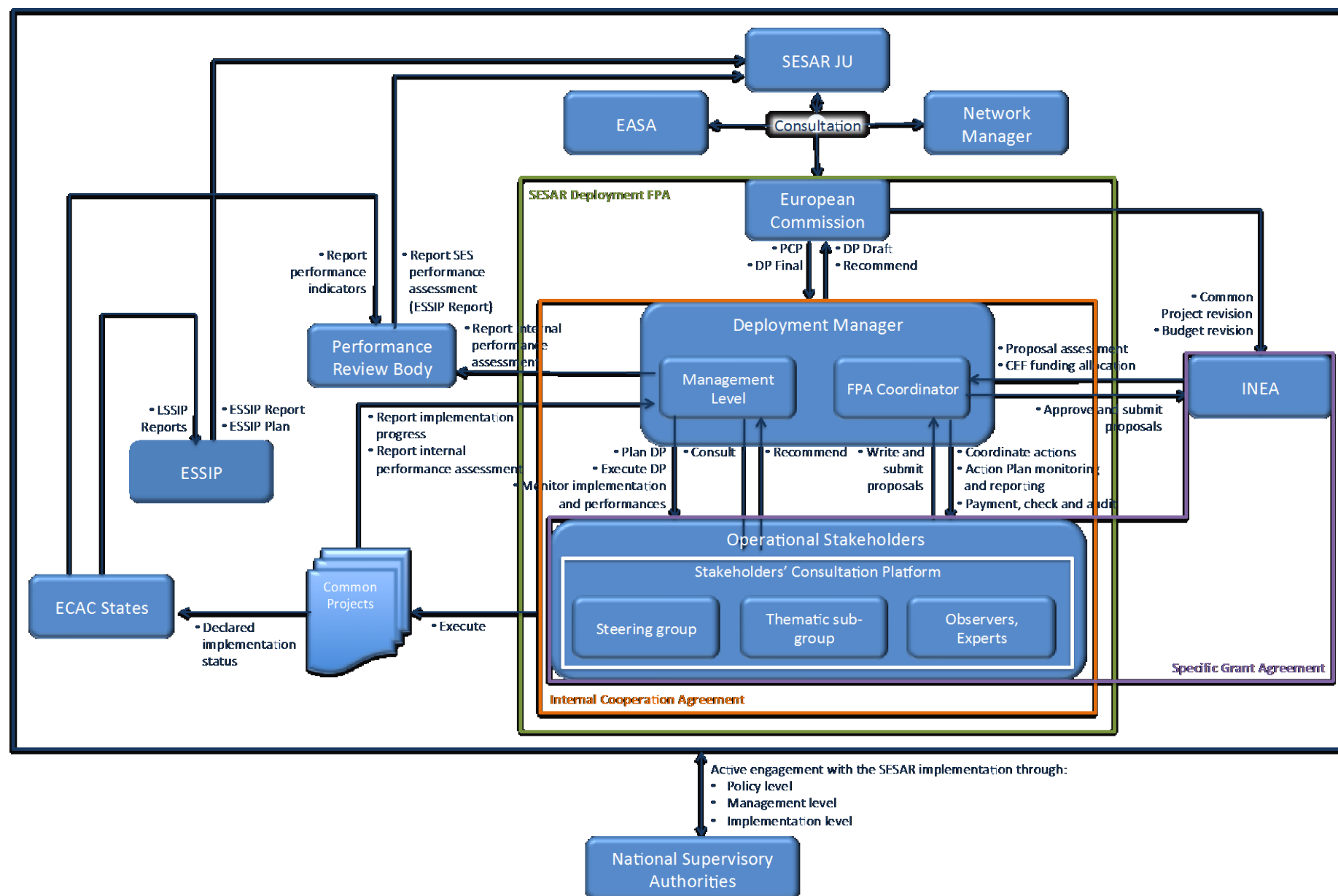
The report provides a functional representation of the ATM in order to appreciate the impact of the SESAR Deployment on the overall ATM system through a mapping of the relevant deployment projects/processes. This is followed by a detailed review of the relevant literature in the public domain to determine the answers to the research questions and to identify gaps. The results of the literature review are then augmented and validated with inputs from Subject Matter Experts (SMEs) through the various instruments for conducting research interviews. The details on the methodology used are given in the Annexes.



## **2. ANALYSIS AND RESULTS**

One of the challenges associated with the deployment of SESAR is its management structure or architecture that identifies the relevant entities and processes. The structure should identify very clearly the responsibilities and interactions (interfaces) between the various partners and stakeholders. Figure 1 captures this structure, as determined from the relevant literature and the results of the surveys conducted (see Annex I for details on the methodology used). The relevant components of the structure are discussed in the next sub-Sections of this chapter.

**Figure 1: SESAR Deployment Management Structure**



Source: Author's own elaboration

## 2.1. SESAR Deployment Planning

### 2.1.1. The Air Traffic Management (ATM) Master Plan

The main roadmap that connects SESAR research and development with deployment scenarios is described in the ATM Master Plan (henceforth "Master Plan"). The operational realisation of SESAR, described in the Master Plan, is organised around three capability-based concept steps:

- **Step 1 on time-based operations**, which implies bringing all the stakeholders together and thereby synchronising the ATM system by optimising the existing operations in terms of flight efficiency, predictability and the environment.
- **Step 2 on trajectory-based operations**. Building on the synchronised ATM system from Step 1, Step 2 is concerned with the optimisation of trajectories for different stakeholders through information sharing and collaboration.
- **Step 3 on performance-based operations**. Following the technical, procedural, human factors and institutional advancements in the previous two steps, Step 3 is designed to deliver the final SESAR target concept – a *"high performance, integrated, network-centric, collaborative and seamless air/ground ATM system"* (SESAR Joint Undertaking, 2012a, p. 29).

Since the 1<sup>st</sup> edition released in 2009, the SESAR Joint Undertaking (SJU) has the responsibility to manage the production of the Master Plan including revisions and updates (Council of the EU, 2007, 2008). The 2<sup>nd</sup> and the 3<sup>rd</sup> editions were released in 2012 and 2015 respectively. The main differences between the 1<sup>st</sup> and 2<sup>nd</sup> edition can be attributed to:

- the simplification and prioritisation of the elements/activities within the Master Plan;
- the preparation of the SESAR Deployment;
- the promotion of interoperability and synchronisation; and
- the review and update of risks and their mitigations, and standardisation and regulatory roadmaps (SESAR Joint Undertaking, 2012a).

The 3<sup>rd</sup> edition augmented the 2<sup>nd</sup> by accounting amongst others for (SESAR Joint Undertaking, 2015):

- the evolution of European travel demand;
- cyber security threats;
- new deployment scenarios to reflect operational changes;
- the Pilot Common Project (PCP); and
- Remotely-Piloted Aircraft Systems (RPAS).

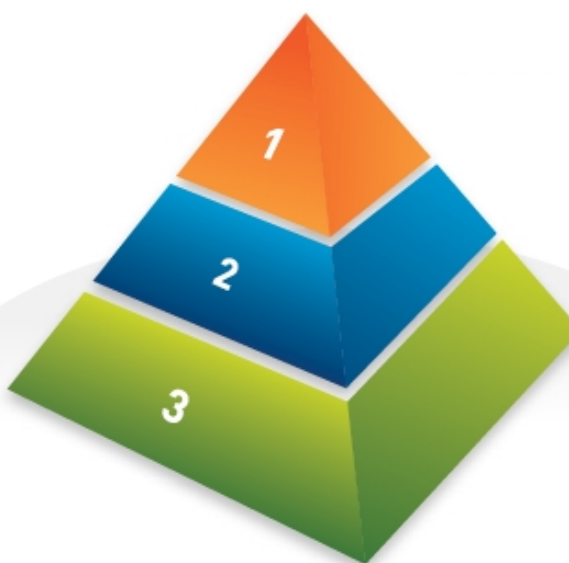
The Master Plan is organised in three Views summarised in Figure 2. **While the Executive View of the Master Plan captures at a high level the operational and technological requirements to deliver the benefits of SESAR, it is not a deployment plan as it does not provide details on geographic implementation** (SESAR Joint Undertaking, 2012a). Furthermore, as stated in Section 1.1, it is not legally binding. All the implementation details (implementation dates, geographical applicability, supporting material, detailed stakeholder implementation actions) are captured in the European Single Sky ImPlementation (ESSIP) Plan, representing together with the ESSIP Report, the Implementation View of the Master Plan.

## Figure 1: Three Views of the European ATM Master Plan

**Executive view of the Master Plan** depicts high-level overview of performances, operational and technological changes and roadmaps, business cases and a risk management plan.

**Planning View of the Master Plan** describes detailed planning information about the Operational Improvements (OIs), enablers and deployment scenarios.

**Implementation View of the Master Plan** offers stakeholders a tool for short-term common implementation planning described in the European Single Sky ImPlementation (ESSIP) Plan.



Source: SESAR Joint Undertaking (2012a, p.12)

## The European Single Sky ImPlementation (ESSIP) Plan

The ESSIP Plan defines the mature implementation objectives, referred to as the ESSIP Objectives, which are to be implemented in a coordinated and timely manner by all the stakeholders, including Airspace Users (AUs), Air Navigation Service Providers (ANSPs), airports, National Supervisory Authorities (NSAs), the military, the Network Manager (NM), the aeronautics industry and international organisations. The ESSIP Plan covers 41 States, corresponding to the European Civil Aviation Conference (ECAC) States plus the Maastricht Upper Area Control Centre (MUAC).

The ESSIP Plan addresses the short to medium-term implementation plan for up to 8 years (SESAR Joint Undertaking and EUROCONTROL, 2015). The importance of the ESSIP Plan in the deployment planning and reporting is recognised by the EC Implementing Regulations (EU) No 409/2013 on the definition of Common Projects (European Commission, 2013b) and No 716/2014 on the establishment of the Pilot Common Project (PCP) (European Commission, 2014c).

According to the ESSIP Plan, each of the stakeholders works on the implementation of the relevant ESSIP Objectives and reports on the implementation plans and progress (i.e. Initial Operational Capability – IOC, and Full Operational Capability - FOC) through the Local Single Sky ImPlementation (LSSIP) documents, which are then processed and aggregated at regional, EU and Pan-European levels to produce an ESSIP Report. This report further summarises the progress made in the implementation objectives during the previous year and presents the plan for actual implementation over the next years. The information contained in the ESSIP Report feeds back into the preparation of the ESSIP Plan for the following year. A summary of the ESSIP/LSSIP yearly lifecycle is presented in Figure 3 while the role of ESSIP within the overall context of the SESAR Deployment is illustrated in Figure 1.

**Figure 3: ESSIP/LSSIP yearly lifecycle**

**Source:** Author's own elaboration

The ESSIP Plan and ESSIP Report are governed by the EUROCONTROL Provisional Council and the SESAR Joint Undertaking (SJU), and as such offer a valuable tool, together with the LSSIP documents, for planning and monitoring short to medium-term deployment of the Master Plan. In addition, the ESSIP/LSSIP mechanism is used for reporting on the status of the Global Air Navigation Plan (GANP). This is with the aim to improve the global air navigation capacity and efficiency, and implementation, for the entire International Civil Aviation Organisation (ICAO) European and North Atlantic (EUR/NAT) region<sup>1</sup>, thus supporting cooperation between EUROCONTROL and ICAO, and ensuring no double reporting by State Authorities (EUROCONTROL, 2015).

### 2.1.3. The Pilot Common Project (PCP)

The requirements for a timely, synchronised and coordinated SESAR Deployment have been outlined in Section 1.1. The European Commission (EC) translated these requirements into practice in the Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects by introducing the concept of a Common Project. The Common Project depicts Air Traffic Management (ATM) concept elements that “*are mature for implementation and that contribute to the achievement of the essential operational changes identified in the European ATM Master Plan*” (European Commission, 2013b).

Required by the EC, the SESAR Joint Undertaking (SJU) drafted the preliminary Common Project, referred to as the Pilot Common Project (PCP) which went through an extensive consultation process (European Commission, 2013b) with: the European Aviation Safety Agency (EASA), the European Defence Agency (EDA), the Network Manager (NM), the Performance Review Body (PRB), EUROCONTROL, the European Standardisation Organisations, the European Organisation for Civil Aviation Equipment (EUROCAE), EU Member States and relevant stakeholders. It also went through an independent global Cost Benefit Analysis (CBA). During this consultation, minor changes were made to the draft PCP primarily related to its geographical scope before being translated into the Implementing Regulation (EU) No 409/2013 on the definition of Common Projects.

Furthermore, the Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP defines a “*first set of ATM Functionalities (AFs) to be deployed in a timely, coordinated and synchronised way*” (European Commission, 2014c). The six AFs are summarised as follows:

<sup>1</sup> Includes 57 Member States listed in ICAO (2016).

- **AF1: Extended Arrival Management and Performance Based Navigation in the High Density Terminal Manoeuvring Areas** refers to precision approaches and early air traffic sequencing to reduce fuel consumption and environmental impact of flights on arrival;
- **AF2: Airport Integration and Throughput** refers to time-based separation in the approach and planning, sequencing, routing, constraint management and safety assurance on the airport surface to improve airport safety, capacity, punctuality and fuel consumption;
- **AF3: Flexible Airspace Management and Free Route** enables Airspace Users (AUs) to fly their preferred trajectory irrespective of the airspace structures or route network thereby improving flexibility, airspace utilisation, fuel consumption and punctuality;
- **AF4: Network Collaborative Management** refers to improvements in flow management strategies, collaborative planning across the network and improvements in complexity assessment that should improve network capacity and flight efficiency;
- **AF5: Initial System Wide Information Management (iSWIM)** refers to the development of interoperable information exchange services between operational stakeholders to improve efficiency of the overall ATM system;
- **AF6: Initial Trajectory Information Sharing** is expected to enhance flight data processing performances to improve predictability of aircraft trajectory and therefore implicitly improve safety, capacity, fuel consumption and punctuality.

For each of the AFs above, the Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP specifies the geographical scope, stakeholders and target date for implementation. **However, it does not provide any assistance to stakeholders on “how” they should be implemented. The answer to this question is contained in the Deployment Programme (DP),** explored in the following Section.

#### **2.1.4. The SESAR Deployment Programme (DP)**

According to the Commission Implementing Regulation (EU) No 409/2013, on the definition of Common Projects, timely, coordinated and synchronised implementation of the Pilot Common Project (PCP) is assured by the DP coordinated by the SESAR Deployment Manager (SDM). The European Commission (EC) is responsible for approval of the DP and any proposal for its amendment.

The first edition of the DP (further referred to in this report as DP2015) was approved by the EC and published by the SDM in 2015 as the result of an extensive consultation process between the SESAR Joint Undertaking (SJU), the Network Manager (NM), the European Defence Agency (EDA) and the operational stakeholders though the Stakeholders Consultation Platform (SCP) further detailed in Section 2.6. The management of the DP is the responsibility of the SDM in coordination with the SJU, NM and the military.

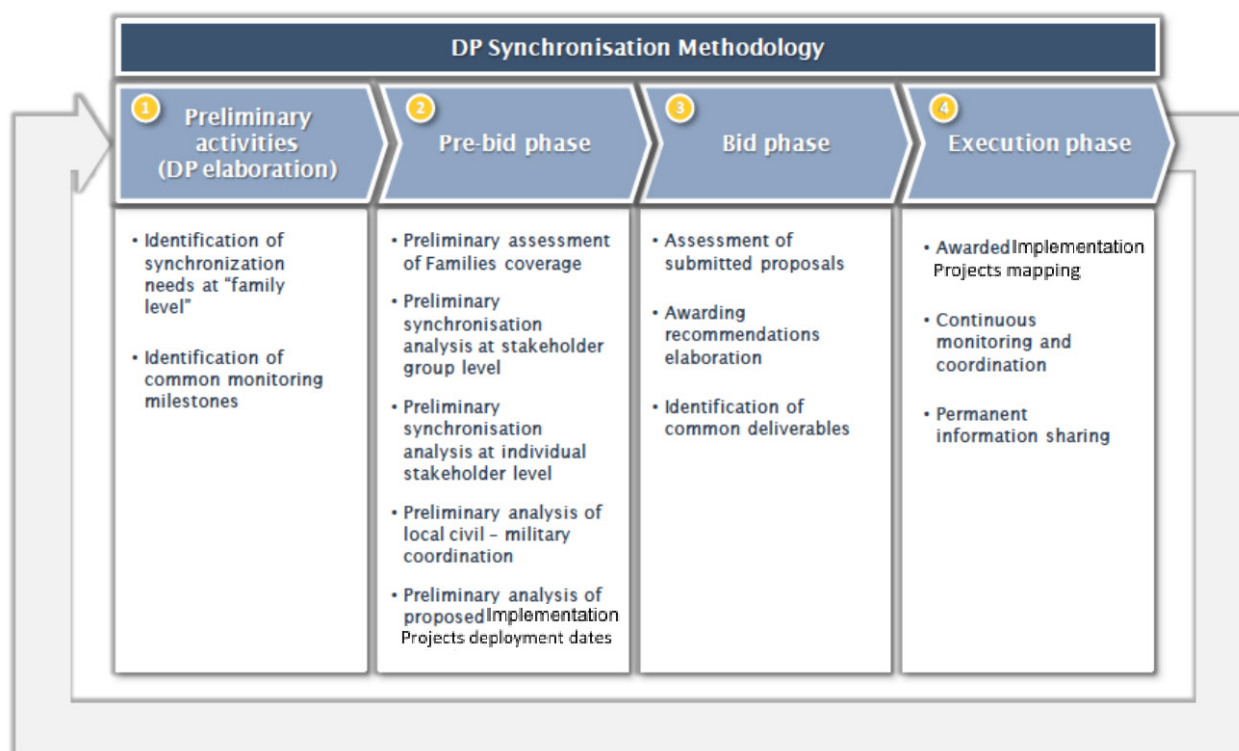
According to Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects, the DP organises the implementation of the PCP through Implementation projects. **For each project, the timeframe, the operational stakeholder responsibility, and the associated risks and mitigations are identified, as well as the geographical scope.**

DP2015 is in line with the high-level structure of the PCP organised around the six ATM Functionalities (AFs) explained in Section 2.1.3, and has undertaken further development to define 44 clusters of Implementation projects, named Project Families (SESAR Deployment Manager, 2015a). The mapping between the PCP, the Master Plan, and DP2015 is presented in Section 2.1.5 and Annex V.

The DP2015 document is organised in six distinct Sections:

- **Strategic View** starts by summarising the project implementation evolution from PCP to DP2015 and the performance policy according to EC Implementing Regulations (EU) No 409/2013 on the definition of Common Projects and No 716/2014 on the establishment of the PCP. Within the context of the Connecting Europe Facility (CEF) Transport and Cohesion Fund Call for Proposals 2015, it then outlines the 44 Project Families in terms of their readiness and criticality for timely PCP implementation grouped into 3 categories:
  - i) 30 high readiness Project Families,
  - ii) 10 medium readiness Project Families and
  - iii) 4 low readiness Project Families.
- **Project View** details implementation activities including: the description and scope, Initial Operational Capability (IOC), Full Operational Capability (FOC), geographical applicability, relevant stakeholders, synchronisation, regulatory requirements, industry standards, and interdependencies, for each of the 44 Project Families and Implementation projects including the projects awarded through the CEF Call 2014.
- **Performance View** refers to performance improvements that could be achieved by the implementation of the PCP. These improvements have been estimated through a global Cost Benefit Analysis (CBA) (European Commission, 2014d) and form the basis for EU Public Funding through CEF in the period 2014-2020. Therefore, this Section of the DP2015 provides an overview of the CBA methodology used together with an overview of the funding and financing mechanisms as well as some preliminary findings from the projects awarded in the CEF Call 2014. A review of the initial CBA, performance monitoring and assessment is provided in Section 2.8.3.
- **Monitoring View** introduces the methodology for SDM synchronisation captured in Figure 4. In addition to the synchronisation methodology, the Section also describes monitoring guidelines referring to:
  - i) the elements that will be monitored by the SDM (tasks, milestones, deliverables and costs),
  - ii) the project monitoring tool (Tool Support System (TSS)),
  - iii) monitoring of project execution timeliness,
  - iv) the party responsible for monitoring of activities and tasks (i.e. SDM, Action Leader, Activity Leader).
- **Risks and Mitigations** Section identifies and assesses the consequences of the main high-level risks to PCP implementation and proposes corresponding mitigation actions. PCP implementation risks and mitigations are reviewed in Section 2.9.
- **Towards DP2016** Section explains the updates and expansion of the DP2015 by emphasising the integration of cyber security requirements and DataLink System (DLS) upgrade. Additionally, this Section summarises the important dates and the planned consultation process leading to the updates required for DP2016.



**Figure 4: Overall Deployment Programme Synchronisation Methodology**

Source: SESAR Deployment Manager (2015a, p. 228))

### 2.1.5. Mapping between the PCP, the DP and the ESSIP Plan

While Sections 2.1.1 to 2.1.4 reviewed various SESAR plans for implementation independently, this Section maps and compares them in order to assess their alignment.

The European Single Sky ImPlementation (ESSIP) Plan, as the Implementation View of the Master Plan, covers all essential elements of the Master Plan across the 41 European Civil Aviation Conference (ECAC) Member States. In contrast, the six ATM Functionalities (AFs) defined in the Pilot Common Project (PCP) and the derived 44 Project Families established in the DP represent only a subset of the Master Plan, with a geographical applicability restricted to the EU. In addition, some of the ESSIP Objectives are pre-requisites for the six AFs.

**The review of the ESSIP Plan 2015 and Deployment Programme 2015 (DP2015) identified a number of inconsistencies between the two plans.** The inconsistencies are notably related to geographical applicability or implementation dates, caused by the different nature of the two documents. The DP covers the EU Member States, the European Free Trade Association (EFTA) Member States (e.g. Norway and Switzerland) and some third countries (e.g. Turkey) (European Commission (2014c)). In contrast, the ESSIP Plan covers the ECAC. To ensure initial consistency with the DP, the ESSIP Plan was already adapted by creating six new and amending nine existing ESSIP Objectives in the 2015 edition of the ESSIP Plan. While progress has been made towards aligning the two plans, six out of 44 Project Families listed in Table 1 have not been mapped between the ESSIP Plan 2015 and DP2015.



**Table 1: ATM Functionalities (AFs) and Project Families not mapped between the ESSIP Plan 2015 and DP2015**

AF 6 Initial Trajectory Information Sharing		
AF 6.1	6.1.1	Flight Data Processing upgrade in preparation of integration of aircraft flight data prediction
	6.1.3	Air Ground Communication Service Upgrade
	6.1.4	Aircraft Equipage in preparation of exchange of aircraft flight data prediction
AF 5 Initial System Wide Information Management		
AF 5.1	Common infrastructure components	
	5.1.1	PENS 1 – Pan-European Network Service v. 1
	5.1.2	Future PENS – Future Pan-European Network Service
AF 4 Network Collaborative Management		
AF 4.3	Calculated Take-off Time to Target Times for Air Traffic Flow and Capacity Management (ATFCM) purposes	
	4.3.2	Reconciled Target Times for ATFCM and arrival sequencing

**Source:** Author's own elaboration

The ESSIP Plan, as part of the Implementation View of the Master Plan, contains a set of ESSIP Objectives that address mature elements of the Master Plan. These elements have the commitment of the EUROCONTROL Member States<sup>2</sup> to implement, within a certain timeframe due to their contribution to the improvement of ATM performance.

Many of these elements are prerequisites to the PCP and are therefore, functionally related to the PCP, even if not strictly a part of the PCP. As such, they have been included within the DP2015 but with different implementation dates to the ones agreed by the States within the Implementation View of the Master Plan.

**The inconsistencies identified above are attributed to the parallel evolution and development of the ESSIP Plan and the DP.** However, following the signature of the Memorandum of Understanding in March 2015 between the SESAR Joint Undertaking (SJU) and the SESAR Deployment Manager (SDM) on coordinated and timely SESAR Deployment, the relevant entities have undertaken (confirmed via the survey described in the Annexes I, II and III) to **strive to achieve alignment between the Master Plan and the DP. This alignment is to be reflected in the ESSIP Plan 2016 and DP2016** (SESAR Joint Undertaking and EUROCONTROL, 2015).

<sup>2</sup> Includes 41 Member States listed in EUROCONTROL (2016).

### 2.1.6. Mapping of the SESAR Deployment with the ATM functional model

A careful review of different plans for SESAR Deployment, summarised in Sections 2.1.1 to 2.1.4, has shown that the existing plans namely the SESAR Deployment Programme (DP), the Pilot Common Project (PCP), and the Master Plan (in particular the Implementation View of the Master Plan which includes the European Single Sky ImPlementation (ESSIP) Plan) take a planning and implementation approach based on Operational Improvements (OIs) rather than on the actual Air Traffic Management (ATM) functions. For a holistic analysis of the ATM system, a functional description is necessary to map these OIs with the actual ATM functions.

Following, the detailed mapping between the 10 ATM functions by Studic (2015) (see Annex I) and the 44 Project Families from the DP (SESAR Deployment Manager, 2015a), along with the analysis of the estimated declared implementation delays and their causes (based on Local Single Sky ImPlementation (LSSIP) data for 2015) further discussed in Section 2.8.1, the remainder of this Section provides a summary of this mapping of the two different concepts, highlighting the expected changes for each of the 10 ATM functions, following the implementation of the PCP:

- **Communication function** is expected to be enhanced in the domain of the air/ground (A/G) and ground/ground (G/G) voice and data information exchange between stakeholders required to support Direct Routings (DCTs), Free Routing Airspace (FRA), Initial System Wide Information Management (iSWIM) and Initial Trajectory Information Sharing concepts.
- **Navigation function** focuses on the improvements of procedural, aircraft and ground capabilities to support Required Navigation Performance (RNP) in high-density Terminal Manoeuvring Areas (TMAs).
- **Surveillance function** is to be improved on the airport surface through the implementation of Advanced Surface Movement Guidance and Control System (A-SMGCS) levels 1 and 2, on board the aircraft through Automatic Dependent Surveillance-Contract (ADS-C), Extended Project Profile (EPP) and in the airspace through adaptations of the Flight Data Processing (FDP) to process ADS-C EPP service.
- **Information management function** refers to a range of improvements in the domain of information exchange and management systems (i.e. Airport Collaborative Decision Making (A-CDM), Airport Operations Plan (AOP), Network Operations Plan (NOP), SWIM) that connect all stakeholders to improve management of trajectories, airspace and the overall ATM network.
- **Airspace management function** is expected to improve civil-military coordination in airspace and network management through the implementation of real-time dynamic airspace management support tools. Additionally, the airspace management function will be enhanced with the implementation of the concepts of Direct Routings (DCTs) and Free Route Airspace (FRA).
- **Network management function** will be enhanced by introducing close to real-time dynamic tactical Air Traffic Flow and Capacity Management (ATFCM) based on the monitoring of expected traffic complexity and close collaboration between the Network Manager (NM), the Airspace Users (AUs) and the Air Navigation Service Provider (ANSP).

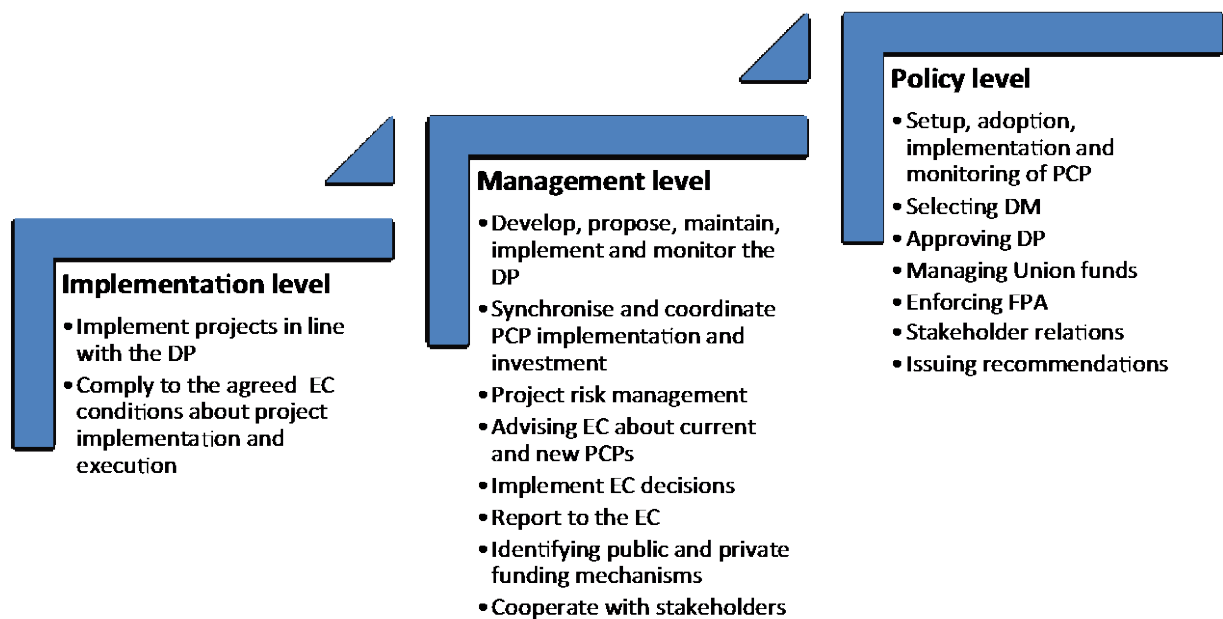
- **Trajectory management function** is to be improved through the combination of ground and aircraft-based systems required to execute an Initial Four Dimensional (i4D) aircraft trajectory through the collaborative efforts of the AU, the NM and the ANSP.
- **Safety assurance function** will be improved through the implementation of systems on the airport surface (i.e. A-SMGCS), in the Terminal Manoeuvring Area (TMA) and in the airspace so that new concepts of Performance-Based Navigation (PBN), DCT and FRA will be supported, without jeopardising the safety of the ATM system.
- **Security assurance function** refers to the security protection incorporated into the information collection, exchange, processing and distribution infrastructure to support SWIM.
- **Environmental management function** will be enhanced primarily in the TMA due to Required Navigation Performance (RNP) 1 operations in high-density areas but also in the en-route phases of flight as a consequence of more direct routings (i.e. FRA, DCT).

The quantification of the performance improvements expected as a result of PCP implementation is discussed in Section 2.8.3.

## 2.2. The SESAR Deployment Governance

The SESAR Deployment Governance is responsible for the “*timely, coordinated and synchronised implementation of Common Projects*” (European Commission, 2013b) through the policy, management and implementation levels. Their main roles and responsibilities for each of the levels are summarised in Figure 5.

**Figure 5: Deployment Governance summary**



**Source:** European Commission (2013b)

While the European Commission (EC) and Executive Agencies entrusted with certain tasks in the management of European Union (EU) programmes (e.g. the Innovation and Networks Executive Agency (INEA)), are responsible for the policy level of the SESAR Deployment, the operational stakeholders are responsible for the remaining two levels. **It should be noted that to date, the Policy level governance is not in place.** There is a real need for an effective Policy level governance so as to ensure (as captured in Article 5 of the Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP) effective monitoring of the implementation of Common Projects and their contribution to the achievement of the EU-wide performance targets.

### 2.3. The Framework Partnership

The Framework Partnership is a European Commission (EC) instrument, established in the Commission Delegated Regulation (EU) No 1268/2012 on the financial rules applicable to the general budget of the European Union (EU) (European Commission, 2012). It is a type of public-private partnership that governs work programme activities (i.e. the implementation of the PCP) related to coordination, financing, management and implementation between the EC and the partners (i.e. operational stakeholders). The partners have the right to choose whether to participate in either both management and implementation levels or either just the implementation level (European Commission, 2014e).

The partners that participate in the former, referred to as coordinating partners, are designated as the SESAR Deployment Manager (SDM), the role and responsibilities of which are summarised in Figure 5 under the Management Level. Furthermore, the underlying relationships between various partners and stakeholders within the SESAR Framework Partnership Agreement (FPA) are illustrated in Figure 1. In contrast, partners that only participate in the implementation level, referred to as implementing partners, are solely responsible for work programmes implementation (i.e. the Deployment Programme (DP)).

In addition to coordinating and implementing partners, operational stakeholders can take other supporting roles in the Framework Partnership such as affiliated partners, subcontractors and third parties. As discussed in the next Section, the Framework Partnership is governed by the FPA and the Specific Grant Agreements (SGAs).

### 2.4. The Framework Partnership Agreement (FPA) and the Specific Grant Agreements (SGAs)

Two **legally binding** instruments govern the Framework Partnership (European Commission, 2012): the FPA and the SGAs. The roles, responsibilities, rights and obligations of the European Commission (EC) and the operational stakeholders are specified in the FPA (European Commission, 2012, European Commission, 2014e, 2014).

Furthermore, according to the Commission Delegated Regulation (EU) No 1268/2012 on the financial rules applicable to the general budget of the European Union (EU) (European Commission, 2012), the FPA has the status of a grant and is awarded through open Calls for Proposals.

The objective of these Calls for Proposals are to (European Commission, 2014a):

- identify and select the partners for the SESAR Deployment Framework Partnership;
- formalise the Framework Partnership by signing the FPA;
- designate the SESAR Deployment Manager (SDM);
- award a Specific Grant to the SDM, as a Connecting Europe Facility (CEF) programme support action, to facilitate the execution of the tasks defined in Article 9 of the Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects;
- specify the Deployment Programme (DP) identifying the projects implementing the Pilot Common Project (PCP).

SGAs refer to the formalisation of Specific Grants that are awarded on the basis of the FPA according to the procedures specified in these agreements (European Commission, 2012). The SGA describes the activities to be carried out during its award period. Distinction can be made between two types of SGA grants, for Programme Support Action (PSA) and for Implementation projects, described in detail in the following Section.

## **2.5. EU financial support for SESAR Deployment**

### **2.5.1. The role of the Innovation and Networks Executive Agency (INEA)**

With the aim to support the European Commission (EC) to focus on its “*core activities and functions that cannot be outsourced*” (European Commission, 2013a, L 352/65), Regulation (EC) No 58/2003 on the statute for EC Executive Agencies empowers the EC to delegate its responsibilities for the implementation of some of the European Union (EU) programmes and projects.

In the transport sector, to support coordinated financial aid for trans-European transport and energy networks, the European Parliament and Council adopted The Trans-European Transport Networks (TEN-T) programme. Furthermore, the technical and financial implementation of the TEN-T programme was assigned to the Trans-European Transport Network Executive Agency (TEN-T EA).

A Cost-Benefit Analysis (CBA) carried out for the period between 2008 and 2015 demonstrated savings in the order of EUR 8.66 million (European Commission, 2013a) as a result of the delegation of management tasks related to the TEN-T programme from the EC to the TEN-T EA. Additional EUR 54 million savings were estimated for the continuation of the outsourcing trend in the 2014-2020 timeframe (European Commission, 2013a). Therefore, by the Implementing Decision of 23 December 2013 (European Commission, 2013a) it was decided to create a new Executive Agency with extended mandates that superseded TEN-T EA: the Innovation and Networks Executive Agency (INEA).

In addition to the implementation of its legacy programmes (including the TEN-T programme), INEA was assigned the responsibility to support the implementation of two additional EU programmes: the Connecting Europe Facility (CEF) and Horizon 2020 (H2020). INEA aims to provide “*stakeholders with expertise and high-level programme management, whilst promoting synergies*” (INEA, 2015c). Towards this aim, INEA supports the projects under these programmes in two ways: evaluating project proposals for the funding, and undertaking administrative and control functions related to the allocation of funds.

### 2.5.2. The Connecting Europe Facility (CEF)

To support the implementation of the projects of common interest, the European Commission (EC) has established financial assistance through the creation of the CEF. It aims to accelerate investment in the field of trans-European transport, telecommunications and energy by leveraging funding from both the public and private sectors (European Parliament & Council of the EU, 2013b).

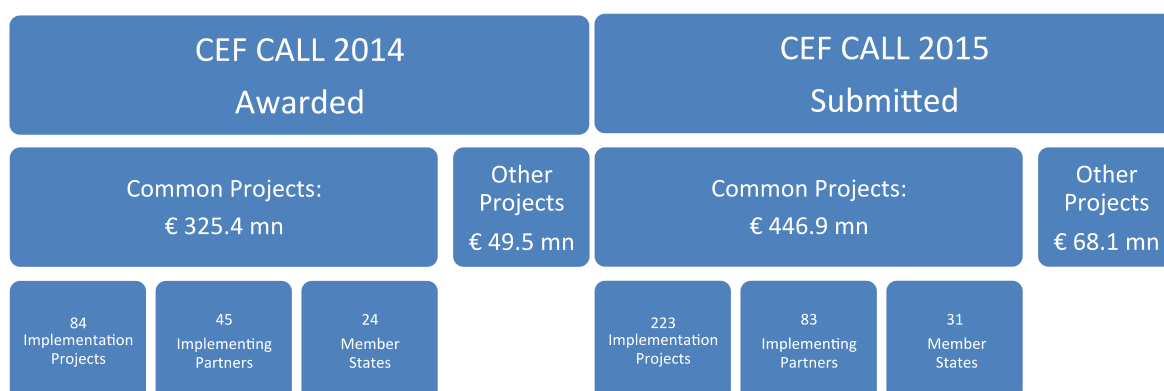
In total, the EC has budgeted in excess of EUR 33.2 billion for the implementation of the CEF in the 2014-2020 period (European Commission, 2015d). The total budget for all transport projects is EUR 26.2 billion across all European Union (EU) Member States, out of which EUR 11.3 billion is made available only for projects in EU Member States eligible for the Cohesion Fund (European Commission, 2015d). The Cohesion Fund is an EU financial mechanism that aims to support the EU Member States whose Gross National Income (GNI) per inhabitant is less than 90% of the EU average in order to promote economic, social and sustainable development of these countries (INEA, 2015a). For the 2014-2020 period, the Cohesion Fund covers 15 EU Member States: Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia (European Parliament & Council of the EU, 2013a).

According to the CEF Regulation (European Parliament & Council of the EU, 2013b), the rates of financial assistance in the transport sector by the EU should not exceed:

- 50% of the eligible costs for grants for studies;
- 50% of the eligible costs for land-based components of the SESAR system; and
- 20% of the eligible costs for on-board components of the SESAR system.

In the EC Communication on the governance and incentive mechanisms for the deployment of SESAR (European Commission, 2011a), the risks regarding timely SESAR Deployment were identified. In order to address them, financial support in the form of a coordinated combination of private and public funding was proposed. To leverage private funds, it was estimated that an additional EUR 3 billion from the EU public fund is required over the period 2014-2024 (European Commission, 2011a) to facilitate synchronisation and coordination between stakeholders in the SESAR Deployment. **The CEF has been identified as the main instrument for SESAR Deployment.** Other potential sources of financing are loans from the European Investment Bank (EIB), the Single European Sky Charging Regulation and the Emissions Trading Scheme (ETS).

**Figure 6: Allocation of the CEF funding for Common Projects and Other Projects**



Source: INEA (2015b) and European Commission (2015a)

To support SESAR Deployment, so far there have been two CEF Calls for Proposals in 2014 and 2015 respectively, see Figure 6. In the CEF Call 2014, EUR 374.9 million were awarded of which about 87% (EUR 325.4 million) were allocated for Common Projects funding (INEA, 2015b). A list of funded projects is given in Table 2. **However, the actual expenditure at the State or stakeholder level has not been possible to determine due to inaccessibility to the relevant data as a result of confidentiality issues.** The CEF Call 2015 closed on February 23 when the project evaluation process for the allocation of the available EUR 515 million (European Commission, 2015a) of EU funding for SESAR Deployment started, with an indicative EUR 446.9 million to be allocated to PCP funding. The signature of SGAs is expected in September 2016.

The financial support through the CEF is in the form of grants and financial instruments. Based on the Framework Partnership, partners may be awarded a Specific Grant for an action. Herein, an action can take one of two forms (European Commission, 2014e):

- Programme Support Action (PSA), or
- an Implementation project.

In Article 2(7) of the Commission Regulation (EU) No 1316/2013 on the establishment of the CEF (European Parliament & Council of the EU, 2013b, L 348/138), a PSA refers to “*all preparation, feasibility assessment, coordination, monitoring, stakeholder consultation, control, audit and evaluation activities which are required directly for the management of the CEF and the achievement of its objectives*”. Furthermore, the objective of this PSA (European Commission, 2015a) is to continue to support the SESAR Deployment Manager (SDM) in executing tasks under Article 9 of the Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects (European Commission, 2013b) summarised under the Management level in Figure 5.

A Programme Support Action (PSA) is formalised by signing a Specific Grant Agreement (SGA) between the EC and the SDM. To implement the multi-annual work programme, the SDM is awarded financial aid from the EU in the form of a grant. It should be noted that the PSA excludes the role of coordination of the Framework Partnership, which is specified in the SGA for Implementation projects.

Actions that belong to Implementation projects refer to the deployment of civil and military ATM Functionalities (AFs) defined in the Pilot Common Project (PCP), in accordance with the Deployment Programme (DP). The grants belonging to this category are awarded through SGAs established under the SESAR Deployment Framework Partnership Agreement (FPA). Therefore, following the signing of the FPA, an open Call for Proposals is launched to award Specific Grants for Implementation projects, which is formalised through the signing of a SGA on a project basis. In contrast to the PSA grants awarded from the EC, grants for the Implementation projects are awarded to partners by INEA. The SGAs specify that the SDM is assigned the role of coordinator of the FPA (European Commission, 2015a) and is thus responsible for the management, coordination, monitoring and reporting associated with the deployment of the Implementation projects (European Commission, 2014a). More specifically, the applicants are required to demonstrate their eligibility in line with the Call for Proposals and the DP. Towards achieving this alignment, the SDM takes an advisory and support role in the project assessment to maximise its eligibility for the grant award.



**Table 2: Results of the CEF Call 2014**

<b>COORDINATING APPLICANT</b>	<b>EU MEMBER STATES</b>	<b>RECOMMENDED FUNDING</b>	<b>PCP OR OTHER PROJECTS</b>
Belgocontrol	Belgium	<b>353 609</b>	Other
EUROCONTROL	Belgium, Germany, The Netherlands	<b>1 187 550</b>	Other
EUROCONTROL	Belgium	<b>3 724 586</b>	Other
EUROCONTROL	Belgium, Germany, Luxembourg, The Netherlands, Slovenia	<b>2 447 294</b>	Other
Deutsche Flugsicherung GmbH (DFS)	Belgium, Germany, France, The Netherlands, The United Kingdom	<b>16 528 347</b>	PCP
ENAV, SpA	Austria, Belgium, Croatia, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Latvia, Norway, Poland, Portugal, Sweden, United Kingdom	<b>140 779 908</b>	PCP
ENAV, SpA	Austria, Belgium, Denmark, France, Italy, Spain, Sweden, Switzerland, Romania, The Netherlands, United Kingdom	<b>104 249 430</b>	PCP
French Ministry of Ecology, Sustainable Development and Energy	Belgium, Germany, French, Luxembourg, The Netherlands	<b>20 731 830</b>	Other
AustroControl GmbH	Austria, Denmark, Croatia, Ireland, Sweden	<b>12 249 000</b>	Other
SESAR Related Deployment Airport Operations (SDAG/NATS)	Austria, Belgium, Denmark, France, Ireland, Italy, Spain, Sweden, The Netherlands, United Kingdom	<b>62 717 443</b>	PCP
HungaroControl	Austria, Czech Republic, Croatia, Hungary, Slovenia, Slovakia, UK	<b>1 106 345</b>	PCP
HungaroControl	Hungary	<b>521 716</b>	Other
LVF	Sweden	<b>4 809 500</b>	Other
Birmingham Airport	UK	<b>1 706 410</b>	Other
Heathrow Airport	UK	<b>1 814 234</b>	Other
	<b>TOTAL</b>	<b>374 927 202</b>	

Source: INEA (2015b)



Additionally, the applicants are required to demonstrate the following (European Commission, 2015a, 2015d):

- evidence of civil-military coordination;
- validation and agreement on the proposals by the EU Member State(s);
- consistency with their adopted performance plans referred to in Regulation (EU) No 691/2010 laying down a performance scheme for air navigation services and network functions.

Following the approval of the SDM, the applications are submitted to INEA, who is responsible for the management of the application process. Based on the detailed award criteria specified in the Calls for Proposals (European Commission, 2015c, 2015a), the CEF Committee at INEA, on behalf of the EC, carries out the assessment and evaluation of the submitted proposals. The projects that meet the eligibility criteria are awarded a grant for the project delivery. However, it should be noted that the awarded grants are based on a co-funding mechanism defined in the CEF Regulation (European Parliament & Council of the EU, 2013b).

In addition to grants, other sources of EU financial support include financial instruments (European Parliament & Council of the EU, 2013b) such as investment funds and loans and/or guarantees for actions contributing to projects of common interest. The financial instruments may be combined with grants funded from the EU budget.

## **2.6. The Stakeholder's Consultation Platform (SCP)**

In line with the Article 9 of the Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects, the responsibility of the SESAR Deployment Manager (SDM), is amongst others, to (European Commission, 2013b):

- associate with the operational stakeholders in the implementation of the Deployment Programme (DP);
- demonstrate its capacity to represent operational stakeholders implementing the DP.

Operational stakeholders, defined in Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects, include both civil and military stakeholders, Airspace Users (AUs), Air Navigation Service Providers (ANSPs) and airport operators.

To discharge its responsibilities, the SDM has created a SCP, organised in two levels (SESAR Deployment Manager, 2015e): the Steering Group and the Thematic Sub-Groups, both composed of members appointed to represent the interests of respective operational stakeholders. In addition to the two groups, external observers and experts can be involved in the consultation process based on the terms in a Cooperative Agreement.

The Steering Group is responsible for the management of the SCP and for the issue of formal recommendations to the SDM, with the objective to improve:

- the DP, including risk assessments and mitigation actions to facilitate DP implementation; and
- the stakeholders' participation and commitment to the implementation of the DP.

Recommendations presented by the Steering Group result from a detailed analysis of specific issues carried out by the Thematic Sub-Groups.

The Stakeholders' Consultation process lasted between April and June 2015, during which the draft DP was distributed to the Thematic Sub-Groups for consultation and elaboration of comments (SESAR Deployment Manager, 2015d). The comments were consolidated by the Steering Group and subsequently reviewed by the SDM before being submitted to the European Commission (EC) for approval.

The effectiveness of the SCP is assessed based on:

- a) the number of Implementation projects,
- b) the number of stakeholders submitting proposals from different States, and
- c) the alignment with their individual investment programmes.

**The results based on the data from 2014 and 2015 show a significant increase not only in the project allocation but also in the stakeholder participation.** In order to increase further the level of engagement of the operational stakeholders, during the DP2016 updating process, the Stakeholders' Consultation process will be expanded from three to over six months allowing for two rounds of consultation prior to submission of the DP2016 draft to the EC (SESAR Deployment Manager, 2015a).

## **2.7. The National Supervisory Authorities (NSAs)**

The NSAs are at the forefront of SESAR Deployment. They play important roles in all three governance levels as the local agents for the Single European Sky (SES) implementation (NSA Coordination Platform Working Group, 2015):

- At **Policy level** (Article 8(3) of Regulation (EU) No 409/2013 on the definition of Common Projects): providing advice to the European Commission (EC), based on the experience gained through exercising its local powers deriving from SES legislation as well as, potentially, local legislation (e.g. in terms of consumer protection or environment);
- At **Management level**: coordinating and interacting with the Deployment Programme (DP), through cooperative arrangements that need to be established in application of Article 9(2) (j) of Regulation (EU) No 409/2013 on the definition of Common Projects. These cooperative arrangements aim at providing a platform and ensuring adequate coordination between the industry and regulatory bodies to address and overcome possible deployment problems;
- At **Implementation level**: at local level, ensuring safe and secure technology deployment and taking into account all local aspects that may influence the delivery of the programme.

## 2.8. SESAR Deployment reporting and monitoring

The monitoring and reporting processes for SESAR Deployment are captured in Figure 1. Of particular note is that the SESAR Deployment Manager (SDM) proposes to consult with the SESAR Joint Undertaking (SJU) and EUROCONTROL to streamline monitoring activities of SESAR Deployment.

### 2.8.1. Timeliness

The timely deployment of SESAR was the main driver for formulation of the Pilot Common Project (PCP) and the SESAR Deployment Governance. The timeliness of the SESAR Deployment was assessed on the basis of the methodology developed and explained in depth in Annex VII.

The results of the timeliness of the SESAR Deployment are presented at two levels, at the level of the PCP and at the State level.

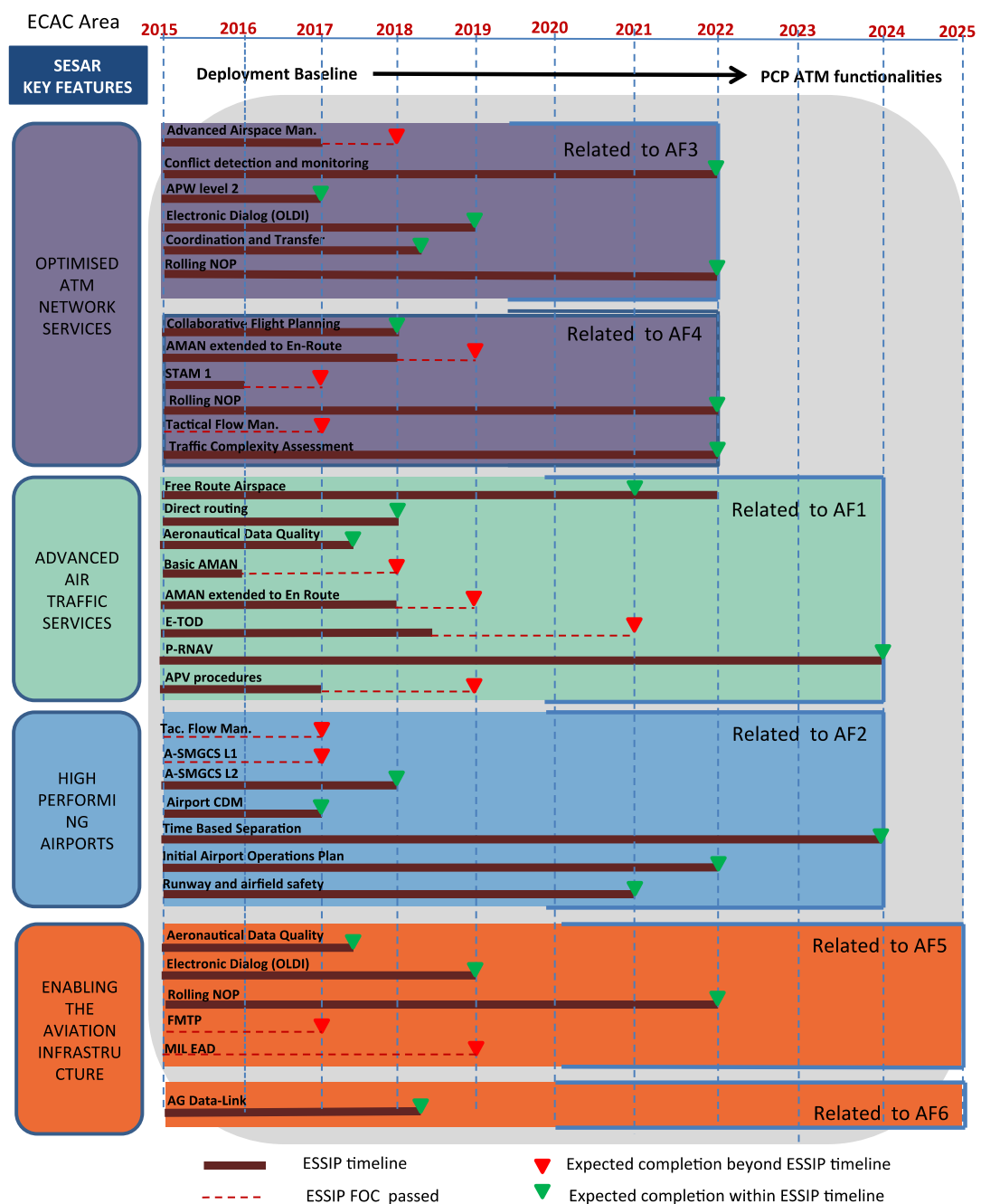
The analysis of the mapping results between the PCP Air Traffic Management (ATM) Functionalities (AFs) and the European Single Sky ImPlementation (ESSIP) Objectives, as illustrated in Figure 7, shows that while some of the ESSIP Objectives exceed the expected ESSIP completion timelines (red triangles in Figure 7), it should be noted that none exceeds the overall Full Operational Capability (FOC) defined in the Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP (European Commission, 2014c). **Therefore, it can be concluded that some of the elements of SESAR implementation are experiencing delays, but not (yet) exceeding the overall PCP timelines.**

Based on the convention adopted in Annex VI, implementation delays were also mapped to the European Union (EU), the European Free Trade Association (EFTA) and the European Civil Aviation Conference (ECAC) States. The results of this analysis for each of the six AFs of the PCP are presented in Annex VII.

There are several reasons for the actual and potential delays in the SESAR Deployment. For many years, technological improvements, which are regulated by the European Commission's (EC) Implementation Rules, have recorded delays. Since some of these objectives are a pre-requisite for the PCP implementation, the ESSIP Report provided recommendations (in 2013 and 2014) to the EC to define corrective measures to address delays in the implementation of interoperability (EUROCONTROL, 2014).

**In the ESSIP Report 2014, a lack of synchronisation in the deployment of technologies by Air Navigation Service Providers (ANSPs) was found as one reason for delays.** This is due to piece-meal planning that neither accounts for the manufacturers' delivery capability nor the integration of systems by different manufacturers. The SESAR Deployment Manager (SDM) is expected to bring significant improvement in this area through its coordination activities. **However, due to the recent SDM mandate, it is too early to assess the effectiveness SDM's coordination activities towards the improvement of the SESAR Deployment synchronisation.**

When considering objectives independently, the following trends in the implementations were observed across the ATM Functionalities (AFs). **Implementation delays in the ground-ground (G/G) automated coordination processes** may affect timely implementations of AF3 (Flexible Airspace Management and Free Route), AF5 (Initial System Wide Information Management) and AF6 (Initial Trajectory Information Sharing).

**Figure 7: PCP AF Deployment timeline**

ESSIP completion criteria = 80% of States in applicability area report full completion

'Related' is to be understood as an ESSIP objective leading into (i.e. pre-requisites to, facilitators for or part of) a DP family.

**Source:** ESSIP email communication

Furthermore, additional delays could be anticipated for AF1 (Extended Arrival Management and Performance Based Navigation in the High Density Terminal Manoeuvring Areas) and AF5 (Initial System Wide Information Management) due to **constraints at technical level in ATM systems or weak business cases for the particular implementation** (EUROCONTROL, 2014).

AF2 (Airport Integration and Throughput) is already facing 48 months delay associated to the implementation of Level 1 of the Advanced Surface Movement Guidance and Control System (A-SMGCS), primarily due to **the slow process of equipping ground vehicles with vehicle transmitters and the lack of consistent provisions and/or regulations** (EUROCONTROL, 2014). This in turn may have a knock on effect on Level 2 A-SMGCS, considering Level 1 A-SMGCS is a pre-requisite for the implementation of Level 2.

### 2.8.2. The Cost

The expenditure on the Pilot Common Project (PCP) via the Connecting Europe Facility (CEF) funding mechanism was EUR 325.4 million in 2014, with a further EUR 446.9 million for the Call for Proposals issued in 2015. This is out of a total of EUR 3 billion investment for the period 2014-2020. A list of the proposals funded in the CEF Call 2014 is given in Table 2.

A detailed analysis of grant allocation at the State or stakeholder level has not been possible due to inaccessibility to the relevant data as a result of confidentiality. **However, such an analysis would have to consider issues of balance, awareness and in some cases stakeholder preference for more “favourable” routes for financing projects.**

### 2.8.3. The Performance Impact

To date the best estimate of the cost benefit to be accrued as a result of the Pilot Common Project (PCP), as represented by the package of the Air Traffic Management (ATM) Functionalities (AFs), is contained in a Cost Benefit Analysis (CBA) (Reference and Supporting Material – EC No 716/2014 on the establishment of the PCP) showing that an on-time and synchronised implementation of the PCP would generate a Net Present Value (NPV) of EUR 2.4 billion over the period 2014-2030.

**The current impact of the PCP in terms of the various Key Performance Areas (KPA) is too early to quantify the benefits** as the first projects were awarded in 2014, with the evaluation of proposals for 2015 underway at the time of writing.

What is very important is that a coherent process for monitoring and reporting is in place, with a few clarifications under discussion. It is proposed that the process involves the SESAR Deployment Manager (SDM) playing the role of monitoring, and providing the link between the stakeholders and the Performance Review Board (PRB). In preparation of the proposals for funding, the stakeholders undertake a CBA, and if awarded, they produce reports on actual expenditure and impact. The reports are sent to the SDM, who liaises with the PRB to authenticate the impact of the implementation.

## 2.9. The limitations and opportunities for improvement in the SESAR Deployment

The analysis of the SESAR Deployment concludes by the review of the limitations of the current deployment process and opportunities for its improvement in the future. For each identified limitation, the following text summarises the possibilities for improvement, mainly based on:

- Chapter 6 on Risks and Mitigations from the 2015 Deployment Programme (DP2015) (SESAR Deployment Manager, 2015a); and
- structured communications with the SESAR Deployment Manager (SDM), the European Single Sky ImPlementation (ESSIP) and the Innovation and Networks Executive Agency (INEA) due to their high degree of involvement in SESAR Deployment planning and monitoring.

#### **Limitation 1: Late implementation of iSWIM and DataLink**

The late implementation of the Initial System Wide Information Management (iSWIM) lies in the absence of governance in place (the Policy level is missing). The SDM calls for actions by the European Commission (EC) to fund studies into this topic. In contrast, the late implementation of the DataLink System (DLS) is linked with the perceived issues of the underlying technology. Towards this aim, the SESAR Joint Undertaking (SJU) and the SDM will collaborate closely in the future.

#### **Limitation 2: Late development of standards and regulations**

For the projects early in their deployment phase, the standard and regulations are only developed at a later stage which could have a significant negative impact in terms of harmonised and timely Pilot Common Project (PCP) implementation. Therefore, the SDM calls for a close collaboration on these standards and regulatory material between the SJU, the European Aviation Safety Agency (EASA), the European Organisation for Civil Aviation Equipment (EUROCAE), the European Standardisation Organisations, the manufacturing industry and the EC.

#### **Limitation 3: SDM mandated to monitor only projects awarded through SESAR Deployment Framework Partnership Agreement (FPA)**

This could potentially create inaccuracies in the assessment of benefits and of the current status of the PCP implementation. The SDM, therefore, proposed to the EC to expand its scope for the purpose of monitoring. However, we note that EUROCONTROL has a wider remit in this regard than the SDM. This issue should thus be resolved between the relevant entities.

#### **Limitation 4: Geographical and temporal Connecting Europe Facility (CEF) funding applicability restriction**

- i) The PCP benefits cannot be achieved without global synchronisation. Therefore, it would be necessary to support countries not eligible for co-funding under the current CEF award criteria.
- ii) In the DP2015, the SDM has identified risks in the CEF funding mechanisms associated with the uncertainty of the availability of CEF co-funding between 2016 and the next financial period (2021-2027), which is still to be agreed. This implies that the Project Families that are not ready for implementation will potentially miss out on the 2016 Call for Proposals and be required to wait for at least another 5 years before they can resume their PCP implementation. To avoid this delay in PCP implementation, the SDM proposed to the EC to relax the implementation readiness criteria (according to the European Operational Concept Validation Methodology (E-OCVM)) for the 2016 Call for Proposals or alternatively propose an additional funding mechanism in the 2017-2020 period.

**Limitation 5: Lack of operational stakeholder's awareness about CEF funding**

The awareness of CEF funding, measured through the number of Implementation projects and the number of stakeholders submitting applications for funding, considerably increased in the 2015 Call for Proposals when compared to the 2014 Call for Proposals (see Figure 6) as a consequence of a strong promotion of the Deployment Programme (DP) and of an active communication between the SDM and operational stakeholders. This trend is expected to continue in the future.

**Limitation 6: Misalignment between the DP and the operational stakeholder's business plans**

Since the CEF mechanism is based on a co-funding principle, the operational stakeholders who have not aligned their budgets with the DP will be unable to participate in the CEF Calls for Proposals and could thus delay the PCP implementation. To overcome this limitation and facilitate the compliance with the Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP, the SDM is actively working on raising awareness and informing the stakeholders on the potential benefits of the PCP implementation for all operational stakeholders.

**Limitation 7: CEF funding to date only allocated to the civil operational stakeholders**

Since the military plays an important role in the PCP implementation, it is of utmost importance for the SDM to foster the promotion and coordination of the PCP with the military.

**Limitation 8: Inability to access performance data**

This limitation significantly constrained the results of this report in terms of the costs related to the implementation of Common Projects but also the cost of delays associated with the PCP implementation.

**Limitation 9: Potential conflict of interest in the monitoring of SESAR Deployment should be avoided.**

The obligations of the State/National Supervisory Authorities (NSAs) in the SESAR Deployment prescribe a number of important tasks to be carried out at all three levels of the SESAR Deployment Governance (as depicted in the NSA guidance for SESAR Deployment). There is a need for an independent, long standing and State controlled planning and monitoring tool to enable the NSAs to perform their role at both policy and management levels of the SESAR Deployment Governance.





### 3. CONCLUSIONS

The following conclusions are drawn from the work undertaken and presented in this report.

- Significant effort has been made to create an integrated management structure for SESAR Deployment (Figure 1) with a clear assignment of responsibilities and interfaces/interactions (details in Section 2). This structure should facilitate the removal of potentially unnecessary duplication of effort and wastage of resources. Within the context of this structure, the two main issues to be addressed to achieve maximum cohesion and integration are:
  - the need for coordination between the Air Traffic Management (ATM) Master Plan (with its European Single Sky ImPlementation (ESSIP) Plan) and the Deployment Programme (DP) for Pilot Common Project (PCP) related elements; and
  - the achievement of complementarity between the ATM Master Plan planning and implementation reporting mechanism (ESSIP/Local Single Sky ImPlementation (LSSIP)) and the SESAR Deployment Manager (SDM) reporting mechanism.
- As the implementation of the PCP started in 2014, it is too early to quantify the benefits of the SESAR Deployment to date in terms of the SESAR Key Performance Areas (KPAs). The initial cost benefit analysis determined the overall benefit to be accrued from the PCP as EUR 2.4 billion for the period 2014-2030.
- There is in place a monitoring and reporting structure, with the task of quantifying the actual operational benefits embedded in it. However, potential conflict of interest in this function should be avoided through a wholly independent process.
- The expenditure on PCP via the CEF funding mechanism was EUR 325.4 million in 2014 (see Table 2), with a further EUR 446.9 million for the Call for Proposals issued in 2015. This is out of a total of EUR 3 billion investment expected for the period 2014-2020. The expenditure at the State level is confidential and not in the public domain.
- To date, the implementation of the PCP is on time, although there are delays anticipated in the ESSIP Report for a number of the PCP pre-requisites. For these delays, the SDM is looking at ways of accelerating the implementations to deviate as little as possible from the original target end dates. Information on the consequences of the delays in terms of cost is still to be determined.
- To achieve the full potential of the PCP, countries that do not belong to the EU but are a part of the European Free Trade Association (EFTA) or neighbouring States (third countries) are expected to implement parts of the PCP. Their involvement is either as formal partners or as third parties whose air transport activities have close links with those of the EU.
- Risk management is a critical element of the SDM's responsibility. DP2015 contains a detailed analysis of risks together with the ways to mitigate them. These are reviewed on a continuous basis and updates are made. In addition to these risks, further limitations in the SESAR Deployment have been identified in this report and should be incorporated into DP2016 together with their mitigations. The consolidated risks are the lack of operational awareness of the CEF, the misalignment between the DP and the operational stakeholder's business plans, the allocation to date of CEF funding only to civil operational stakeholders, the need for independent monitoring of

performance, the geographical restrictions on CEF funding, the lagging or late development of standards and regulations, and the lack of access to performance data due to confidentiality issues.

- The SESAR Deployment Governance has three levels (implementation, management and policy). However, the highest level (policy level) is not yet in place. This is required urgently in order to ensure a better involvement of State Authorities in the process, because ultimately States are responsible for the implementation of the PCP, as declared in the National Safety Authority (NSA) guidance for SESAR Deployment.

Finally, this report has used information and data provided by the relevant stakeholders. It has captured the expenditure in 2014 and what is planned for 2015, out of the total of EUR 3 billion expected for the period (2014-2020). As evidenced in Annex II, and following a consultation with the SDM on the breakdown of expenditure at the stakeholder and State levels, INEA could not avail this information for the reason of confidentiality. Furthermore, this report has captured the anticipated delays, emphasising that the PCP implementation is currently on time. However, following consultation with the SDM, it was clear that definitive figures on the consequences of these anticipated delays were unavailable mainly because the implementation of the PCP is still at an early stage. The same reason is given for the lack of definitive figures on the benefits in terms of the Key Performance Areas (KPA's). However, the report details the processes including those responsible for producing the figures, which should be incorporated as they become available.

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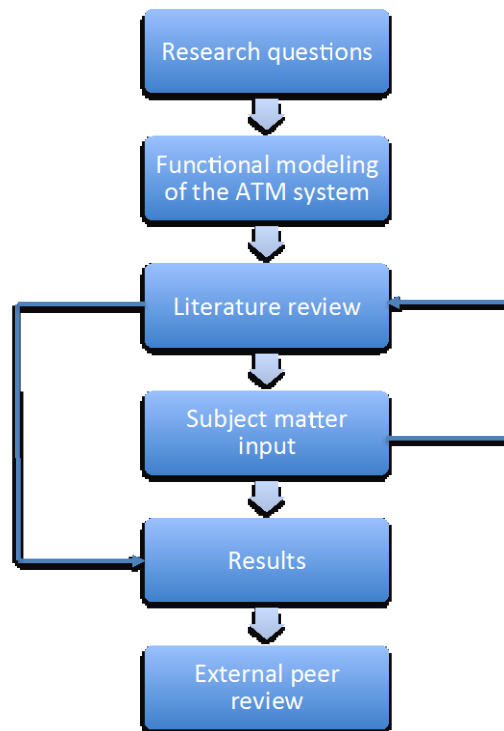
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## ANNEXES

### Annex I: Methodology

The methodology employed in the report is captured in Figure 8. It consists of five stages together with the necessary iterative loops to ensure exhaustive coverage of each stage. The first stage involves the derivation of research questions from the objectives. This is followed in the second stage by a functional representation of the Air Traffic Management (ATM) in order to appreciate the impact of SESAR Deployment on the overall ATM system through a mapping of the relevant Deployment projects/processes. Stage 3 then undertakes a detailed review of the relevant literature in the public domain to determine the answers to the research questions and identify gaps. In stage 4, the results of the literature are augmented and validated with inputs from Subject Matter Experts (SMEs) through the various instruments for conducting research interviews. The results from Stage 4 are reviewed and validated in Stage 5 through an external peer review process.

**Figure 8: Methodological approach for the report**



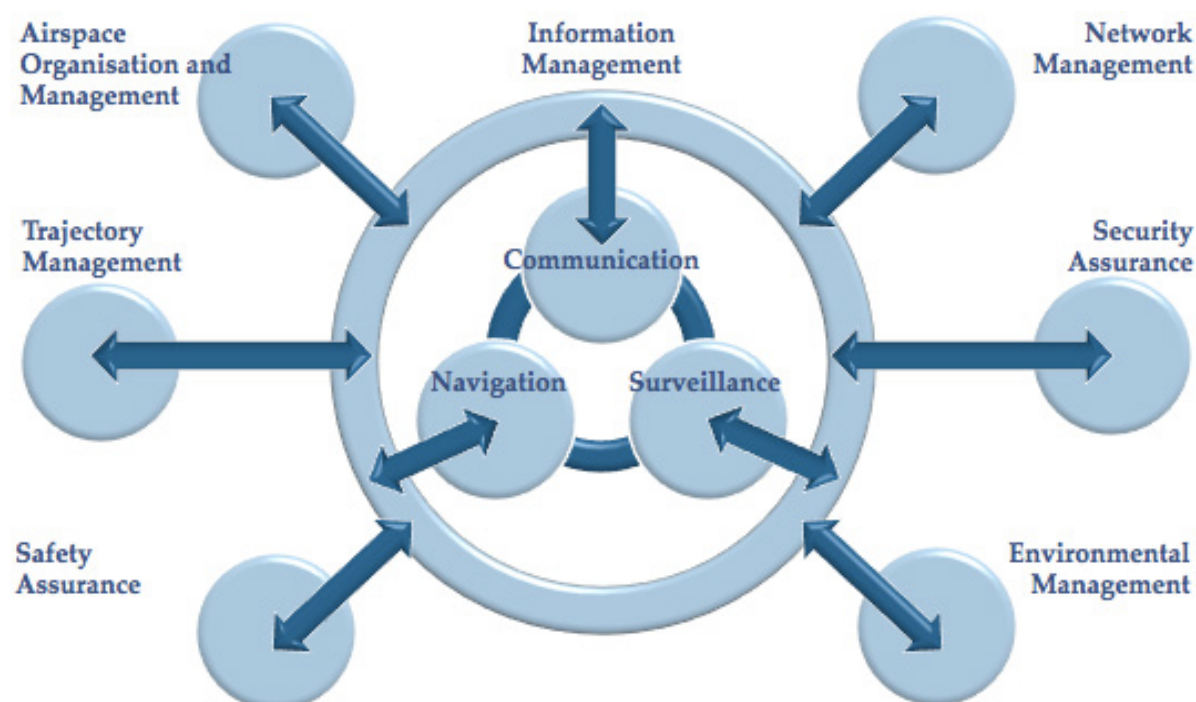
**Source:** Author's own elaboration

### ATM functional model

To provide a reference for the analysis of the SESAR Deployment contained in the SESAR ATM concept of operations (ConOps), it is necessary to firstly take a holistic approach to the ATM system description and then map the Implementation projects on it. This approach not only fosters the understanding of how the Implementation projects fit within the ATM system's architecture and their wider impacts, but also of the details on interdependencies amongst the projects and implementation gaps.

The ATM functional architecture by Studic (2015) is employed in this report due to its completeness (and thus invariable nature), and ability to represent the ATM system in any phase of the SESAR Deployment. The functional model is captured in Figure 9 where the ATM functions are represented in light blue and the relationships between the functions in dark blue. The definitions of the functions are summarised in Table 3.



**Figure 9: Functionally invariant model of the ATM system**

Source: Studic (2015)

**Table 3: Definitions of the ATM functions**

FUNCTION NAME	DEFINITION
Communication	Enables point-to-point ground/ground (G/G), air/ground (A/G) and air/air (A/A) voice and data information exchange between stakeholders.
Navigation	Enables a stakeholder to locate its present position and then to determine the course to steer to arrive at the next desired point both on the ground and in the air.
Surveillance	Broadcasts, receives, processes and displays information about the position and/or identity, speed and future intent of aircraft, vehicles, obstacles and weather phenomena.
Information management	Receives, manages and distributes aggregated information from multiple services and stakeholders required for a timely, safe, efficient and cost-effective management of ATM operations.
Airspace organisation and management	Designs, allocates and coordinates civilian and military airspace at strategic, pre-tactical and tactical levels to achieve the most safe, efficient and harmonious use of airspace in the European Civil Aviation Conference (ECAC) airspace and beyond.
Network management	Ensure safe, orderly and expeditious flow of air traffic at strategic, pre-tactical and tactical levels by ensuring that Air Traffic Control (ATC) capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate Air Traffic Services (ATS) authority.



Trajectory management	Ensures efficient management of four dimensional (4D) aircraft trajectories from en-route-to-en-route, whilst accounting for both airspace user preferences in terms of Key Performance Areas (KPA) (i.e. cost, environmental impact, time) and the optimal network and airspace organisation and management solutions.
Safety assurance	Ensures conflict free management of 4D aircraft trajectories from en-route-to-en-route.
Security management	Protects the ATM system against airborne threats such as terrorist and illegal acts, attacks against infrastructure, cyber-attacks and electromagnetic attacks.
Environmental management	Reduces and manages the environmental footprint of aviation.

**Source:** Studic (2015)

### Literature review

Having identified the research questions, specified the ATM functional model and mapped the Implementation projects to it, the next step is to carry out a detailed literature review based on the publicly available documentation to analyse the status of SESAR Deployment. Table 4 lists the documentation reviewed in this report along with the corresponding references with respect to the research questions defined in Section 1.2.

**Table 4: Literature review**

RESEARCH QUESTION	REFERENCE
Pilot Common Project (PCP)	Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects (European Commission, 2013b) Commission Implementing Regulation (EU) No 716/2014 on the establishment of PCP (European Commission, 2014c) Global cost-benefit analysis (European Commission, 2014d)
SESAR Deployment Manager (SDM)	Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects (European Commission, 2013b) Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP (European Commission, 2014c)
SESAR Deployment Framework Partnership Agreement (FPA)	Commission Delegated Regulation (EU) No 1268/2012 on the financial rules applicable to the general budget of the EU (European Commission, 2012) Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects (European Commission, 2013b) Call for SESAR Deployment Framework Partnership (European Commission, 2014a) SESAR Deployment Framework Partnership Agreement (European Commission, 2014e) Explanatory document on SESAR Deployment Governance (SESAR Deployment Manager, 2014) SESAR Framework Partnership diagram (European Commission and SESAR Deployment Manager, 2014)

Deployment Programme (DP)	Commission Implementing Regulation (EU) No 409/2013 on the definition of Common Projects (European Commission, 2013b) SESAR Deployment Programme 2015 (SESAR Deployment Manager, 2015a, 2015b, 2015c)
European Single Sky Implementation (ESSIP)	ATM Master Plan Edition 2015 (SESAR Joint Undertaking, 2012a, SESAR Joint Undertaking, 2015) ESSIP Plan Edition 2015 (SESAR Joint Undertaking and EUROCONTROL, 2015) ESSIP Report for 2014 (EUROCONTROL, 2014)
Innovation and Networks Executive Agency (INEA)	Council Regulation (EC) No 58/2003 laying down the statute for EC Executive Agencies (Council of the EU, 2003) Implementing Decision establishing INEA (European Commission, 2013a) SESAR Framework Partnership diagram (European Commission and SESAR Deployment Manager, 2014) INEA Annual Work Programme 2015 (European Commission, 2015b)
Connecting Europe Facility (CEF)	European Parliament and of the Council Regulation (EU) No 1316/2013 on the establishment of CEF (European Parliament & Council of the EU, 2013b) Commission Implementing Decisions (European Commission, 2014b, 2015d) Objectives and priorities of the CEF - Transport sector (European Commission, 2015a) CEF Transport – 2015 Call for Proposals (INEA, 2015a, 2015c)
Stakeholder's Consultation Platform (SCP)	Information Paper on the Stakeholders' Consultation Platform (SESAR Deployment Manager, 2015d) Terms of Reference for the Stakeholders' Consultation Platform (SESAR Deployment Manager, 2015e)

**Source:** Author's own elaboration

### Subject Matter Experts input

Subject Matter Experts (SME) input was sought to both augment and validate the results from the literature review. Specific questions were formulated and circulated by email. In some cases, answers were received via email and followed up by a teleconference, while in others it was deemed necessary to conduct a face-to-face survey. Because of their pivotal roles in SESAR Deployment, the SDM, INEA and EUROCONTROL (Unit DPS/PEPR responsible for ESSIP/LSSIP) were surveyed through a number of pertinent questions in Annexes II, III, and IV respectively. The questions were formulated to augment and validate the results from the literature review of public domain documentation.

### External peer review

This stage involved a sanity check of the report by an expert with experience in all aspects of SESAR Deployment.

## Annex II: Questions for the Deployment Manager

1. To what degree is the Deployment Programme (DP) in line with the Pilot Common Projects (PCP) and the SESAR Master Plan? Are there any aspects that have not been included or sufficiently addressed in DP2015?
2. What is the link between the PCP (and their Deployment) and the original SESAR pilot programme?
3. Who is responsible for tracking the implementation progress of PCPs? It appears that the Objectives of the European Single Sky ImPlementation (ESSIP) are not fully aligned with the PCP ATM Functionalities (AFs), can you tell us more about this? How is this going to be addressed in the future?
4. To what extent does DP2015 contribute to the delivery of the SESAR Master Plan?
5. Is there any quantitative data on the contribution of different Project Families to the main SESAR Key Performance Areas (KPs)? If so, how are the estimations done?
6. What are the timeframes for the Deployment of the PCPs and DP2015? What are the data and methodologies used to estimate the milestones for Initial Operating Capability (IOC) and Full Operating Capability (FOC)? How are potential delays in project implementation determined?
7. The ESSIP Plan 2015 indicates delays exceeding 12 months in implementation of certain projects such as:
  - a. RNP 1 Operations in high density TMAs (ground capabilities);
  - b. RNP 1 Operations in high density TMAs (aircraft capabilities);
  - c. Implement Advanced RNP routes below Flight Level 310;
  - d. A-SMGCS Level 1;
  - e. Implement enhanced tactical flow management services;
  - f. Apply a common flight message transfer protocol (FMTP).

Please explain the reasons for the delays of these projects. Furthermore, are further delays expected on other additional projects/Objectives and why?

8. What is the stakeholders consultation process?
  - a. who are the participating stakeholders?
  - b. what is the consultation platform and process?
  - c. evidentially, have the established platform and process been effective so far ?
9. What is the role of neighbouring countries in SESAR Deployment? How are they affected by the Deployment?
10. What is the process for evaluating the progress and commitment of Member States, industry and SJU in SESAR Deployment?
11. What is the extent of the financial investment related to the SESAR Deployment up until now (including R&D) and what is expected to come?
12. What are the additional sources of funding other than through CEF and INEA?
13. In your opinion, are there any limitations in the existing Deployment Governance, legal setup or financial flows that hinder SESAR Deployment?
14. Could you propose recommendations that in your opinion would improve timely, coordinated and synchronised SESAR Deployment?



## Annex III: Questions for INEA

1. Explain the working methods of the Innovation and Networks Executive Agency (INEA) with regard to:
  - a. Managing programme implementation;
  - b. Instruments of budget execution for revenue and expenditure;
  - c. Support programme execution
2. What is the budget definition and allocation process used by INEA for the Union's programmes with a particular focus on the Connecting Europe Facility (CEF)? Is the budget fixed or is it subject to an annual revision?
3. Explain the budget allocation for the following themes and underlying projects?
  - a. Removing bottlenecks and bridging missing links
  - b. Ensuring sustainable and efficient transport in the long run
  - c. Optimising the integration and interconnection of transport modes and enhancing interoperability, safety and security of transport
  - d. Connecting Europe Facility (CEF) — Cohesion Fund allocation
4. What is the nature of the process that INEA uses to report to the European Commission (EC). How is the reporting process used to inform the budget of the EC
5. What is the nature of the relationship/link/interface between INEA and the Deployment Manager (SDM)?
6. What is the nature of the relationship/link/interface between INEA and the EC?
7. In your opinion, are there any limitations in the existing Deployment Governance, legal setup or financial flows that hinder SESAR Deployment?
8. Could you propose recommendations that in your opinion would improve timely, coordinated and synchronised SESAR Deployment?



## **Annex IV: Questions for ESSIP**

1. Your role in SESAR Deployment including the monitoring and reporting process
2. The alignment between the ESSIP Plan and the Deployment Program including ESSIP Objectives and the PCP Project Families
3. The interface/link between ESSIP and Deployment Manager
4. How you measure and evaluate the individual progress and commitment of Member States, industry and the SJU; and if it would possible to get quantitative on this to date.





## Annex V: Mapping between ESSIP Objectives and DP Project Families

Objective Designator	Objective title	Related Families (DP V1)
AOM13.1	Harmonise Operational Air Traffic (OAT) and General Air Traffic (GAT) handling	• 5.3.1
AOM19	Implement Advanced Airspace Management	• 3.1.1 • 3.1.2 • 3.1.3 • 3.1.4
AOM21.1	Implementation of Direct Routing	• 3.2.1 • 3.2.3
AOM21.2	Implement Free Route Airspace	• 3.2.1 • 3.2.4
AOP04.1	Implement Advanced Surface Movement Guidance and Control System (A-SMGCS) Level 1	• 2.2.1 • 2.5.2
AOP04.2	Implement Advanced Surface Movement Guidance and Control System (A-SMGCS) Level 2	• 2.2.1 • 2.4.1
AOP05	Implement Airport Collaborative Decision Making (CDM)	• 2.1.1 • 2.1.3
AOP10	Time-based separation	• 2.3.1
AOP11	Initial Airport Operations Plan	• 2.1.4
AOP12	Improve runway and airfield safety with ATC clearances monitoring	• 2.1.2 • 2.5.1
ATC02.5	Implement ground based safety nets - APW level 2	• 3.2.1
ATC07.1	Implement arrival management tools	• 1.1.1
ATC12.1	Implement automated support for conflict detection and conflict monitoring	• 3.2.1
ATC15	Implement, in En-Route operations, information exchange mechanisms, tools and proc's in support of Basic AMAN operations	• 1.1.2 • 4.3.1
ATC17	Electronic Dialogue as Automated Assistance to Controller during Coordination and Transfer	• 3.2.1 • 5.6.1
FCM01	Implement enhanced tactical flow management services	• 2.1.3 • 4.2.3
FCM03	Implement collaborative flight planning	• 4.2.3
FCM04	Implement Short Term ATFCM Measures - phase 1	• 4.1.1 • 4.1.2
FCM05	Implement interactive rolling NOP	• 4.2.2 • 4.2.4 • 5.1.3 • 5.2.2 • 5.5.1
FCM06	Traffic Complexity Assessment	• 4.4.2
INF07	Electronic Terrain and Obstacle Data (TOD)	• 1.2.2
ITY-ADQ	Ensure quality of aeronautical data and aeronautical information	• 1.2.2 • 5.4.1
ITY-AGDL	Initial ATC air-ground data link services above FL-285	• 6.1.2
ITY-COTR	Implementation of ground-ground automated co-ordination processes	• 3.2.1
ITY-FMTP	Apply a common flight message transfer protocol (FMTP)	• 5.2.1
NAV03	Implement P-RNAV	• 1.2.3 • 1.2.4 • 1.2.5
NAV10	Implement APV procedures	• 1.2.1 • 1.2.2

Source: SESAR Joint Undertaking and EUROCONTROL (2015, p. 9)



## **Annex VI: Methodology for assessment of timeliness of SESAR Deployment**

Building upon the roles of ESSIP and SDM in SESAR Deployment monitoring, touched upon in Sections 2.1.2 and 2.2 respectively, this Section focuses on the different strategies used for monitoring of the timeliness by the two entities.

Timeliness monitoring carried by the ESSIP is wider in scope and covers the whole ECAC region whereas SDM's scope is limited to the EU Member States, the European Free Trade Association (EFTA) Member States (Norway and Switzerland), and third countries (e.g. Turkey) (European Commission, 2014c). Furthermore, data used for the estimation of the timeliness of ESSIP Objective implementation is based on the declarative and predictive information about the implementation progress with respect to ESSIP Full Operational Capabilities (FOC) dates collected through the LSSIP reporting process explained in Section 2.1.2.

In contrast, the SDM's approach to monitoring and managing implementation timeliness is purely based on the actual evidence-based implementation progress and does not provide an estimation of potential implementation delays in the future. Instead, the SDM focuses on backward project management from the FOC, defined in the Commission Implementing Regulation (EU) No 716/2014 on the establishment of the PCP (European Commission, 2014c), through assignment of buffers in project planning but also the use of mitigation strategies to address breaches in the project implementation plans. For more information on the risks and mitigation strategies for the SESAR Deployment refer to Section 2.9.

Due the immaturity of the SDM timeliness reporting and its inability to provide estimations of future delays in the project implementation, it was decided to use ESSIP data to assess SESAR Deployment timeliness.

As a basis for this assessment, the latest LSSIP 2015 cycle dataset was used. While the detailed ESSIP Report 2015 on the SESAR implementation will be produced and made publically available in June 2016, the analysis carried out in this report predominantly focused on the timeliness of the PCP implementation. Therefore, the raw data was organised into the PCP AFs according to the mapping provided the ESSIP Plan 2015 (SESAR Joint Undertaking and EUROCONTROL, 2015). However, due to the "inconsistencies" discussed in Section 2.1.5, the results should be interpreted with caution.

The aim of the analysis was to assess the difference between the FOC dates and the dates planned (expected dates), further referred to as Expected Operational Capability (EOC), by the relevant stakeholders in every State (EU, EFTA, and ECAC). However, the planned dates were only available for those stakeholders/States who have actually made an internal implementation plan for the project of interest. If not, that would mean that the Stakeholder has not made a plan for the implementation of the particular project in the following 5 to 8 years and as such could negatively impact timeliness. In the dataset, those instances were recorded with the "no plan" label assigned to the EOC variable. Due to the mixture of quantitative and qualitative data inputs for the two variables of interest, a convention for data analysis and interpretation was made.

To facilitate aggregation of data per State and diagrammatical illustrations, 4 colours were used to mark the average difference between EOC and FOC for every State:

- Dark Green – denotes the States that have already implemented (regardless of delay in the implementation) or plan to implement the relevant ESSIP Objectives ahead of or on-time;
- Light Green – denotes the States in which EOC is up to 6 months longer than the FOC;
- Orange – denotes the States in which the difference between the EOC and the FOC ranges between 6 and 24 months;
- Red – denotes the States in which the difference between the EOC and the FOC exceeds 24 months.

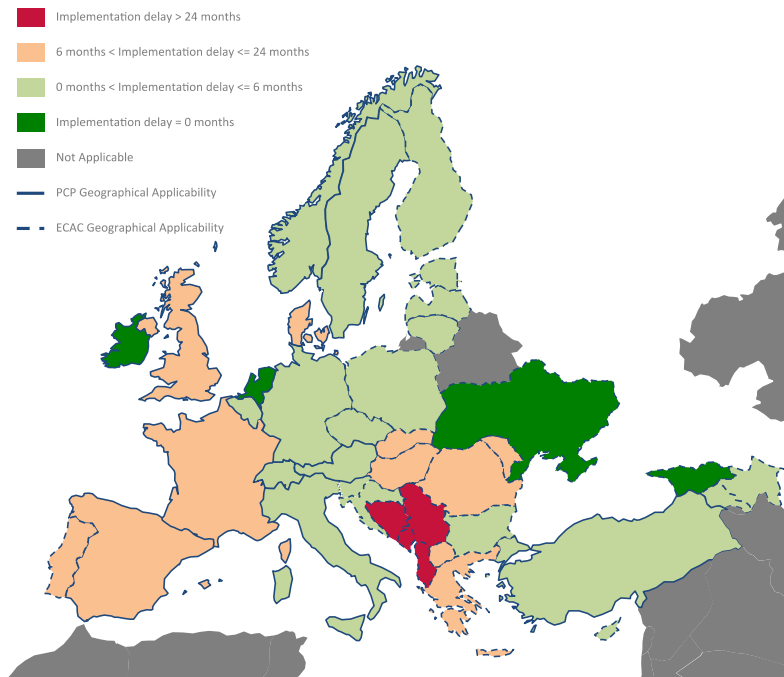
In some cases, because some of the stakeholders have implemented projects before FOC, the newly created variable  $\text{DELTA} = \text{EOC} - \text{FOC}$  had negative values. Since for the purpose of this analysis it was only relevant whether the project was implemented and if not to estimate the delay this may cause in the future, these values were neutralised and assigned a value "0" denoting "on-time" implementation.

Furthermore, the mixed nature of the dataset requires definition of additional conventions, as follows:

- If the share of the total number of ESSIP Objectives per State and AF is  $<20\%$ , the Light Green colour is assigned to the State (corresponding to the implementation delay of 6 months from above);
- If the share of the total number of ESSIP Objectives per State and  $20\% \leq \text{AF}$  is  $<50\%$ , the Orange colour is assigned to the State (corresponding to the implementation delay between 6 and 24 months from above);
- If the share of the total number of ESSIP Objectives per State and AF is  $\geq 50\%$ , the Light Red colour is assigned to the State (corresponding to the implementation delay longer than 24 months from above);
- If there is  $<20\%$  of "No Plan" AND the rest of the ESSIP Objectives have an average implementation delay between 6 and 24 months, the Orange colour is assigned to the State;
- If there is  $<20\%$  of "No Plan" AND the rest of the ESSIP Objectives have an average implementation delay exceeding 24 months, the Red colour is assigned to the State;
- If there is  $20\% \leq \text{AF}$  is  $<50\%$  of "No Plan" AND the rest of the ESSIP Objectives have an average implementation delay exceeding 24 months, the Red colour would be assigned to the State.

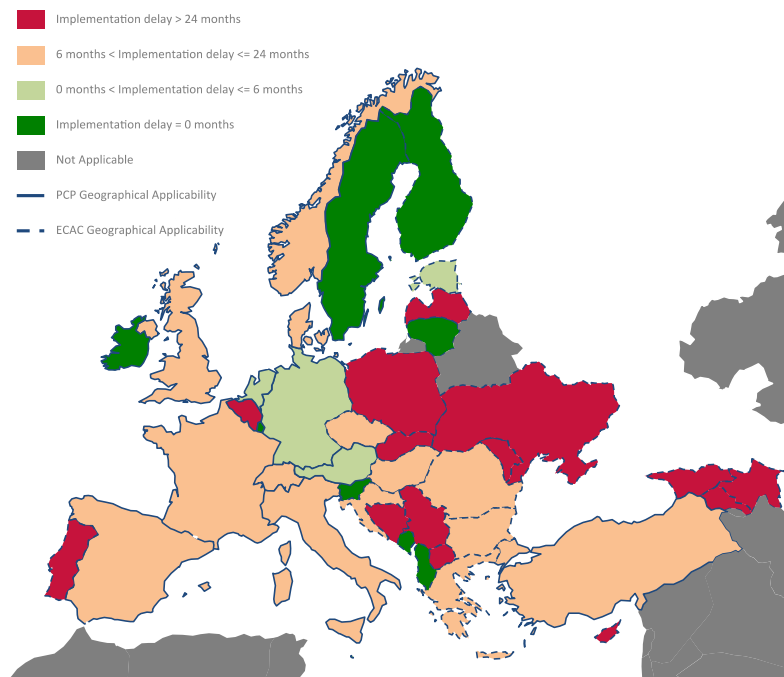
## Annex VII: Implementation delays with respect to the ESSIP Objectives

AF1 Extended Arrival Management and Performance Based Navigation in the High Density Terminal Manoeuvring Areas



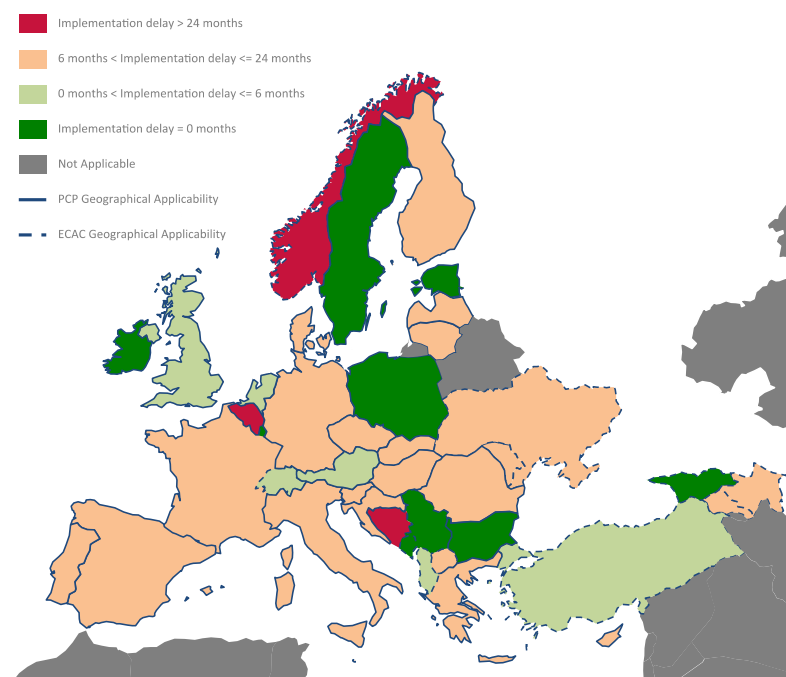
Source: Author's own elaboration

AF 2 Airport Integration and Throughput



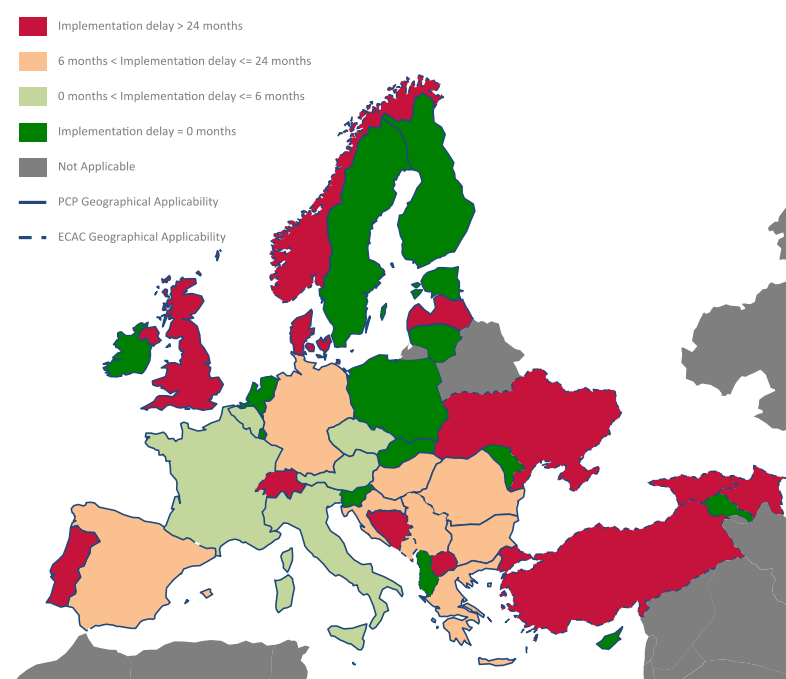
Source: Author's own elaboration

### AF 3 Flexible Airspace Management and Free Route



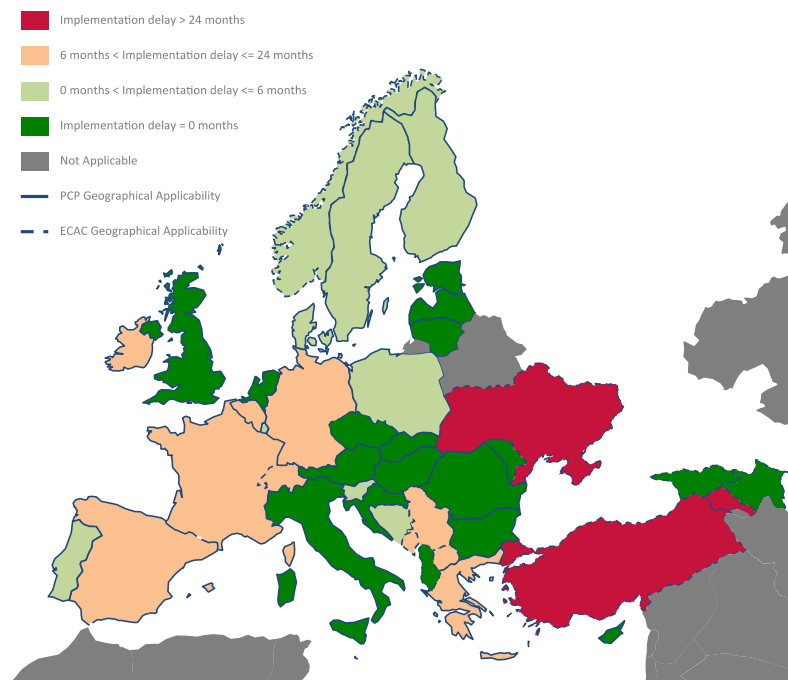
Source: Author's own elaboration

### AF 4 Network Collaborative Management



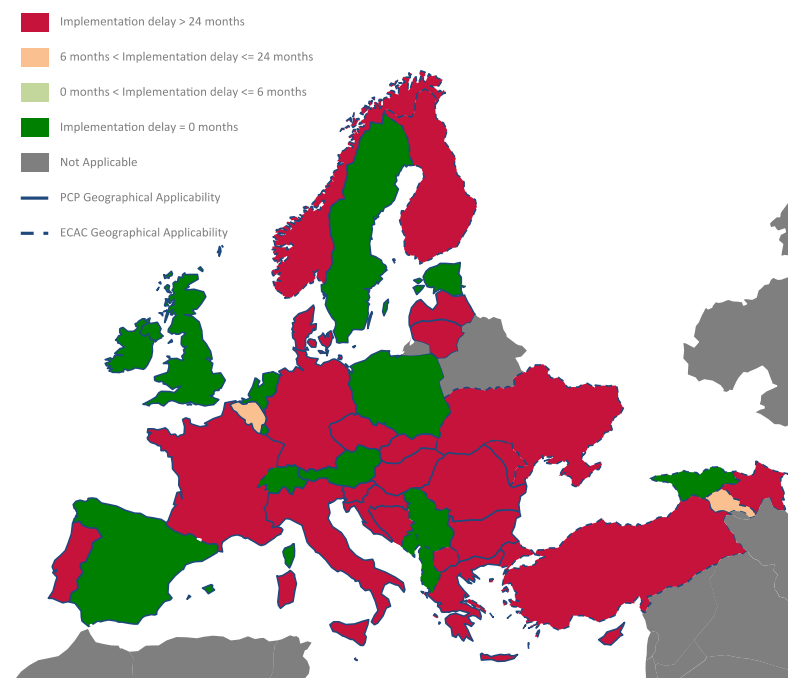
Source: Author's own elaboration

## AF 5 Initial System Wide Information Management



**Source:** Author's own elaboration

## AF 6 Initial Trajectory Information Sharing



**Source:** Author's own elaboration

Please note that the results for AF6 are included for completeness only as they are based on only one objective covering one Project Family and are unreliable because of lack of data.





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ISBN 978-92-823-9110-5 (paper)  
ISBN 978-92-823-9111-2 (pdf)

doi:10.2861/876285 (paper)  
doi:10.2861/372871 (pdf)