



# ***Supplement to the Mandate to the SESAR Joint Undertaking for drafting a proposal on the content of a pilot common project***

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In response to the supplement to the mandate received from the European Commission, this document contains the SESAR Joint Undertaking's analysis of the interdependencies between the Pilot Common Project (PCP) and the "Centralised Services" identified by Eurocontrol.

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This document was created by the SESAR Joint Undertaking (SJU) to assist the European Commission in providing a technical analysis of the interdependencies between the PCP and the "Centralised Services" options identified by Eurocontrol, in accordance with the Commission supplement to the PCP mandate received 18 March 2013.

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## EXECUTIVE SUMMARY

In accordance with the supplement to the Pilot Common Project (PCP) mandate received from the European Commission on 18 March 2013, the present report assesses and describes the interdependencies between the PCP and the Centralised Services. Its results are based on an analytical and deductive approach aiming to understand how the changes foreseen by the implementation of the PCP may be impacted by Centralised Services. It also details the relation to the European ATM Master Plan edition 2012 as well as the impact on SJU R&D activities.

Overall the content of the PCP remains valid as described in the proposal handed over to the European Commission earlier in May 2013 and de facto a level of centralisation is already included in the PCP for elements that are in the scope of the Network Manager. A direct technical interdependency can be established between 4 of the 6 ATM Functionalities (AFs) of the PCP and 4 of the 9 Centralised Services (CSs) identified by Eurocontrol. These 4 CSs as they are proposed provide a more detailed view of “how” a number of changes contained in the PCP could be implemented. In fact, while the PCP identifies the technical content, operational and financial impact of the solutions, the concerned CSs express an option on how the service could be delivered.

Most of the operational/technological changes related to these 4 CSs are already in the process of being partly or fully validated in the context of the SJU activities. It is therefore expected that prototype developments, feasibility assessments and pre-operational activities on these 4 CSs be part of the Eurocontrol contracted contribution to SJU activities.

More generally, the notion of Centralised Services may bear significant impacts on the overall ATM architecture and underlying business models. The different aspects – technical, economic, service provision, etc. - shall be properly assessed to ensure that they are duly taken into account in the next ATM Master Plan edition and in the SESAR Programme, as necessary.

Finally it should be noted that the results contained in this report are affected by the following limitations, independent from the SJU work:

1. The definition of CSs is being refined at the time this report is issued. The information made available to the SJU to elaborate this report was still lacking some maturity in particular with regards to the Concept of Operations and Technical Enablers. As a result, the SJU was not in a position to perform yet a fully detailed and comprehensive analysis in terms of interdependencies between PCP and the proposed CSs. Consequently, although an high level link between AFs and CSs could be established it has to be noted that in order to better envisage the interdependencies between the what, where and when of the ATM Functionalities and the how (at local, regional, central levels) a more in depth work will be necessary in the context of the SESAR Programme;
2. Insufficient economic information on the CSs prevented the SJU from evaluating their impact on the PCP business cases;
3. The level of consultation and coordination performed by the SJU in the context of the supplement to the mandate was not as extensive as the one performed for the PCP.

# 1 BACKGROUND AND APPROACH

## 1.1 Background

In accordance with the supplement to the Pilot Common Project (PCP) mandate received from the European Commission on 18 March 2013, this document contains the SESAR Joint Undertaking's (SJU) analysis of the interdependencies between the Pilot Common Project (PCP) and a list of 9 "Centralised Services" identified by Eurocontrol.

While during the work performed in the preparation of the European ATM Master Plan 2012, the notion of "centralised service provision" had not been put forward and therefore not analysed as such, two of the key features for the development and deployment of Essential Operational Changes (namely "SWIM" – System Wide Information Management – and the "Network Operations Planning") already introduce a significant change in the way information is managed and decision are taken across the whole European ATM system.

In this respect, the ATM Master Plan specifies<sup>1</sup> that SWIM will use "services" as the mechanism for information exchange and apply methodological, technical and information management standards to their development. This "service oriented approach" shall allow the producers of information to be decoupled from the consumers, thus increasing flexibility and agility in responding to business needs thereby making information easier and less costly to share as well as being fully consistent across the ATM network.

Thereafter, during the elaboration of the proposal for the PCP, which defined in particular the deployment objectives of an initial set of SWIM services<sup>2</sup> and Network Operations Planning capabilities<sup>3</sup>, "non-local" (central or regional) deployment opportunities were addressed although not to their fullest extent due mostly to the limited time and information available from stakeholders.

## 1.2 High-level summary of central/non-local deployment considerations in the PCP proposal

In order to optimise the PCP CBA (cost benefit analysis) and taking into account the specific role of the Network Manager, a certain level of centralisation was already embedded in the PCP proposal as summarised for each of the ATM functionalities listed below.

- AF # 3: Flexible Airspace Management and Free Route<sup>4</sup>
  - o "In an environment where airspace and route structures are dynamic, it is important that external agencies such as military ATC and air defence units work on the same information. Consequently, the ASM,

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<sup>1</sup> European ATM Master Plan, Edition 2, Section 3.5.7 (Source: SJU)

<sup>2</sup> Proposal on the content of a pilot common project, Section 5.5 (Source: SJU)

<sup>3</sup> Proposal on the content of a pilot common project, Section 5.4 (Source: SJU)

<sup>4</sup> Proposal on the content of a pilot common project, Section 5.3.1.3 (Source: SJU)

- ATFCM and ATS systems shall interface to such systems in a way that allows their users to provide services based on a common understanding of the airspace and traffic environment. The systems of these external actors shall be modified to enable this functionality”.
- “Centralised AIS systems, such as the EAD, shall be able to promulgate this information to all affected stakeholders in a timely manner so that planning may be undertaken based on accurate information relevant to the time of the planned operations. Local AIS systems shall be updated to enable this functionality and to enable the upload of changing local data”. See also section 2.4 of this report.
  - “A tool to calculate and manage traffic loads at FMP shall be deployed at central level”. See also section 2.3 of this report.
- AF # 4: Network Collaborative Management (Flow & NOP)<sup>5</sup>
- “For NM functionality, ETFMS/IFPS shall be upgraded to deal with a more flexible and dynamic sector configuration to the traffic demand/pattern. ATFCM planning needs to be significantly enhanced at Network and Local levels, including interaction between the two levels”.
  - “In addition, tools are required for re-routeing and to calculate and manage traffic loads and complexity at FMP and central level”.
- AF # 5: iSWIM Ground-ground integration and aeronautical data management and sharing<sup>6</sup>
- “The iSWIM functionality is intended to be applied on the entire European network. The provision of flow management and aeronautical / airspace data is to be organised centrally. It will be ensured through the concept of CSs currently being developed”.
  - “AF # 5 has a marginally negative CBA in the deployment scenario envisaged for the PCP. The work performed to establish this proposal provides good indications that a wider deployment of the solutions can be further optimised considering “non-local” deployment scenarios”.

Nevertheless, the related high level definition of the deployment architecture was not fully addressed in the PCP and it was acknowledged that future decisions on “local” vs. “non-local” (central or regional) deployment and operations of some ATM functionalities would probably impact their cost-benefit analyses.

### 1.3 High level description of the Centralised Services

Eurocontrol defines “Centralised Services” as “an air navigation service or related function exercised at the central European or network level bringing significant benefits in cost-effectiveness and harmonisation”. A synthetic description, which was the basis for analysis of each Centralised Service can be found in the table below.

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<sup>5</sup> Proposal on the content of a pilot common project, Section 5.4.1.3 (Source: SJU)

<sup>6</sup> Proposal on the content of a pilot common project, Sections 3.6 & 5.5.2.1 (Source: SJU)

The assessment of the SJU is based on the Eurocontrol proposal on Centralised Services submitted to the European Commission in March 2013<sup>7</sup>.

Reference	High-level description
<b>CS # 1: Flight Plan and Airport Slot Consistency Service (FAS).</b>	Match flight plans and airport slots to better exploit airport capacity and improve flight punctuality.
<b>CS # 2: 4D Trajectory Flight Profile Calculation for planning purposes Service (4DPP)</b>	Provide a centralised facility for common reference for the 4D Trajectory profile for all ATM planning activities with an increased accuracy, allowing reduction of buffers around airspace occupancy, reducing under-/over- delivery.
<b>CS # 3: European Tracker Service (ETKS)</b>	Enable the creation of an ECAC-wide, consistent, high quality Air Situation Picture and the provision of its required subsets to any user of processed surveillance information, civil and military.
<b>CS # 4: Advanced Flexible Use of Airspace Support Service (AFUAS)</b>	This service will provide civil-military collaborative ASM decision-making processes based on transparent ASM data and ASM performance feedback.
<b>CS # 5: European ATM Information Management Service (EAIMS)</b>	Accurate and timely information needs to be organised and provided through flexible means that support system-wide interoperability, secured seamless information access and exchange. In this Service the EAD service is integrated and enlarged by additional functions, such as ADQ, weather briefing, digital NOTAMs, briefing depicting relevant NOTAMs on a chart in accordance with the flight track etc.
<b>CS # 6: Management of Common Network Resources Service (CNR)</b>	The scarce resource management addresses the Transponder Code Function (TCF) and Radio Frequency Function (RFF). These functions improve the management of these resources, optimising utilisation for the benefit of stakeholders and the Network as a whole, including allocation of scarce interrogator codes to Mode S radars installed in Europe. A centralised management of common resources (network addresses for instance) ensures a coherent and efficient utilisation of the resources shared by all the stakeholders.
<b>CS # 7: Network Infrastructure Performance monitoring and analysis Service (NIPS)</b>	In order to achieve a safe and efficient operation the CNS infrastructure performance needs to be monitored and managed all along its deployment and operation. This service, consisting of seven interlinked and inter-dependent sub-services, such as datalink and transponder functions, will help to acquire a better knowledge of the infrastructure performance and therefore help in preparing infrastructure rationalisation.

<sup>7</sup> Eurocontrol Proposal for a first set of Centralised Services to contribute to SES Performance Achievement, Version 2.0, 25<sup>th</sup> of March 2013 (Source: Eurocontrol)

<b>CS # 8: Pan European Network Service (PENS)</b>	To meet all present and future ground communication needs a secure connectivity is required between sites and partners. PENS is a shared service with centralised management based on IPv6 and compliant with SES regulation for FMTP as well as ICAO ATN/IPS standards. The provision is contracted out to a Network Service Provider. Potential to be expanded and could cover all stakeholders.
<b>CS # 9: Data Communications Service (DCS)</b>	To increase interaction between the air and ground ATM-related systems and replace current fragmented means of communication, a data communication service is required in all airspace (airport, TMA en-route, polar and oceanic); this service shall support all A/G services such as datalink, AOC services, ADS-C, flight information services, airport coordination services, space-based ADS-B, etc.

As outlined in the Executive Summary, the definition of Centralised Services is being refined at the time this report is issued. The information assessed in the preparation of this report is still subject to interpretations and raised a number of questions, for which there is a need to pursue the work in the context of the SESAR Programme.

## 1.4 Approach and methodology

The analysis was conducted during the period May-June 2013. It was made up of two phases:

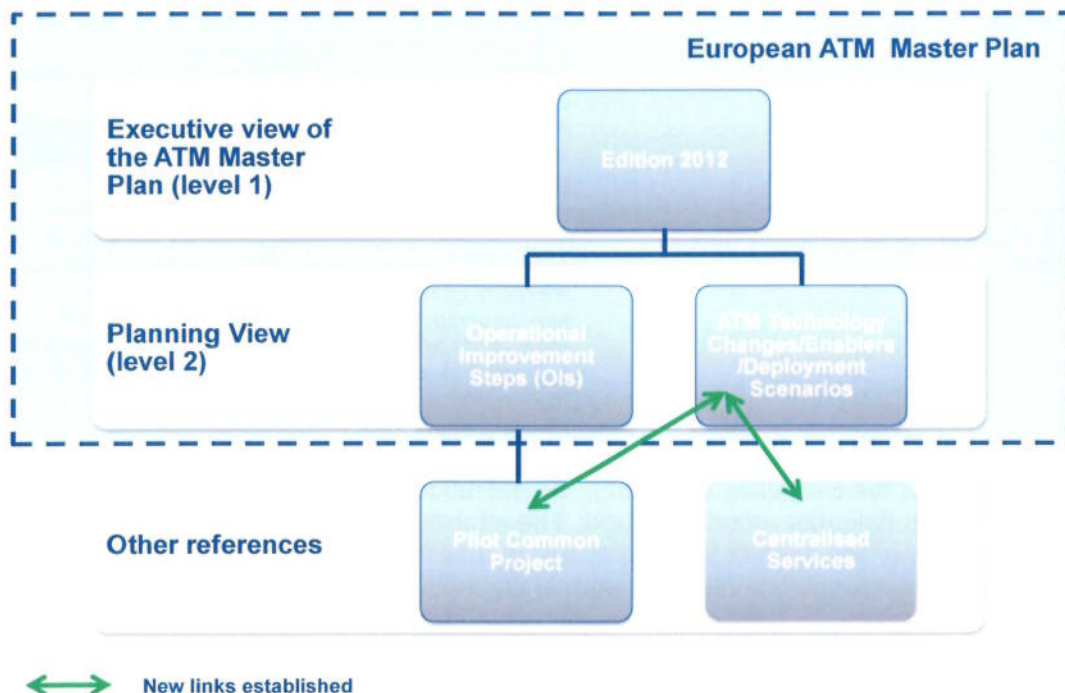
- Phase one, during which the methodology used was agreed and preliminary interdependencies identified were shared with stakeholders,
- Phase two, consisting in a refinement of the analysis, taking into account stakeholders' feedback.

During phase one, having given due consideration of the limited information made available to the SJU and time constraints, it was decided to limit the assessment to the identification of the technical interdependencies between the PCP and the proposed CSs.

The identification of technical interdependencies was performed on the basis of an analysis of the relation between the CSs and Edition 2012 of the European ATM Master Plan. Despite the fact that the notion of "Centralised Services" had not been put forward in the latest ATM Master Plan update campaign, the identification of the direct or indirect links between CSs and the ATM Master Plan was in principle established at the level of aggregated ATM Technology Changes<sup>8</sup> that support Essential Operational Changes. This is illustrated below, further information can also be found in the appendix. The disassociation between Deployment Baseline and Step 1 elements proved to be too complex and with limited benefits to be performed at this early stage.

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<sup>8</sup> European ATM Master Plan, Edition 2, Section 4.1 ATM Technology upgrades supporting Step 1 Essential Operational Changes (Source: SJU)



In addition, the SJU has assessed the links of the proposed Centralised Services with SESAR R&D and their impact thereof.

In the absence of IDSG conclusions on this topic this report does not include an analysis of the link between the PCP and essential Deployment Baseline prerequisites.

The SJU making use of its consultation and cooperation mechanisms has received extremely valuable input from the ATM stakeholders, although within important time constraints. The stakeholders consulted are representatives of:

- Air navigation service providers
- Network manager
- Airspace users
- Airport operators
- Military
- Met service providers
- Staff associations
- Ground system manufacturing industry
- Aircraft manufacturing industry

To allow an effective management of conflict of interests, stakeholder inputs were collected strictly on the basis of information consolidated by the SESAR Joint Undertaking and discussed through stakeholder specific consultation meetings as outlined above.



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The SJU would like also to acknowledge and thanks Eurocontrol's DSS for the support during the overall process

It is important to note that the definition of CSs is still being refined at the time this report is issued. Consequently the information used to elaborate this report was still subject to interpretations and raised a number of questions that could not be resolved during the period of the analysis.

## 2 IDENTIFICATION OF INTERDEPENDENCIES BETWEEN PCP AND THE CENTRALISED SERVICES

### 2.1 Overview of the interdependencies

The interdependencies were identified using a four-step approach:

1. Understanding the operational and technological changes proposed for the 9 CSs
2. Identifying the links with the ATM Master Plan Essential Operational Changes aggregated at ATM Technology Changes level. A “link” was identified when the CS-ATM Master Plan connection met at least one of the following 3 criteria:
  - The CS change has a direct positive impact on the functions of the ATM technology improvement
  - The CS has an indirect positive impact on the functions of the ATM technology improvement (more accurate data)
  - Some elements of the ATM technology changes need to be implemented for the operations of the CS.
3. Identifying the interdependencies with the PCP at ATM Functionalities level. An interdependency was established only where a direct connection could be established at a principle level with the operational and system requirements outlined in the PCP.
4. Qualifying the impact of CSs on the PCP at ATM Functionalities level using two categories of impact:
  - “Complements the PCP proposal”: the proposed Centralised Service does not introduce a new idea, it mainly clarifies the conditions through which a given ATM Functionality can be implemented
  - “Already included in the PCP proposal”: the principle of centralisation of the proposed service was already included in the PCP proposal

The implementation of four CSs (as described) is considered to involve technological and operational change related to four of the ATM Functionalities outlined in the PCP as per the table below:

PCP \ CS	CS # 1: Flight Plan and Airport Consistency Service	CS # 2: 4D Trajectory Calculation Service for Planning Purpose	CS # 4: AFUA Support Service	CS # 5: European ATM Information Management Service (EAIMS)
AF # 3 Flexible Airspace Management incl. Free Route		✓	✓	✓
AF # 4 Network Collaborative Management (Flow and NOP)	✓	✓	✓	✓
AF # 5 ISWIM functionality				✓
AF # 6 Initial Information Sharing (I4d)		✓		

Two Centralised Services notions are already included in the PCP proposal:

- CS #2: 4D Trajectory Calculation Service for Planning Purpose
- CS #5: European ATM Information Management Service (EAIMS),

While two of them complement the PCP proposal:

- CS #1: Flight Plan and Airport Slot Consistency Service
- CS #4: AFUA Support Service

In addition, CS # 9 can be considered, on the one hand, as a possible mitigation action to partially de-risk the deployment of AF # 6 and, on the other hand, introducing a potential risk in the procurement process. A centralised European communication service based on satellite and terrestrial communication technologies can support the Initial Trajectory Information Sharing enabling the downlinking of the EPP trajectory information. This supports the PCP by de-risking the wide-scale ANSP specific deployment of ADS-C EPP capable datacom systems and ensures that any investment on the airborne equipment would be beneficial across Europe. ANSP FDP systems and tools such as AMAN would still need to be adapted to make best use of the downlinked trajectory information.

Other CSs have no or no notable interdependency with the PCP. It is worth noting that no link with the ATM Master Plan was identified for CS # 3 European Tracker Service while it is assumed that all other CSs are Deployment Baseline related.

The table below summarises the interdependencies:

CS	Link ATM Master Plan	Related SJU R&D	Link PCP AF	PCP Impact
#1 Flight Plan and Airport Slot Consistency Service	Yes	Limited	AF # 4	Complements PCP proposal
#2 4D Trajectory Calculation Service for Planning Purpose	Yes	On-going – Part of Release Plans	AF # 3 AF # 4 AF # 6	Already included in PCP proposal
#3 European Tracker Service	No	No	No	-
#4 AFUA Support Service	Yes	On-going – Part of Release Plans	AF # 3 AF # 4	Complements PCP proposal
#5 European ATM Information Management Service (EAIMS)	Yes	On-going – Part of Release Plans	AF # 3 AF # 4 AF # 5	Already included in PCP proposal
#6 MNG of Common network Resources Services	Yes	Limited	No	-
#7 Network Infrastructure Performance Monitoring and Analysis Service	Yes	No	No	-
#8 PENS	Yes	No	No (1)	-
#9 Data Communication Service	Yes	No	de-risking (2)	-

Notes:

(1) PENS is identified as a key enabler for AF # 5 in the PCP proposal

(2) Can be considered as a possible mitigation action to partially de-risk the deployment of AF # 6 while, on the other hand, introducing a potential risk in the procurement process.

## 2.2 AF # 3 Flexible Airspace Management incl. Free Route

Centralised Service	Links with the ATM Master Plan	Qualification of the link with the AF
<b>CS # 2: 4D Trajectory Calculation Service for Planning Purpose</b>	Airspace Management Systems, AMAN, AMAN/SMAN/DMAN integration, Enhanced CWP, Enhanced FDP, Enhanced DCB, Flight Planning and demand data, Enhanced AOC/WOC systems, Airport CDM.	<p><b>CS # 2 complements PCP AF #3 proposal</b></p> <ul style="list-style-type: none"> <li>The CS is linked to enablers that are considered as part of this ATM functionality.</li> <li>No impact is expected on geographical scope of implementation and associated timeframes (considering the CS is limited to planning phase).</li> </ul> <p>4DPP enables NMs to refine the planned trajectory up to the point of departure, ensuring that an optimised trajectory is agreed between the AO and NM, and is common to both NM and aircraft systems. This leads to increased predictability, ensuring that the flight, including any segments flown on Free Routes, is planned and coordinated at a network level, providing safety and capacity benefits.</p> <p>Tools shall enable FPL checks against current and planned airspace status. ATM systems and FDPs will need to be updated to make use of the 4D trajectory information.</p>
<b>CS # 4: AFUA Support Service</b>	Enhanced FDP, Flight Planning and demand data, Enhanced AOC/WOC systems.	<p><b>CS # 4 complements PCP AF # 3 proposal</b></p> <ul style="list-style-type: none"> <li>The CS is linked to enablers that are considered as part of this ATM functionality.</li> <li>No impact expected on geographical scope of implementation and associated timeframes</li> </ul> <p>Effective Free Route operations are only possible if the activation and release of ARES are conducted in a manner that is fully coordinated with wider network operations. AFUAS improves the ability of military authorities, ANSPs and NM to coordinate airspace utilisation, allowing Free Route operations to be conducted without being adversely impacted by unpredicted ARES activation.</p>
<b>CS # 5: European ATM Information Management Service (EAIMS)</b>	Enhanced conflict management tool, Enhanced CWP, Enhanced FDP, Flight Planning and demand data, Enhanced AOC/WOC systems.	<p><b>CS # 5 is included in PCP AF # 3 proposal</b></p> <ul style="list-style-type: none"> <li>The centralised approach is considered as part of the ATM Functionality definition.</li> <li>The alignment of the technical scope of this CS with the PCP (AF # 5) shall be ensured</li> </ul> <p>Free Route operations allow AOs to plan to fly on routes of their own choosing, subject to constraints applied as a result of changes in the ATM environment. The EAIMS provides more</p>

accurate, consistent and up-to-date aeronautical information to AOs, thus improving predictability, allowing Free Routes to be planned and flown with no unwelcome surprises, and providing safety benefits.

## 2.3 AF # 4 Network Collaborative Management (Flow & NOP)

Centralised Service	Links with the ATM Master Plan	Qualification of the link with the AF
<b>CS # 1: Flight Plan and Airport Consistency Service</b>	Airspace Management Systems, AMAN, AMAN/SMAN/DMAN integration, Enhanced CWP, Enhanced FDP, Enhanced DCB, Flight Planning and demand data, Enhanced AOC/WOC systems, Airport CDM (AOP).	<p><b>CS # 1 complements PCP AF #4 proposal</b></p> <ul style="list-style-type: none"> <li>The CS is linked to enablers that are considered as part of this ATM functionality</li> <li>No impact expected on geographical scope of implementation and associated timeframes</li> </ul> <p>Improvement to the accuracy of the AOP requires ensuring consistency between the Flight Plan and the airport slot. Identifying and solving these inconsistencies through a collaborative decision making between slot coordinators, airports, ATC and Network Manager will reduce traffic overloads and improve predictability both at airport and network levels.</p>
<b>CS # 2: 4D Trajectory Calculation Service for Planning Purpose</b>	Airspace Management Systems, AMAN, AMAN/SMAN/DMAN integration, Enhanced CWP, Enhanced FDP, Enhanced DCB, Flight Planning and demand data, Enhanced AOC/WOC systems, Airport CDM (AOP).	<p><b>CS # 2 is included in PCP AF # 4 proposal</b></p> <ul style="list-style-type: none"> <li>The centralised approach is considered as part of the ATM Functionality definition.</li> <li>The alignment of the technical scope of this CS with the PCP (AF # 5) shall be ensured.</li> </ul> <p>Improvements to the accuracy of the NOP lead to the imposition of fewer unnecessary ATFCM constraints resulting from planned trajectories that are inaccurately represented in the NOP. 4DPP helps to improve the accuracy of the trajectory information within the NOP by continually refining that information, in coordination with the AO, until the point of departure. This two-way refinement also allows the NOP, including information received from the arrival airport's AOP, to be used to modify the aircraft's departure time to promote a smoother and less constrained flight.</p>
<b>CS # 4: AFUA Support Service</b>	Enhanced FDP, Flight Planning and demand data, Enhanced AOC/WOC systems.	<p><b>CS # 4 complements PCP AF # 3 proposal</b></p> <ul style="list-style-type: none"> <li>The CS is linked to enablers that are considered as part of this ATM functionality.</li> </ul>

		<ul style="list-style-type: none"> <li>No impact expected on geographical scope of implementation and associated timeframes</li> </ul> <p>The smooth planning and operation of the NOP must take into consideration military activities, including the location, activation and de-activation of ARES. The AFUAS provides improved information on ARES activity to network planners, leading to improved predictability and reliability of trajectory constraints. This enables NM to modify the NOP in a timely fashion, leading to a more efficient flow of traffic, with fewer unexpected constraints.</p>
<p><b>CS # 5: European ATM Information Management Service (EAIMS)</b></p>	<p>Enhanced conflict management tool, Enhanced CWP, Enhanced FDP, Flight Planning and demand data, Enhanced AOC/WOC systems.</p>	<p><b>CS # 5 is included in PCP AF # 4 proposal</b></p> <ul style="list-style-type: none"> <li>The centralised approach is considered as part of the ATM Functionality definition.</li> <li>The alignment of the technical scope of this CS with the PCP (AF # 5) shall be ensured</li> </ul> <p>The smooth running and continual evolution of the NOP depends on accurate and up-to-date aeronautical information including longer-term information from State authorities and shorter-term information resulting from more dynamic sources. The EAIMS allows aeronautical information that is continually updated by stakeholders to be instantly available to NM, thus promoting more precise and accurate network planning. When data is changed more dynamically, STAM can supplement or replace more constrictive ATFCM constraints, leading to a smoother traffic flow.</p>

## 2.4 AF # 5 iSWIM functionality

Centralised Service	Links with the ATM Master Plan	Qualification of the link with the AF
<p><b>CS # 5: European ATM Information Management Service (EAIMS)</b></p>	<p>Airspace Management Systems, AMAN, AMAN/SMAN/DMAN integration, Enhanced CWP, Enhanced FDP, Enhanced DCB, Flight Planning and demand data, Enhanced AOC/WOC systems, Airport CDM (AOP).</p>	<p><b>CS # 5 is included in PCP AF # 5 proposal</b></p> <ul style="list-style-type: none"> <li>The centralised approach is considered as part of the ATM Functionality definition.</li> <li>The alignment of the technical scope of this CS with the PCP (AF # 5) shall be ensured</li> </ul> <p>iSWIM is the mechanism by which a European ATM Information Management Service could be implemented. The scope and outline of iSWIM Aeronautical and Meteorological information services as defined for AF#5 and the CS EAIMS</p>

service appear at their current high level outlines aligned. The proposed AF#5 services contribute to the service landscape as described in the CS#5. Up to date and consistent Aeronautical and Meteorological information across all stakeholders is a prerequisite for robust and reliable trajectory management, as trajectories need to be optimised within the boundaries of Aeronautical and Meteorological constraints.

## 2.5 AF # 6 Initial Information Sharing (i4d)

Centralised Service	Links with the ATM Master Plan	Qualification of the link with the AF
<b>CS # 2: 4D Trajectory Calculation Service for Planning Purpose</b>	Enhanced conflict management tool, Enhanced CWP, Enhanced FDP, Flight Planning and demand data, Enhanced AOC/WOC systems.	<p><b>CS # 2 complements PCP AF #6 proposal</b></p> <ul style="list-style-type: none"> <li>• The CS can benefit from the deployment of this ATM Functionality</li> <li>• No impact expected on geographical scope of implementation and associated timeframes</li> </ul> <p>The traffic prediction needs to be as precise as possible in order to optimise ATFCM measures. Today the traffic loads are computed using flight profiles that are based either on updated flight plans for pre-departure traffic or on predicted trajectory for airborne flights. This predicted trajectory is updated on regular basis by correlated position. The EPP exchange (AF #6) will support updates to the predicted profile using more accurate data for the next leg of the trajectory, leading ultimately to more accurate load prediction. The link between the CS # 2 and the AF #6 will be stronger as critical mass of A/C will be reached</p>

## 3 R&D IMPLICATIONS

### 3.1 Interdependencies identified between the PCP and the 9 Centralised Services

As a result of the analysis of the nine proposed CSs, a link with the PCP was established between no more than five of them and the on-going SESAR R&D, as displayed in the table below. At this stage, no SESAR Demonstration activities are on-going or planned for these services.

Centralised Service	Link to on-going/planned SJU R&D
<b>CS # 1: Flight Plan and Airport Slot Consistency Service</b>	<p><b>Limited</b></p> <p>P07.06.05 Demand Capacity Balancing (within the medium to long term planning phase) and P7.3.2 and OFA05.01.01 projects (06.03.01)</p> <p>No SESAR Demonstration activities on-going or planned</p>
<b>CS # 2: 4D Trajectory Calculation Service for Planning Purpose</b>	<p><b>On-going, part of Release plans</b></p> <p>P11.1.X, 7.6.2, WP13, 9.1</p> <p>No SESAR Demonstration activities on-going or planned</p>
<b>CS # 3: European Tracker Service</b>	None
<b>CS # 4: AFUA Support Service</b>	<p><b>On-going, part of Release plans</b></p> <p>P07.05.02 and several other projects in WP 7 Network</p> <p>P13.02.01 (developing the technical systems), 8.3.5</p> <p>No SESAR Demonstration activities on-going or planned</p>
<b>CS # 5: European ATM Information Management Service (EAIMS)</b>	<p><b>On-going, part of Release plans</b></p> <p>MET and AIM Information projects SWP 11M.00, P11.02.01, P11.02.02, 13.02.02, 08.01.04, 08.03.03 &amp; WP14 &amp; Link with the WP7&amp;13 Network Operations Plan (NOP). All projects "using" this information e.g. 07.05.02, 07.06.05, 07.06.01.</p> <p>No SESAR Demonstration activities on-going or planned</p>
<b>CS # 6: MNG of Common network Resources Services</b>	<p><b>Limited</b></p> <p>No SESAR Demonstration activities on-going or planned</p>



<b>CS # 7: Network Infrastructure Performance Monitoring and Analysis Service</b>	None
<b>CS # 8: PENS</b>	None PENS is identified as a key enabler for some validation activities (VPN created for SESAR validation)
<b>CS # 9: Data Communication Service</b>	None if limited to ATNB1 Future communication system is developed in SESAR (ATNB2 etc)

### 3.2 Notion of Centralised Services

It is essential to fully understand the consequences on the overall designed system now and in the future. This understanding is needed from a functionality point of view but also in terms of performance, timeliness, quality of service, resilience and recovery, investment cost, operating costs etc. This assessment must be made during development as design cannot be retrospectively applied. There are therefore implications for R&D, depending on the connectedness of the service considered and the time-frame in which it is to be operational. This assessment must be carried out during R&D design stages.

In this respect, the notion of CSs impacts at the same time the overall architecture of the future ATM system as well as the information-related standards of SWIM<sup>9</sup> developed within SESAR, where options are defined and validated in order to feed the activities of deployment preparation such as future SESAR Demonstrations, Common Project definition (in particular related to the “how”) and ATM Master Plan update campaigns.

For any proposal to move, harmonise or make change to core ATM services it is essential to provide a thorough analysis at the ‘Total’ ATM System level (assessing the broader architectural implications), so as to ensure that the objectives set can reasonably be achieved without causing unexpected consequences elsewhere in the system.

The recent Eurocontrol initiative on Centralised Services and the need to take a ‘total’ ATM system and architecture approach, brought the SJU to propose to its Membership a new SESAR Project to assess the high level architecture options for service delivery at a local, non-local, regional/FAB and centralised at European or Network level, with particular focus on addressing the high-level architecture needs in delivering the different options.

This work is focussed on Step 2 of the European ATM Master Plan where there is already a description of how SWIM will change information management using standards for interoperability, how information will be unlocked and shared more

<sup>9</sup> The Information Service Reference Model (ISRM) provides the service-oriented specifications of information exchanges between different ATM Stakeholders as logical models for information services. This standard helps to achieve interoperability and to reduce number of interfaces between different ATM systems across multiple organisations. The ISRM is developed in the SESAR Programme

effectively, how service orientation will be the mechanism and how stakeholders will maintain responsibility for their own information in a federative approach, with the operating concept for this step being finalised in the SESAR Programme today.

The role of CSs in this vision of the future common information model is not yet clear and additional R&D work is therefore required. Furthermore, regulatory pressure on cost reduction in ANSPs will also drive the need to be able to deliver Virtual Centre capabilities consisting of wider distribution of controller workstation locations while data delivery is from more concentrated points of technical service delivery. This evolution requires development of the necessary open standard interface in the evolving ATM System and it has also been proposed as a new project by the SJU, and will need to be performed with strong links to the CSs initiative. It is therefore essential to continue carrying out these activities in a coordinated within the context of the SESAR Programme.

In the longer term, (Step 3 and beyond) the defined SJU Long-Term Research scope already includes work on new approaches to designing the ATM system and understanding the means of enabling faster, more cost-efficient change. These activities include conducting a design exercise and determining the transition steps to a fully service oriented and scalable architecture for ATM in Europe, while taking account of safety, security and how liability concerns will be addressed. The SJU will continue this work and continue to look for ideas to transition from the longer term research into more mature concepts and technologies to be further developed in later (increased maturity) stages of the innovation lifecycle.

## APPENDIX: ANALYSIS OF THE LINKS BETWEEN THE CENTRALISED SERVICES AND THE EUROPEAN ATM MASTER PLAN

Within the task of identifying and assessing the interdependencies between the PCP's six ATM Functionalities (AFs) and the proposed Centralised Services (CSs) as described in section 1.4 of this report, EUROCONTROL DSS has provided technical assistance to the SJU.

At ATM Master Plan level 2 the technical scope of the PCP is defined as related to the following Operational Improvement Steps (OIs) and related Enablers:

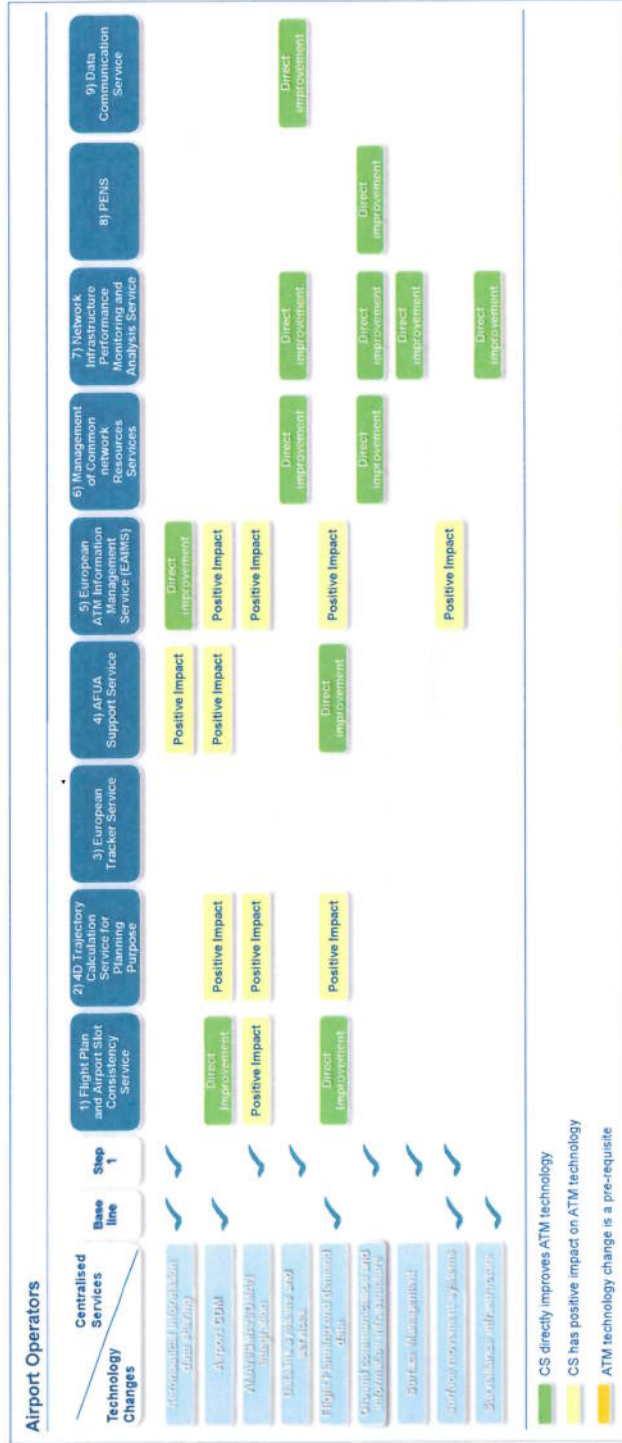
ATM Functionality	Operational Improvement Step (OI) code	Operational Improvement Step (OI) name
AF # 1	TS-0303	AMAN multiple airports
	TS-0305	Arrival Management Extended to En Route Airspace
	AOM-0603	RNP APCH (assumed RNP 1 including SID and STARs)
AF # 2	TS-0202	Departure Management Synchronised with Pre-departure Sequencing
	TS-0203	Departure Management integrating Surface Management Constraints
	AO-0205	Automated Assistance to Controller for Surface Movement Planning and Routing
	AO-0303	Time Based Separation for Final Approach - full concept
	AO-0104-A	Airport Safety Nets for Controllers in Step 1
	AO-0209	Enhanced runway usage awareness to reduce hazardous situations on the runway (even if not yet in the MP, SJU agreed on its integration in PCP)
AF # 3	AOM-0206-A	Airspace Management and Advanced Flexible Use of Airspace
	AOM-0501	Use of Free Routing for Flight in cruise and vertically evolving, inside FAB above a certain level, with low to medium traffic complexity areas
	AOM-0502	Use of Free Routing (H24) for Flight in cruise and vertically evolving, through FABs above a certain level, extended to high traffic complexity areas
	AOM-0403-A	Pre-defined ATS Routes activation only when and where required within FRA (Free Route Airspace) in Step 1
	CM-0204	MTCD with CORA & Conformance Monitoring
AF # 4	CM-0103-A	Automated support for traffic complexity assessment
	DCB-0308	Enhanced Short Term ATFCM Measures
	DCB-0103-A	Collaborative NOP for Step 1
	Refinement on-going	CTOT to Target Times for ATFCM purposes
AF # 5	IS-0901	SWIM for Step1
	MET-0101	Enhanced operational planning decisions through MET information integration
AF # 6	IS-0303-A	Use of onboard 4D trajectory data to enhance ATM ground system performance – Initial and Time-based operations

Supplement to the mandate to the SESAR Joint Undertaking for drafting a proposal on the content of a pilot common project

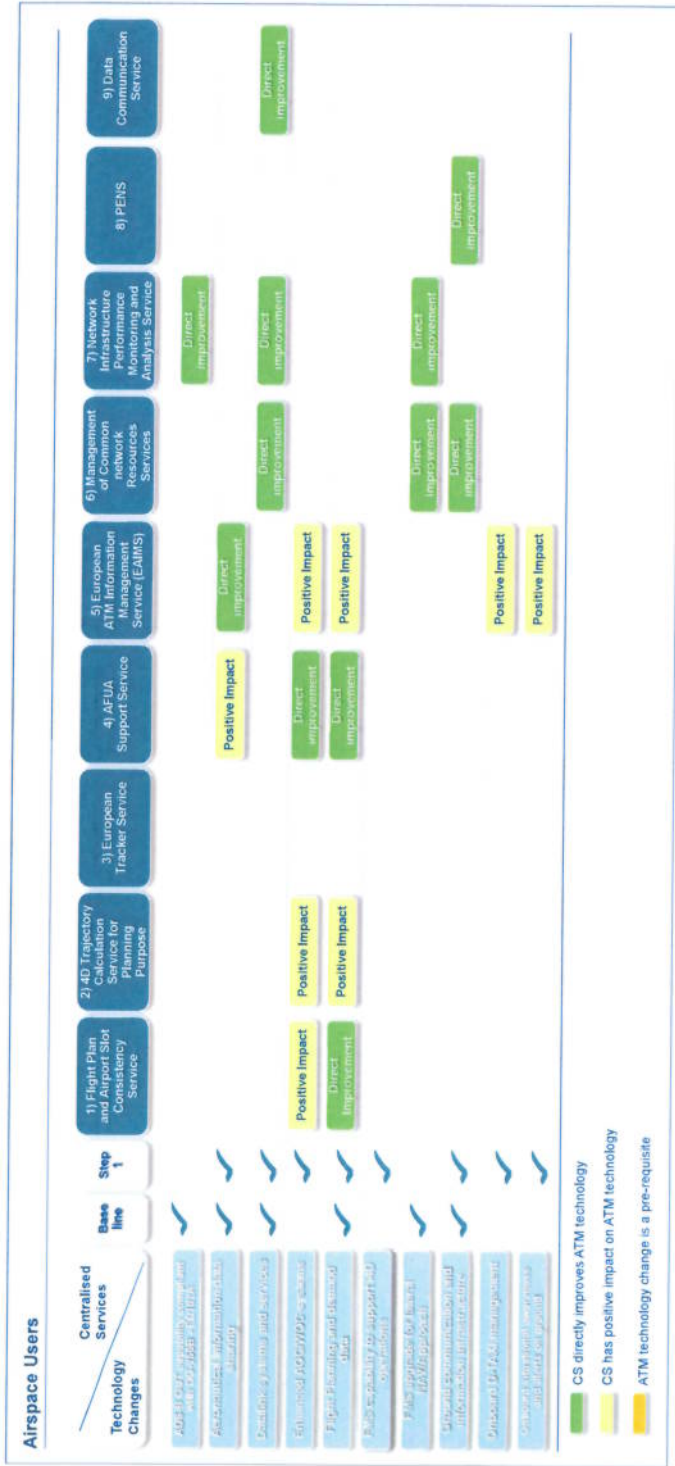
The outcome of the analysis contains a mapping of all CSs vis-à-vis the ATM Technology Changes necessary to deliver the Master Plan's Essential Operational Changes which can then be connected to the PCP as outlined in section 2.1 of this report. The main outcomes of the analysis are shown in the following figures for each stakeholder category.



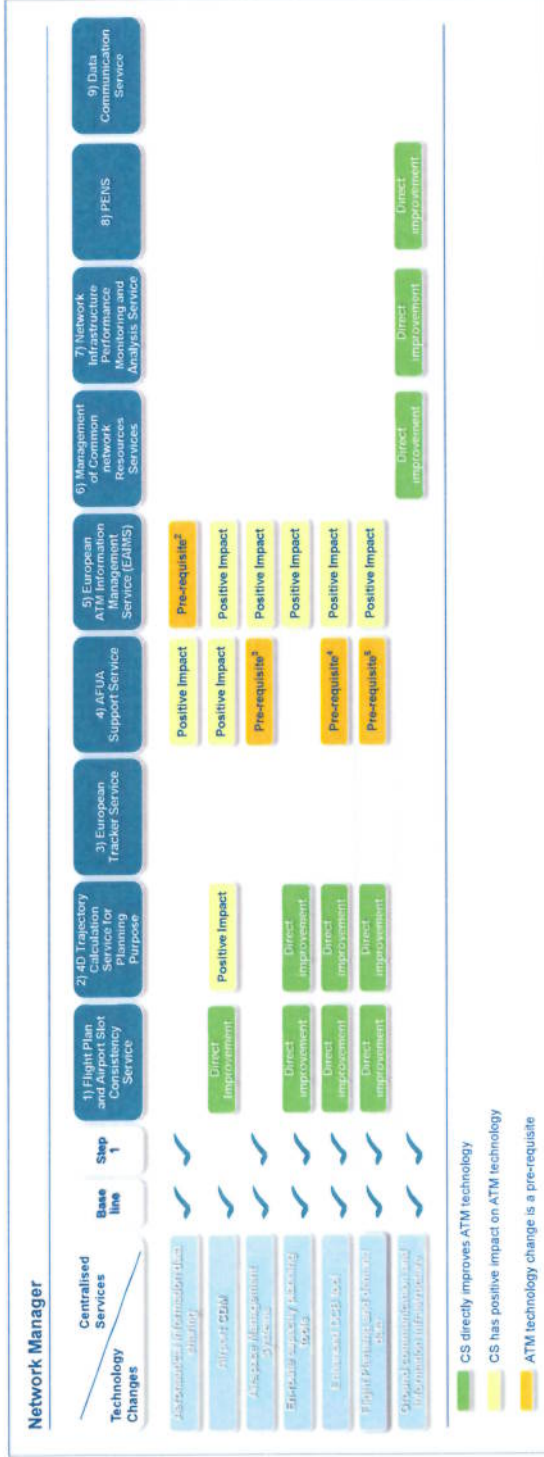
Supplement to the mandate to the SESAR Joint Undertaking for drafting a proposal on the content of a pilot common project



Supplement to the Mandate to the SESAR Joint Undertaking for drafting a proposal on the content of a pilot common project



Supplement to the mandate to the SESAR Joint Undertaking for drafting a proposal on the content of a pilot common project



<sup>2</sup> The implementation of ADR (AIMS-20) and Pre-Flight Briefing (AIMS-07) are pre-requisite for the implementation/use of CS5. AIMS-20 operation in 2013 and AIMS-07 already in operation

<sup>3</sup> The implementation of ADR (AIMS-20) and B2B information exchange with AMC (AAMS-06b) are pre-requisites for CS4 implementation/use. AIMS-20 operation in 2013 and AIMS-06b operation in 2014 (as part of IDP).

<sup>4</sup> The implementation of A/S Impact assessment tools (AAMS-15) is a mandatory pre-requisite for CS4 (will be implemented in 2013, as part of ESSIP)

<sup>5</sup> The implementation of usage of the latest A/S information in Flight Planning system is a mandatory pre-requisite to CS4 (already implemented)