sesar
DEPLOYMENT MANAGER

SESAR Deployment Programme

- 2022 -

Modernising
Air Traffic Management
As One

Funded by the
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Contents

1. Introduction

A new Regulation, an updated SESAR Deployment Programme

The SESAR Deployment Programme provides a common workplan to all operational stakeholders involved in the deployment of Regulation (EU) n. 2021/116, so called Common Project One (CP1), clearly defining the scope of the implementation activities, the synchronisation needs, as well as the suggested deployment approach.

Considering its role as a blueprint for ATM Stakeholders' investment plans, the SESAR Deployment Programme is therefore organised into the following three sections:

- Section 1 provides an introduction of the SESAR Deployment Programme and the CP1 regulatory framework;
- Section 2 provides the project view of the SESAR Deployment Programme, including the timeline, work breakdown structure, CNS enablers and performance aspects;
- Section 3 describes the six ATM Functionalities included in the Regulation from the implementation perspective, providing all the details on how to implement them.

Figure 1 - SESAR Deployment Programme and its Supporting Material

The SESAR Deployment Programme is also underpinned by a set of Supporting Material that entails:

- the Standardisation and Regulatory material;
- the updated Short-Term Deployment Approach, which helps identifying the elements to be more urgently addressed by ATM stakeholders;
- a short set of best practices and success stories that operational stakeholders have been carrying out in the 2014 – 2020 timeframe to accelerate the implementation of CP1;
- the risks and mitigation actions associated with the implementation of CP1;
- an outlook of the performance assessment and CBA methodology used by the SESAR Deployment Manager;
- the Stakeholders' Deployment Roadmaps, in which each stakeholder category is provided with a summary and timeline of all activities that must[1] be performed to ensure compliance with the CP1 provisions.

1 Along the document, requirements are expressed using the following notation:
a) "shall" indicates a mandatory requirement, coming directly from CP1 regulation's text
b) "must" indicates a requirement as per SDM's view,
b) "should" indicates a recommendation,
c) "may" indicates something that is permitted.

2. Common Project 1: the Project View

2.1. Overview

According to the definitions included into Article 2 of recently revised Regulation (EU) n. 409/2013, an ATM functionality is defined as:

"*a group of ATM interoperable operational functions or services and their technological enablers related to trajectory, airspace and surface management or to information sharing within the en-route, terminal, airport or network operating environments*"

In this perspective, the technical Annex to Regulation (EU) n. 2021/116 lays down a set of six ATM functionalities (AFs) to be implemented across the European ATM Network up to 2027, thus setting forth the content of the Common Project 1. CP1 AFs are also divided into 20 sub-ATM functionalities (sub-AFs), which are integral parts of AFs and contribute to their respective scope.

AFs and sub-AFs are based on SESAR Solutions, as developed and validated by the SESAR Joint Undertaking and linked to Essential Operational Changes (EOCs) described in the European ATM Master Plan. Further details can be found in the SDP Supporting Material.

With the goal of further detailing the business view included in the Regulation and of breaking it down into technical and operational terms, the SESAR Deployment Programme aims at translating these AFs and Sub-AFs into coherent deployment Families with clear deployment milestones for each affected stakeholder.

A Family is defined as a specific set of homogeneous technological and operational elements, which include systems and procedures and must be deployed within a defined geographical scope and timeframe. This will ensure that the operational scenario defined by the CP1 Regulation, and its associated benefits (performance improvements) become a reality. The timely and synchronised implementation of the CP1 Families is paramount to ensure the associated performance improvements are delivered to the ATM Community and – in turn – to European passengers.

Each sub-ATM functionality can be composed of one or more Families: in this perspective, the 25 Families identified in the SESAR Deployment Programme regroup all local implementation activities that contribute to the deployment of the 20 sub-AFs, and subsequently the 6 ATM Functionalities listed in the Common Project 1 Regulation.

Families are implemented by the relevant ATM operational stakeholders through specific implementation projects, under the coordination and synchronisation of the SESAR Deployment Manager: such implementation projects, to be aligned with the requirements set forth by the CP1 Regulation, must be executed by stakeholders with their own funds or with the support of EU co-funding (as part of the SESAR Deployment Framework Partnership Agreement). In both cases, however, the implementation projects shall be designed and executed in accordance with the content and timeline set forth by the SESAR Deployment Programme.

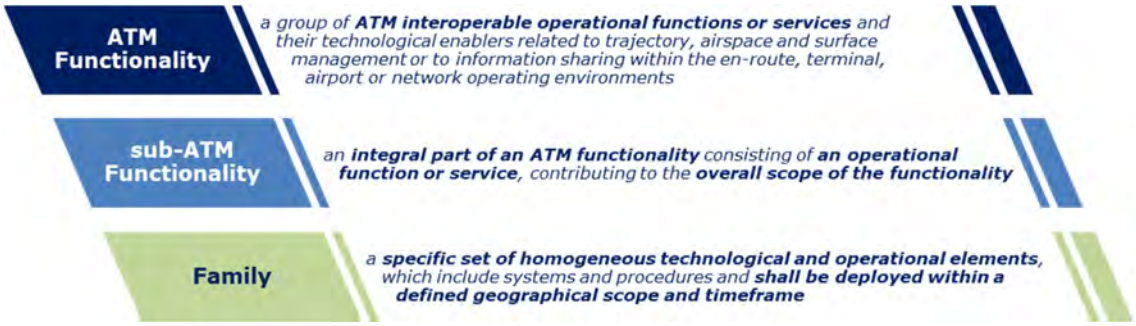

Figure 2 - AFs, sub-AFs and Families: definitions

As a stable reference, the following Work Breakdown Structure reflects the structure of the Common Project 1, as well as its organisation into ATM Functionalities, Sub-ATM Functionalities and Families.

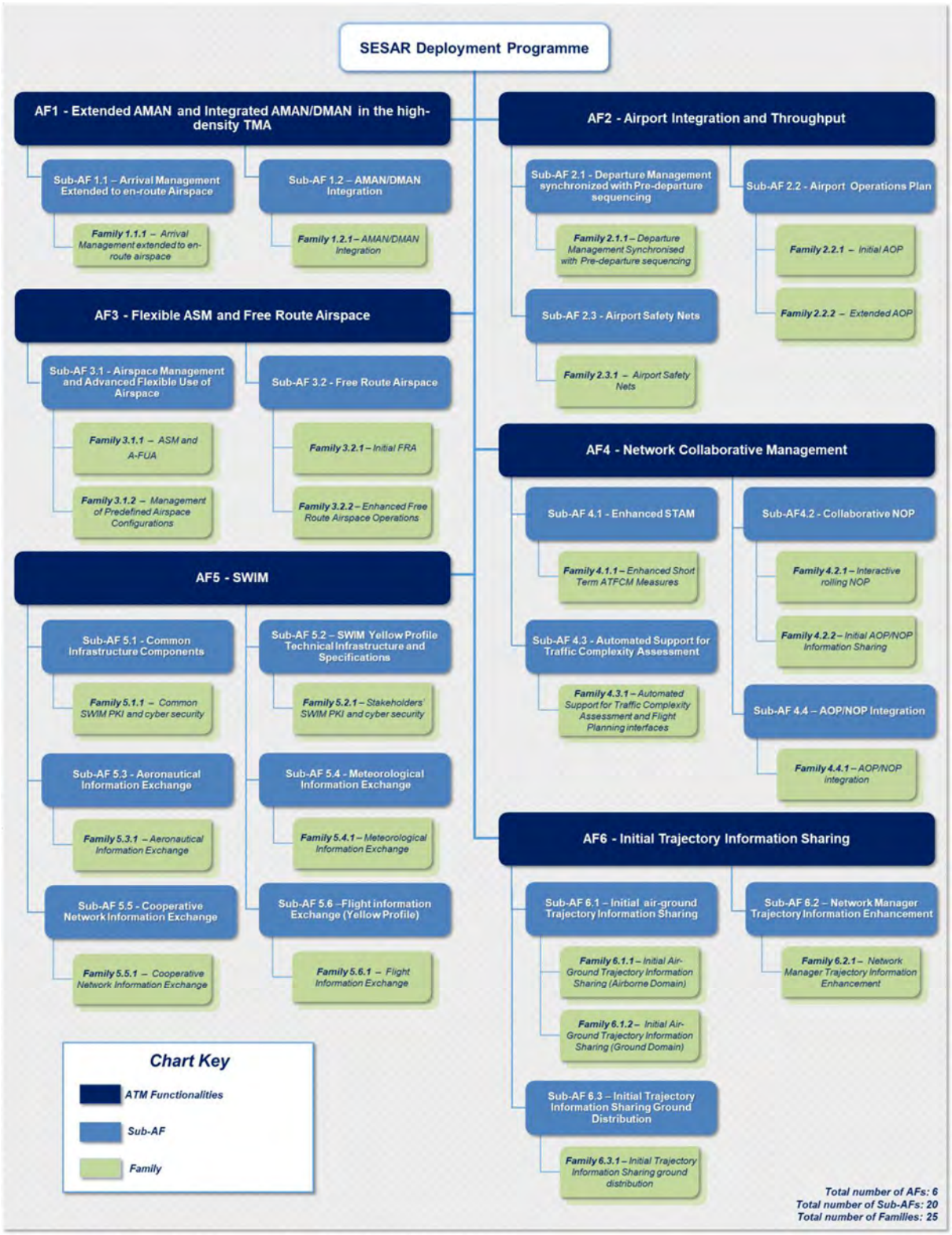

Figure 3 - SESAR Deployment Programme Work Breakdown Structure

2.2. The timeline for CP1 implementation

2.2.1. CP1 Regulation: regulatory target dates

The content of Regulation (EU) n. 2021/116 is not limited to the definition of the Functionalities and sub-Functionalities to be deployed, it also identifies the overall timeline to be followed for their deployment.

The Common Project 1 Regulation introduces a fixed final implementation deadline for all its content, which is set on the 31 of December 2027: this date is well within the timeframe of Reference Period 4, as described by the Performance Scheme, and is defined as the date by which all implementation activities linked to CP1 should be completed. With the full deployment of the Regulation, the full potential of Common Project 1 will be materialised, also in terms of operational and performance benefits.

However, the Annex to the Regulation goes a step beyond, with the goal of providing a high-level timeline for all stakeholders required to invest to implement its content. In particular, for each AF and sub-AF, Articles 1.3, 2.3, 3.3, 4.3, 5.3 and 6.3 of the Annex to the Regulation define their own "*target dates*".

In particular, the Annex to the Regulation defines:

- The *implementation target dates*, i.e., the dates by which the deployment of each ATM Functionality and Sub-ATM Functionality shall be completed and ready for the operational use of the services and functions thereby included.
- The *industrialisation target dates*, i.e., the dates by which the standardisation and certification processes linked to a specific ATM Functionality (or sub-ATM Functionality) shall be completed, enabling its procurement, installation, and synchronised implementation by ATM stakeholders.

Industrialisation target dates are foreseen only for those Functionalities and sub-Functionalities that have not yet reached an adequate level of maturity and readiness for the implementation activities: they set an intermediate deadline for concluding all related standardisation and certification processes. Once the industrialisation gate occurs, the readiness for implementation of the Functionalities is carefully assessed: in case the level of maturity is not deemed appropriate, the related AFs and sub-AFs will be removed from the Regulation.

In the framework of CP1, industrialisation target dates are introduced for AF 6, considered as an essential component of the Regulation and as an enabler for the future implementation of Trajectory Based Operations (TBO) as described in the ATM Master Plan. The industrialisation target date for Sub-AF 6.1, 6.2 and 6.3 is set on the 31st of December 2023.

2.2.2. The overall Gantt of the CP1 implementation

The Common Project 1 Regulation sets forth the mandatory target dates to be respected by all relevant operational and non-operational stakeholders, both for standardisation (in the case of AF6) and for actual implementation and entering into operations of its Functionalities and sub-ATM Functionalities. In the case of standardisation, CP1 clearly defines an industrialisation target date by when the industrialisation processes should be successfully finalised.

However, **it is the SESAR Deployment Programme that defines a common and shared roadmap for the implementation activities linked to CP1, including the dependencies among the different Families and the synchronisation needs between the stakeholders and between different geographical locations.** The SDP therefore defines the expected timeframe for the deployment of each individual Family contributing to the different AFs and Sub-AFs, thus defining the most appropriate implementation window for the relevant stakeholders.

The full picture of the implementation windows for each Family is reported in the Gantt chart below. The diagram reflects the pre-requisite type dependencies between the different Families. These are represented with arrows from one Family to another, meaning that the Family where the arrow starts from is a pre-requisite (needs to be completed) to accomplish the implementation of the Family where the arrow ends. To understand all the different links between the Families (not only the pre-requisite type) please refer to the "Dependencies" section under each Family, where they are further detailed.

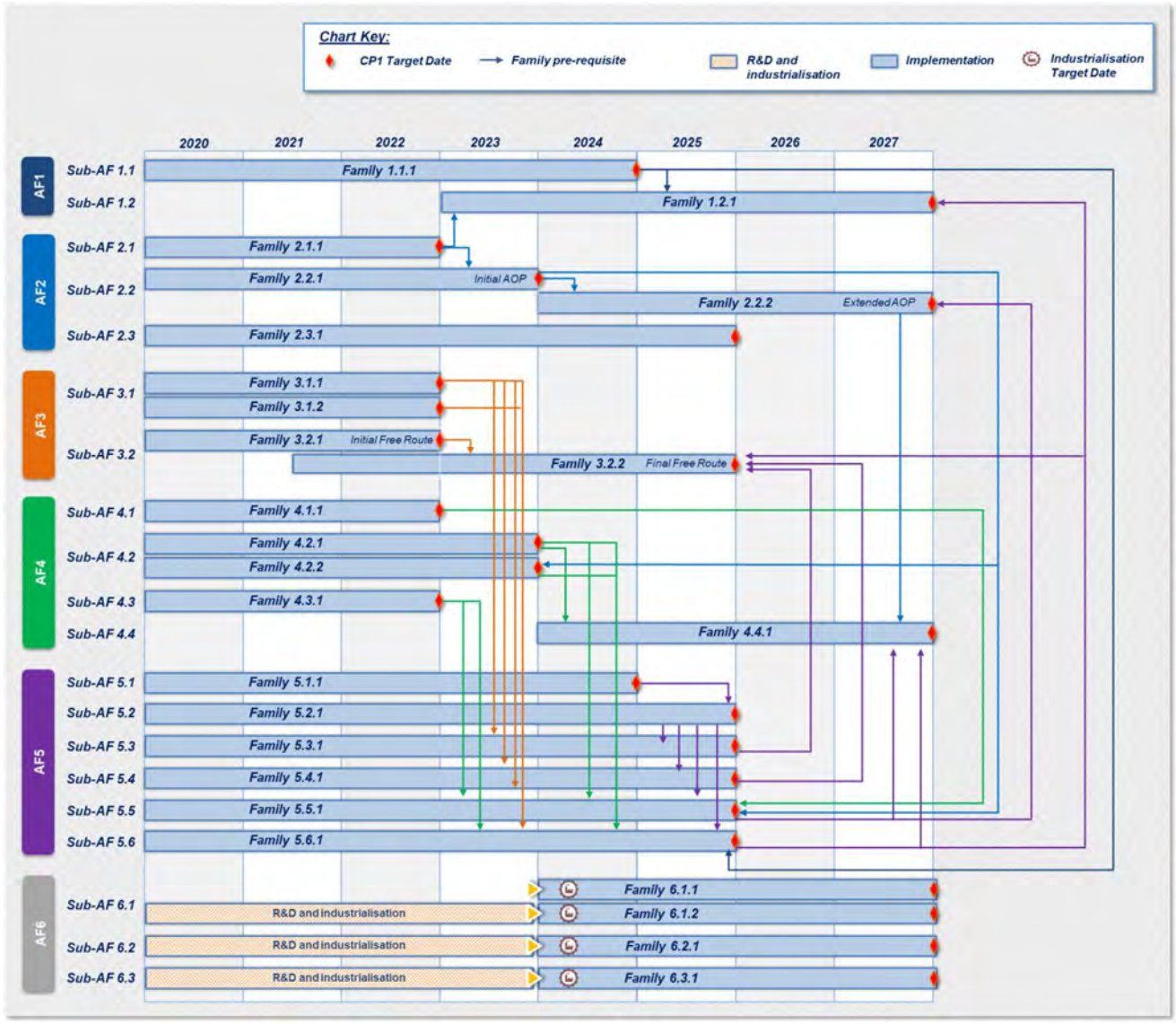

Figure 4 - SESAR Deployment Programme Gantt chart

2.3. CNS in the ATM Master Plan and CP1

Communications, Navigation and Surveillance (CNS) infrastructure is the fundamental enabler for Air Traffic Management and plays an essential role in the safe and effective provision of air navigation services. CNS infrastructure in EU is undergoing a major evolution, driven by a number of currently active implementing regulations[2].

The ATM Master Plan edition 2020 outlines the overall CNS roadmap from 2020 until 2035. Many of the identified CNS enablers are linked to the implementation of the 6 ATM Functionalities in CP1.

[2] Regulation (EU) n. 2015/310 ("DLS IR"), Regulation (EU) n. 1079/2012 ("8.33"), Regulation (EU) n. 2018/1048 ("PBN IR"), Regulation (EU) n. 1207/2011 (SPI IR) and Regulation (EU) n. 1206/2011 (ACID IR), as amended by Regulation (EU) n. 2020/587.

2.4. Performance aspects

2.4.1. The performance improvements delivered by CP1

The Common Project One was adopted by the Commission after positive opinion of the EU Member States and endorsement by the operational stakeholders on the basis of a Cost Benefit Analysis (CBA) that demonstrated a positive Net Present Value (NPV).

The Cost Benefit Analysis has been adjusted and recalculated on the basis of the latest available traffic forecast, therefore the traffic reduction linked to the COVID-19 crisis is duly taken into account.

In this section, the monetisation of the CP1 benefits from the CP1 CBA is divided in their underlying Network Performance components to show the CP1 impact on operational performance. It illustrates that CP1 makes a substantial contribution across several Network Performance elements, most notably in airspace Capacity because of fewer delays, and enhanced Operational Efficiency due to more efficient routes.

2.4.2. Performance benefits brought by CP1

The Table below shows the impact on Network Performance measured in the different Key Performance Areas (KPAs) by the different Key Performance Indicators (KPIs), both as **cumulated values** over 2014-2030 and **per flight** on the year 2030 (end of the CP1 CBA timeframe). All values are calculated against the do-nothing scenario, in which CP1 is not deployed.

When available, a comparison with the ATM Master Plan ambitions is also shown in the last column. It is displayed as a percentage of the targeted improvements per flight. As the targeted improvements per flight are expressed as ranges in the Master Plan (for instance, fuel burn target savings are between 250 and 500 kg per flight), the column shows ranges as well.

Key Performance Area	Master KPI	Impact on Network Performance (cumulated until 2030)	Performance impact per flight (in year 2030)	ATM Master Plan ambitions (in 2035 and per flight)	Fulfilment of SESAR Performance Ambitions
Capacity	Departure delay reduction	252 million minutes saving	2.1 min	1-3 min	N/A[3]
Operational efficiency	Flight time reduction	71 million minutes saving	0.7 min	4.1-4.5 min	16-17%
	Fuel burn reduction	3.3 million tons saving	35 kg	250-500 kg	7-14%
Cost efficiency	ANS Productivity gains	744 million EUR saving	€7.25	€290-380	2-2.5%
Environment	CO_2 emissions reduction	10.4 million tons saving	111 kg	kg 800-1600	7-14%

Table 1 - Network performance benefits per KPA and KPI

Capacity savings (61% of total monetised benefits) and Operational Efficiency improvements (33%) are the largest benefit contributors driving to Environmental savings.

Capacity savings are expected to reach 252 million minutes from 2014 to 2030. These are the total departure delay reductions, including airport and en-route ATFM delays as well as ATC delays reductions, due to improvements in traffic prediction mainly linked to the implementation of Free Route and Flexible Use of Airspace (AF3) and Network Collaborative Management (AF4). This value of 252 million minutes saved represents, at the end of CP1 in 2030, a value of 2.1 minutes of delay reduction per flight. It is worth

[3] A large part of the savings (En-Route ATFM delays) is generated against the "do-nothing" scenario where delays significantly increase in the future. Thus, the savings cannot be compared with the ATM Master Plan targets, which are calculated in comparison to a historical reference (2012).

reminding that the saving is measured against a “no-CP1” (or “do-nothing”) scenario where delays are supposed to increase again in the future when traffic recovers then exceeds its pre-COVID volume.

Operational efficiency savings are expected to reach 71 million minutes and 3.3 million tons of fuel over 2014-2030. They include mainly en-route reductions due to Free Route and Flexible Use of Airspace implementation (AF3) but also significant reductions in the Arrival Sequencing and Metering Area (ASMA) resulting from AMAN (AF1), as well as savings in the airport environment due to DMAN implementation (AF2). These values represent, at the end of CP1 in 2030, 0.7 minute of flight time and 35 kg of fuel savings per flight.

Cost Efficiency savings are expected to reach €744 million from 2014 to 2030. They are driven by ANS productivity increases primarily through AF4 (approximately 93%) with the remaining stemming from AF1. Cost Efficiency benefits were estimated for the whole CP1 CBA based on the share of benefits assigned to CP1 in the ATM Master Plan, then split between AFs based on the initial PCP CBA assumptions. However, benefits assigned to AF5 and AF6 were not counted, to remain conservative and consistent with AF5 and AF6 being enablers for other ATM functionalities. The saving of €744 million represents, at the end of CP1 in 2030 a value of around €7.25 savings per flight.

Environmental savings: It is estimated that – under normal traffic conditions – current trajectories of all flights controlled in the European region entail an additional 6% in CO_2 emissions compared to optimal trajectories. This corresponds to 11.6 million tons of CO_2 emissions that could be avoided. That’s where the timely implementation of Common Project 1 and its Functionalities is expected to play a critical role.

The synchronised deployment of CP1, if realised in accordance with a common roadmap and to the provisions of an agreed workplan, is expected to ensure significant improvements for the environmental performances of ATM in Europe: the expected benefits of the CP1 implementation in Europe amount to 3.3 million tons of jet fuel saved until 2030, which corresponds to 10.4 million tons of CO_2 emissions saved: this is the equivalent of 111 kg of CO_2 emissions per flight in 2030.

These figures are based on the latest available traffic forecast, therefore duly considering the traffic reduction linked to the COVID-19 crisis.

3. The six ATM Functionalities

The Common Project 1 Regulation outlines the six ATM functionalities to be deployed in a synchronised manner at European level. To guide stakeholders through the implementation of these AFs, this section of the SESAR Deployment Programme illustrates their structure, main elements and features.

Within the following paragraphs, each ATM functionality is described with regard to:

- the **Work-Breakdown Structure**, i.e., the AF internal structure and the list of sub-AFs and Families thereby included;
- the **link between the different Families and the related SESAR Solutions** to better frame how the implementation of CP1 will contribute to the overall modernisation of European ATM and to the overall objectives of the SESAR Project. In this perspective, the following paragraphs also include the link to the Essential Operational Changes that the different ATM functionalities contribute to;
- the **deployment approach and synchronisation needs of the ATM Functionality**, including the coordination aspects among involved stakeholders;
- the **CNS enablers** that support or facilitate the implementation of the ATM Functionality;
- the **details of each Family included as part of the AF**, clarifying which technological and/or operational elements, systems and procedures shall and/or must be implemented to ensure their deployment;
- the **expected performance benefits** that the full implementation of the AF is expected to deliver, identifying the key performance areas to which the elements included in the Functionality will contribute in a qualitative manner: those Benefit Areas with a significant impact have been labelled in dark green, whilst those Benefit Areas with a moderate impact have been labelled in light green[4] ;

- the set of necessary **information to push forward the industrialisation and standardisation activities**. These elements are only available for ATM Functionality #6, where the content has not yet achieved its full maturity to enable large-scale deployment, but that is expected to be reached before implementation activities can start.

It is worth mentioning that further guidance and supporting material to ensure harmonised implementation, such as standards, means of compliance, specifications, etc. for each Family is included into the Supporting Material of the SESAR Deployment Programme.

The CP1 Regulation clearly identifies the system requirements that each stakeholder shall implement in order to achieve the ATM Functionalities. Those stakeholders are normally the ones who have to invest and plan their activities according to the CP1 target dates.

The 6 ATM Functionalities and its underpinning Families require synchronised implementation across Europe, as defined in the recently revised Commission Implementing Regulation (EU) 409/2013:

"Synchronised implementation" means an implementation of ATM functionalities in a synchronised way over a defined geographical area, which includes at least two Member States within the EATMN, or between air and ground operational stakeholders based on common planning that includes deployment target dates and the relevant transitional measures for their progressive deployment and involving multiple operational stakeholders"

To this purpose, the SESAR Deployment Programme identifies the most effective way to complete the implementation of the different ATM Functionalities and/or their sub-ATM functionalities, the so-called "Deployment Approach".

[4] Referring to "Cost Efficiency" it must be noted that all Families may have an impact, even if not ticked in the respective tables. Referring to "Security" it must be noted that all the cyber-security aspects are addressed in a specific field of the Families section.

The proposed approach for each ATM Functionality can of course be tailored and fine-tuned at local level on the basis of the particular arrangements pertaining to the specific operational environments, or on the basis of the different distribution of responsibilities amongst the different stakeholders.

The following sections illustrate the Deployment Approach for each of the six ATM functionalities, describing the sequence to be followed by operational stakeholders required to invest by the Common Project One Regulation, the dependencies and the synchronisation needs.

How to define the Deployment Approach at AF level

The Deployment Approach of each ATM functionality has been determined on the basis of the combination and weighting of the following principles criteria: sequence in time, interdependencies between Families and the potential acceleration of performance benefits.

The CP1 Regulation mandates different deployment target dates for different sub-AFs, even when associated with the same ATM functionality: industrialisation and implementation activities should therefore be organised in such a way that allows compliance with the Regulation requirements. To enable the entering into operations of each technology at the appropriate moment, the suggested approaches identify the optimum sequencing to ensure Regulation deadlines are respected.

Within each AF, the Deployment Approach has been defined considering that the activities required to put into operations some Families are pre-requisite to others, and in some cases the deployment of a specific Family could enable enhancements of another. The suggested approach therefore places the Families into the most effective, logical and chronological order: it identifies the Families whose implementation can be carried out in parallel, potentially leading into an earlier achievement of the associated performance improvements.

How to interpret the Deployment Approach diagrams: Families and sub-AFs

The Deployment Approach diagrams are represented in a GANTT-like orientation, using nodes and arrows to represent the milestones and activities. The aim of the Deployment Approach diagrams is both to show the dependencies between different Families and to illustrate their sequencing in time. This would not only help SESAR Deployment Manager to coordinate CP1 deployment activities and monitor its progress, but also to identify potential risks when the implementation is not progressing at the right pace, allowing ad hoc support from SESAR Deployment Manager to the relevant operational stakeholders.

Each Family is represented by an arrow, connecting different bubbles or nodes: these represent the intermediate steps of the Deployment Approach, meaning that a given Family or sub-ATM functionality has been fully implemented and put into operations.

The Families have been represented taking their dependencies into consideration, meaning some of the Families can be implemented in parallel, whilst others need to be implemented in sequence. Each Family (arrow) starts from a bubble or node and ends in another node.

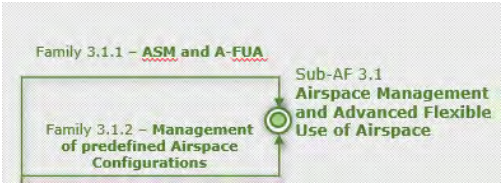

Figure 5 - Example of the sequencing

In the following example (Figure 5), Families 3.1.1 and 3.1.2 are shown contributing to the deployment of Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace. At the same time, the chart depicts how Family 3.1.1 and 3.1.2 can be implemented in parallel.

To properly represent the sequencing and interdependencies of Families and sub-AFs, dotted lines have been added when a specific Family or a sub-ATM Functionality works as a predecessor or contributes to the full implementation of another sub-AF.

The following example explains how the full implementation of s-AF 1.1 (Arrival Management extended to en-route airspace) significantly contributes to the subsequent implementation of sub-AF 1.2 (AMAN/DMAN integration).

Figure 6 - Example of interdependencies of some Sub-AFs

How to read and understand Deployment Milestones (DMs) and related synchronisation needs

Each Family described in the SDP contains a specific section identifying those DMs associated to each stakeholder category (sometimes to more than one category of stakeholders), and each of the DMs describe what has to be implemented (system upgrades, training, development of procedures, etc.) and by whom. The DMs are numerated in sequence.

In the case of Safety Assessment DMs, which is a pre-requisite in all implementations, they have to be developed by the stakeholder in charge of the elaboration of the safety case (i.e, ANSPs, Airport operators, etc.). The role of the competent supervisory authority (NSA, EASA) is to review and eventually approve the safety case.

It is important to address the synchronisation needs among different stakeholders within a given Family. To do so, the Family Deployment Approach defines a serie of Deployment Milestones (DMs) which are proposed to be implemented in sequence by the responsible implementing stakeholder.

Those DMs that require synchronisation among different stakeholders are marked with this synchronisation symbol 

3.1. AF1 - Extended AMAN and Integrated AMAN/DMAN in the high-density TMA

3.1.1. Work Breakdown Structure and SESAR Solutions

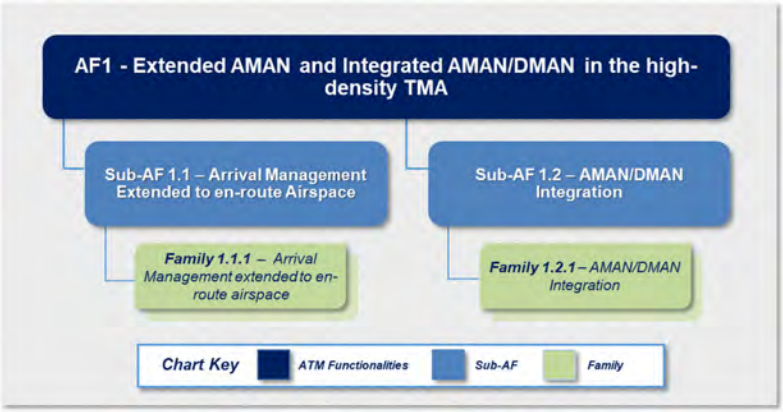

Figure 7 - AF1 Work Breakdown Structure

This ATM Functionality foresees the enhancement of AMAN and DMAN tools in order to improve the accuracy of the approach trajectory and facilitate air traffic sequencing at an earlier stage.

It is composed of two Sub-ATM Functionalities and each Sub-ATM Functionality is addressed by one Family. The links between the Families and the SESAR Solutions can be found in the table below:

Family	SESAR Solutions	EOC
Family 1.1.1 - Arrival Manager extended to en-route airspace	Solution #05 “Extended Arrival Management (AMAN) horizon”	Airport and TMA performance
Family 1.2.1 – AMAN/DMAN Integration	Solution #54 “Flow-based integration of arrival and departure management” Solution #106 – DMAN Baseline for integrated AMAN-DMAN	Airport and TMA performance

3.1.2. Deployment Approach and Synchronisation Needs

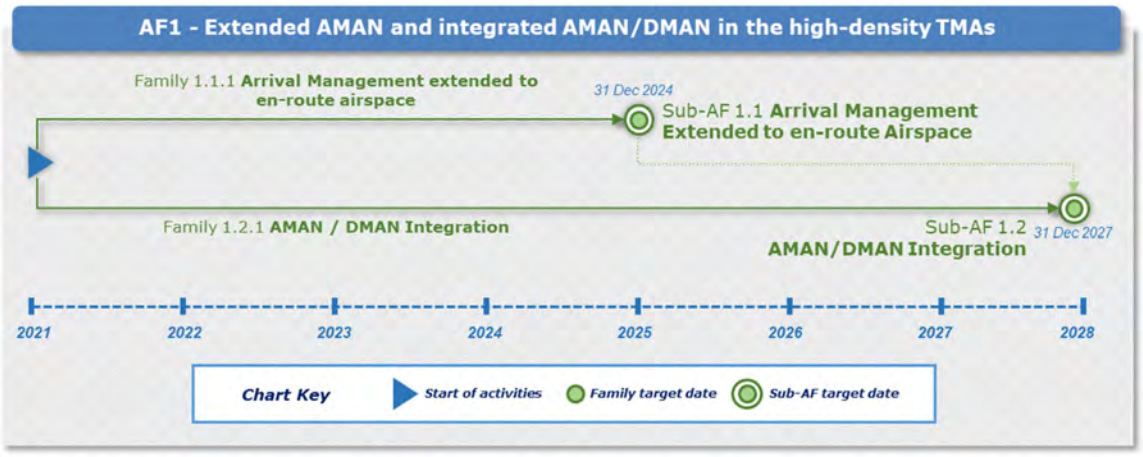

Figure 8 - AF1 Deployment Approach

Extended-AMAN (E-AMAN) allows for the sequencing of arrival traffic much earlier by extending the AMAN horizon from the airspace close to the airport to further upstream. Controllers in the upstream sectors, which may be in a different control centre or even a different State, receive system advisories to support an earlier pre-sequencing of aircraft.

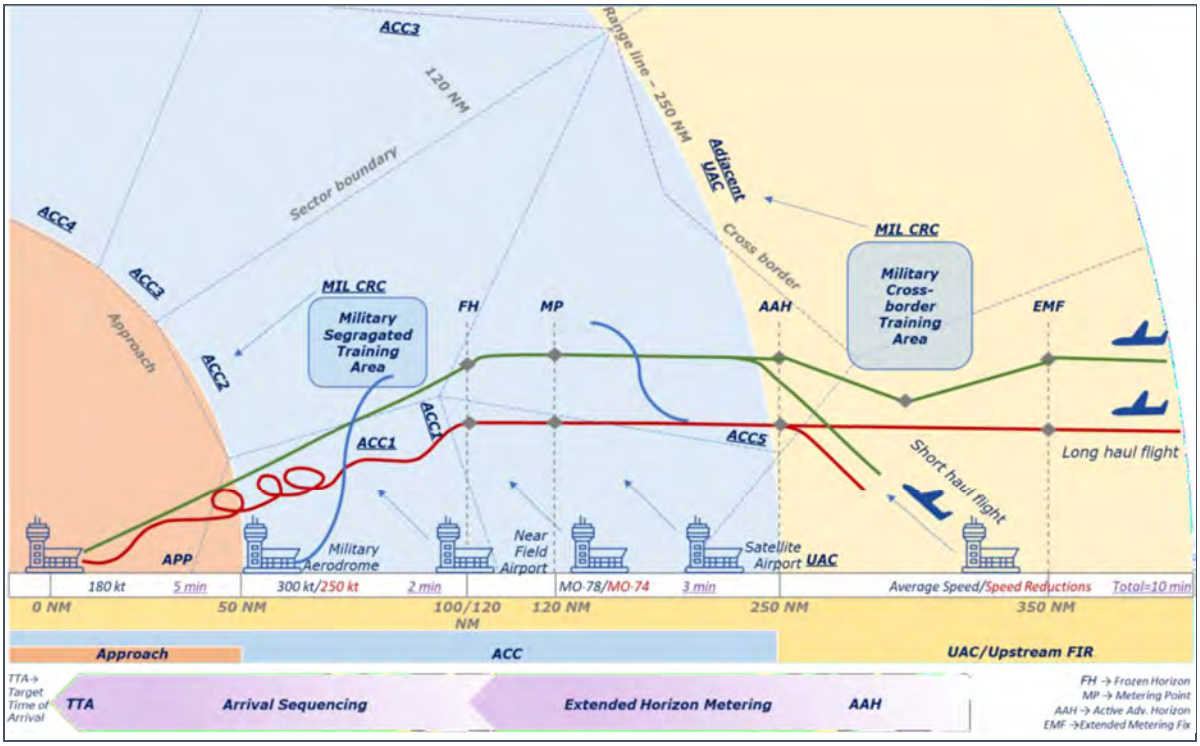

Figure 9 - Extended-AMAN synchronisation needs

Deployment of targeted system and procedural changes shall be synchronised with all affected ATS Units (ANSPs). Coordination, led by the ANSPs, needs to take place with impacted airports (Airport Operators), Airspace users (Airlines) and Air Traffic Flow Management Units (ATFMU) to ensure all the performance objectives/benefits are fully achieved.

The role of ATFCM for extended AMAN is related to the reception of relevant Extended AMAN data by NM for overall network impact assessment and relevant network optimisations.

ATSU may share the relevant Extended AMAN data with the Network Manager for the improved ATFCM, overall network impact assessment and relevant network optimisations using Arrival Planning Information (API).

Synchronisation is also required to ensure all the concerned stakeholders have the necessary systems to exchange E-AMAN data including trajectory information for ensuring constraints compliance and monitoring. This includes the need to adjust/upgrade the ATM-systems of the adjacent ACCs/UACs to process the arrival messages provided by Extended AMAN.

The ANSPs coordination with NM/ATFM for particular extended AMAN aspects and overall network optimisation may also be considered.

AMAN/DMAN integration requires synchronisation of investments among all affected ANSPs (ATS Units) and impacted Airport Operators in order to ensure optimised runway-use policy and achievement of all the associated performance objectives/benefits e.g., improved time management and runway occupancy, enabling significant reduction in fuel burn and CO_2 emissions.

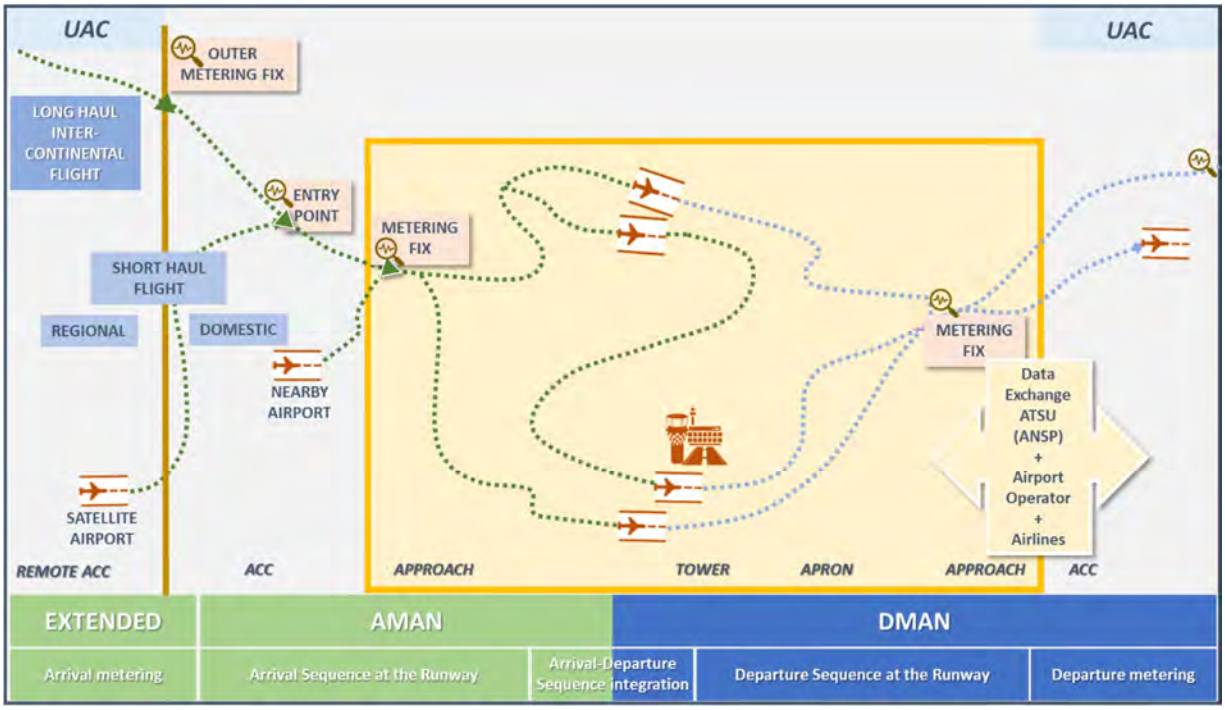

Figure 10 - AMAN/DMAN Integration synchronisation needs

Synchronisation is also required for enhanced tactical runway scheduling by ensuring improved predictability and the stability of the arrival sequence managing the arrival fix for metering time, target time of arrival, as well as of linked departure sequence managing off-blocks times, start-up approval time and Departure time (target take-off time).

Finally, at the mandated airports, AMAN/DMAN integration requires coordination with the airport stakeholders (as defined at page 36).

Synchronisation needs of AF1:

Between Member States	Between air and ground stakeholders	Between civil and military stakeholders
✓		

3.1.3. CNS Enablers for AF1

CP1 requires that Arrival Management is operated on a horizon on 180 NM. Given the persisting reliance on national CNS infrastructures largely confined to operations within national borders, the AF1 requirement presents a unique challenge in that reliable and accurate flight information is required to construct and maintain the arrival sequence at long ranges. This exceeds the normal operational ranges of the national surveillance systems which generate the high accuracy – high update rate flight surveillance data that is required by the Arrival Management process. Thus, surveillance data provided by Surveillance systems (SSR, WAM and ADS-B) and trajectory data improved with EPP is key to enhance the AMAN sequencing, complementing the flight data.

In this line, a robust ground surveillance infrastructure is required for accurate prediction and metering of the flights included in the Arrival Management process.

ADS-B deployment progress has been monitored by SESAR Deployment Manager and reported on in the SDM ADS-B Implementation Plan from 2018 to present. Additionally, ADS-C which is subject to implementation in a dedicated AF6, characterised by a lower update rate and the availability of aircraft intent, can contribute with valuable data (through the Extended Projected Profile) to the construction of the sequence in early stages.

Sub-AF 1.1 – Arrival Management extended to en-route airspace

Family 1.1.1 - Arrival Management extended to en-route airspace

Target Date	31/12/2024

Description

This Family addresses the implementation of extended arrival management by the en-route ATS units feeding the traffic to the busiest airports in Europe. The Arrival Manager extended to en-route airspace requires an extension of AMAN advisories up to a minimum of 180 nautical miles from the arrival airport. Shorter horizon distance will be considered when, due to the geographical location of the arrival airport, the extension of the AMAN horizon does not provide additional performance benefits. Traffic sequencing/metering should be conducted in the en-route before top-of-descent, to improve predictability and smooth the flow of traffic. Extending the AMAN horizon may affect the airspace design, and it is therefore essential that all stakeholders, including military authorities are consulted.

ATS units implementing extended AMAN operations shall coordinate with Air Traffic Services (ATS) units responsible for adjacent and up-stream en-route sectors as well as ATS units responsible for inbound traffic originating from airports impacted by the Extended AMAN horizon. Input data to Extended AMAN need to be provided by the most accurate trajectory prediction information available (including EFD or flight data available via the NM B2B publish/subscribe mechanism).

ATSU should exchange the relevant Extended AMAN data with the Network Manager for the improved ATFCM and arrival sequencing, overall network impact assessment and relevant network optimisations using Arrival Planning Information (API).

System requirements

An ATSU operating an Extended AMAN shall be able to communicate with the relevant sectors (not restricted to adjacent ones) by SWIM service when it is available. Until SWIM is available, ATSUs may send and receive the OLDI AMA message to and from adjacent sectors and forward OLDI AMA messages further upstream to communicate with the relevant sectors (not restricted to adjacent ones).

In order to facilitate timely implementation of the arrival sequence, a sector receiving arrival messages shall display arrival management information for the controller.

ATM systems shall be upgraded to provide coverage to a minimum of 180 nautical miles (or shorter distance as indicated in the Family description) from the arrival airport and the impacted en-route sectors in order to be able to generate, communicate, receive, acknowledge, and display arrival management information (i.e., SWIM services or AMA message). Bilateral agreements will be established between all concerned sectors that could be under the responsibility of different ATS units as well as located in different countries.

Dependencies

AF 2 Family 2.1.1: Extended AMAN shall support airport departure management systems with real time information, enabling airport stakeholders to plan and prepare for aircraft turn-around at an early stage. This supports sequencing of departing traffic respecting AMAN and DMAN constraints for an optimum utilisation of RWY(s).

AF 4 Family 4.2.1: there are interdependencies with Collaborative Network Management (NOP) to coordinate reconciled target times for improved ATFCM and arrival sequencing set out in AF 4.

Family 5.6.1 Flight Information exchanges. To ensure interoperability, Data exchanges on ground concerning Extended AMAN shall be implemented as a SWIM service. Until SWIM is available, existing data exchange technology may be used.

Family 5.4.1 Implement Meteorological Information exchange. Aerodrome meteorological information Service will support AMAN.

Civil / Military Coordination

Coordination with appropriate concerned military authorities as required[5].

Stakeholders impacted	ANSPs
Geographical scope	Extended AMAN shall be deployed at ATS units corresponding to the following airports and in the associated en-route sectors within 180 nautical miles: Adolfo Suárez Madrid-Barajas; Amsterdam Schiphol; Barcelona El Prat; Berlin Brandenburg Airport; Brussels National; Copenhagen Kastrup; Dublin; Düsseldorf International; Frankfurt International; Milan-Malpensa; Munich Franz Josef Strauß; Nice Cote d'Azur; Palma De Mallorca Son Sant Joan; Paris-CDG; Paris-Orly; Rome-Fiumicino; Stockholm-Arlanda; Vienna Schwechat.
ATM Master Plan reference	Essential Operational Change (EOC): Airport and TMA performance https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: ATC15.2 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This sub-AF can be exposed to cyber security risks. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

ANSP	**DM1** Upgrade ATC systems to support extended AMAN	Upgrade ATC systems to support extended AMAN in En-route sectors (including data exchange, data processing and information display at the ATCO working positions to support the handling of AMAN constraints). ATM systems need to be upgraded in order to be able to generate, communicate, receive, and display AMA OLDI messages or the extended

[5] It is foreseen that civil-military coordination should take place whenever/wherever situation requires. Such coordination would be necessary on a case-to-case basis as required & agreed mutually. For example, where military airfield/airspace are close to concerned civilian airports

		AMAN data exchanges via SWIM service (SWIM service is mandated by 2025, before that date E-AMAN can be implemented without SWIM) This DM needs to be synchronised between ANSPs. ***Milestone achievement conditions:*** ATC systems have been upgraded and can exchange SWIM and/or OLDI AMA messages and display the necessary information.
	DM2 Implement ATC procedures to support extended AMAN	Develop and implement the required ATC procedures to support the extended AMAN functionality. This DM needs to be synchronised between ANSPs and AOs (for possible environmental impact). ***Milestone achievement conditions:*** ATC Procedures have been developed, validated and published.
	DM3 Establish Bilateral Agreements	Establish Bilateral agreements between the ATS units involved for extended AMAN operational procedures and data exchanges, as well as between the concerned ATS unit and NM. This DM needs to be synchronised between ANSPs and NM. ***Milestone achievement conditions:*** Bilateral agreements are concluded.
	DM4 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. The competent authority must assess the safety case and eventually approve it. ***Milestone achievement conditions:*** The safety assessment has been approved by the competent authority.
	DM5 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM6 Operational use	Extended AMAN is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Extended AMAN is put into service.

Performance impact – Family 1.1.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 1.2 – AMAN/DMAN Integration

Family 1.2.1 – AMAN/DMAN Integration

Target Date	31/12/2027

Description

Integrated Arrival and Departure management aims at increasing airport and TMA throughput, resilience, and predictability by improved co-ordination between En-Route/Approach, local ATC and airports. DMAN provides optimum departure sequence based on information provided by airport operator, airlines, and ATC.

Similarly, AMAN calculates the optimum arrival flow to the airport. Integration of runway sequence, respecting AMAN and DMAN constraints, allows for optimum utilisation of runway.

Where this integration interferes with the 180 nautical miles (or shorter distance as indicated in Family 1.1.1) requirement for extended AMAN, the system has to be tuned to allow as large horizon as possible.

System requirements

Integration of departure and arrival flows are done by integrating existing AMAN and DMAN functions where runways are operated in mixed mode. AMAN and DMAN systems shall be able to share data to be included in their planning algorithms calculating arrival and departure flows. The integration of AMAN and DMAN must be based on the optimised pre-departure sequence and interfaces with airport CDM systems.

Controller Working Position (CWP) needs to support the display of AMAN/DMAN overlapping sequences.

Dependencies

AF2 Family 2.1.1 (Departure management, synchronised with pre-departure sequencing).

AMAN/DMAN integration will further improve and enhance airport and TMA throughput as AMAN information is provided in real-time enabling all airport stakeholders to minimise delay and to process optimisation. Extended AMAN will support airport departure management systems with real time information, enabling airport stakeholders to plan and prepare for aircraft turn-around at an early stage. This supports sequencing of departing traffic respecting AMAN and DMAN constraints for an optimum utilisation of RWY(s).

AF4 Family 4.2.1: There are interdependencies with Collaborative Network Management (NOP) to coordinate reconciled target times for improved ATFCM and stabilise runway sequence policy.

Civil/Military Coordination

Coordination with appropriate concerned military authorities as required.

Stakeholders impacted	ANSPs, Airport Operators
Geographical scope	AMAN/DMAN integration shall be operated at the following airports as well as the associated approach and en route sectors: • Berlin Brandenburg Airport; • Düsseldorf International; • Milan-Malpensa; • Nice Côte d'Azur; • Paris-CDG.

ATM Master Plan reference	Essential Operational Change (EOC): Airport and TMA performance https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: ATC19 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This Family could be exposed to cyber security risks as time critical arrival/departure planning information would be exchanged among concerned stakeholder using legacy protocol until availability of secure SWIM TI Yellow profile protocols. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach[6]

ANSP	**DM1** Couple AMAN and DMAN systems	Arrival Management (AMAN) and Departure Management (DMAN) systems must be coupled and must support co-ordination between ACC/APP, local ATC and airports. The AMAN, acting as the master, must set-up gaps (Arrival Free Intervals) which must be filled by the DMAN (slave) allocating departures in the AFIs. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** AMAN and DMAN have been coupled in a master/slave configuration and the AMAN gaps (AFIs) are filled by DMAN.
	DM2 Establish Bilateral Agreements	Establish Bilateral agreements between the stakeholders[7] and airports involved for AMAN/DMAN operational procedures and data exchanges This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Bilateral agreements are concluded
	DM3 Upgrade CWP to incorporate the information from integrated AMAN/DMAN	Upgrade CWP to enable display and management of the data coming from integrated AMAN/DMAN. ***Milestone achievement conditions:*** The system has been upgraded
	DM4 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:***

[6] The Milestones listed under this section should be addressed to air navigation service providers as well as to airport operators. This is due to the fact that some airports operate their own ground control units for specific areas of responsibility at the airport. Airport operators providing air traffic control services qualify as ANSPs and are therefore covered by the milestones. It is up to each implementer to check and select what is relevant to them, depending on local areas of responsibilities.

[7] For a comprehensive definition of airport stakeholders refer to section 3.2.1

		Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM6 Operational use	Extended AMAN is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** AMAN/DMAN integration is operational and put into service.
AO	**DM1** Upgrade system to incorporate AMAN/DMAN information	Upgrade systems to be able to receive, process and use the information coming from the integrated AMAN/DMAN system. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** The system has been upgraded.
	DM2 Establish bilateral agreements	Establish Bilateral agreements between the stakeholders and airports involved for AMAN/DMAN operational procedures and data exchanges. This DM needs to be synchronised between civil and military ANSPs and AOs. ***Milestone achievement conditions:*** Bilateral agreements are concluded.
	DM3 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed.
	DM5 Operational use	Integrated AMAN/DMAN is ready for operational use once the the systems have been upgraded, bilateral agreements are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** AMAN/DMAN information are operational and put into service.

Performance impact – Family 1.2.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

3.2. AF2 - Airport Integration Throughput

3.2.1. Work Breakdown Structure and SESAR Solutions

Figure 11 - AF2 Work Breakdown Structure

Airport integration and throughput shall facilitate the provision of approach and aerodrome control services by improving runway throughput, enhancing taxi integration, reducing hazardous situations on the maneuvering area and enhance, improve and promote overall safety.

This ATM Functionality is composed of three Sub-ATM Functionalities, and each Sub-ATM Functionality is addressed by one Family, except the Airport Operations Plan Sub-ATM Functionality, which is addressed by two different Families. The links between the Families and the SESAR Solutions can be found in the table below:

Family	SESAR Solutions	EOC
Family 2.1.1 – Departure Management Synchronised with Pre-Departure Sequencing	Solution #53 “Pre-departure sequencing supported by Route Planning” Solution #106 – DMAN Baseline for integrated AMAN-DMAN	Airport and TMA performance
Family 2.2.1 – Initial AOP	Solution #21 “Airport Operations Plan and AOP-NOP Seamless Integration”	ATM interconnected network
Family 2.2.2 - Extended AOP	Solution #21 “Airport Operations Plan and AOP-NOP Seamless Integration”	ATM interconnected network
Family 2.3.1 – Airport Safety Nets	Solution #02 “Airport Safety Nets for controllers: conformance monitoring alerts and detection of conflicting ATC clearances” Solution #04 “Enhanced Traffic Situational Awareness and Airport Safety Nets for the vehicle drivers”	Airport and TMA performance

The following definitions and references, which are only indicative, apply in the context of AF2 Families:

The term 'Controller' is used as a common reference for the following actors:

- Tower Supervisor;
- Tower Runway Controller;
- Tower Ground Controller;
- Tower Clearance Delivery Controller;
- Approach Controller.

Note: Individual Controller roles are used when the text is referring to something that a role does specifically.

The term 'Apron' is used as a common reference according to the following ICAO definitions:

- Apron: *A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance*
- Apron Management: *A service provided to regulate the activities and the movement of aircraft and vehicles on an apron.*

The term 'Vehicle Driver' is used as a common reference for the following actors:

- Ground Handler Vehicle Driver (including Tug drivers);
- Airport Operator Vehicle Driver (for Airside Operational Vehicles used for runway maintenance, wildlife control, etc.);
- ANSP Vehicle Driver (for Airside Operational Vehicles);
- Emergency Services Vehicle Driver (e.g., Fire brigade and ambulance vehicles);
- Security Services Vehicle Driver (e.g., Police forces, Airport Security Service);
- Occasional Airside Vehicle Driver.

The term 'Mobile' is issued as a common reference for:

A mobile is either an aircraft, aircraft being towed or a vehicle. Note: when referring to an aircraft or vehicle, and not another obstacle, the term 'Mobile' is preferred to 'Target'. The term 'Target' is only used when considering an image of a mobile or other obstacle displayed on a surveillance screen.

The term 'Airport Stakeholders' is issued as a common reference for:

- ANSPs;
- Local stakeholders providing surface management on aprons and manoeuvring area;
- Local stakeholders providing Ground handling, De-icing, Cargo handling;
- MET services providers;
- Aircraft operators;
- Custom, Police, Immigration, Cleaning service, etc.

3.2.2. Deployment Approach and Synchronisation Needs

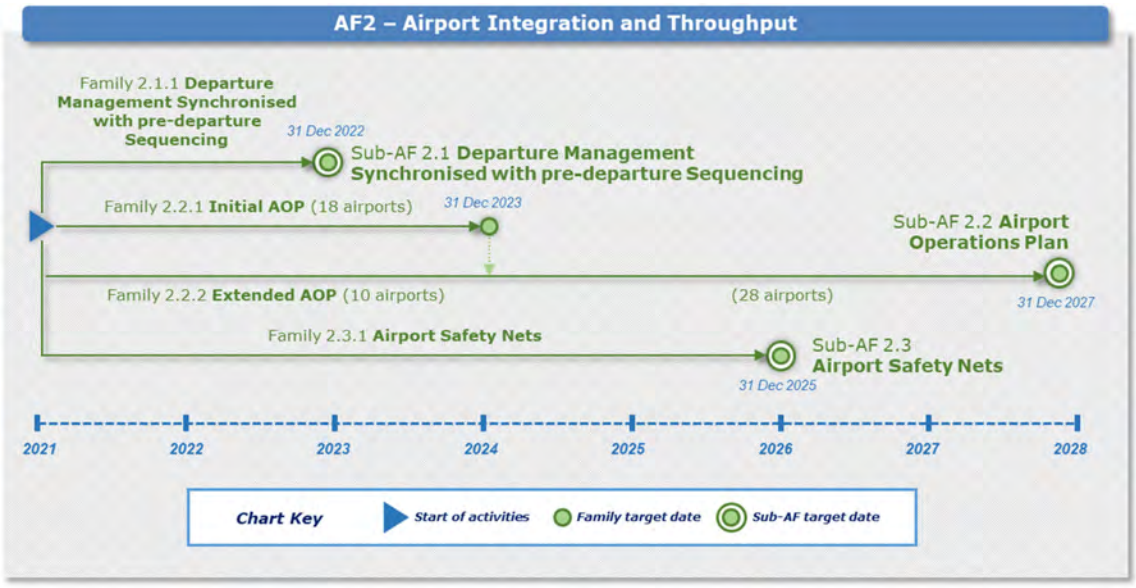

Figure 12 - AF2 Deployment Approach

The deployment of Airport Integration and Throughput functionality shall be coordinated and synchronised among the airport stakeholders (for example, but not limited to, airport operators, air navigation service providers and the Network Manager for the AOP/NOP integration) in order to reach the maximum network performance benefits.

From a technical perspective, the deployment of targeted system and procedural changes must be synchronised in order to ensure the performance objectives are met. This is key for the AOP/NOP integration, where the network performance benefits will grow with the number of airports exchanging AOP information with NM.

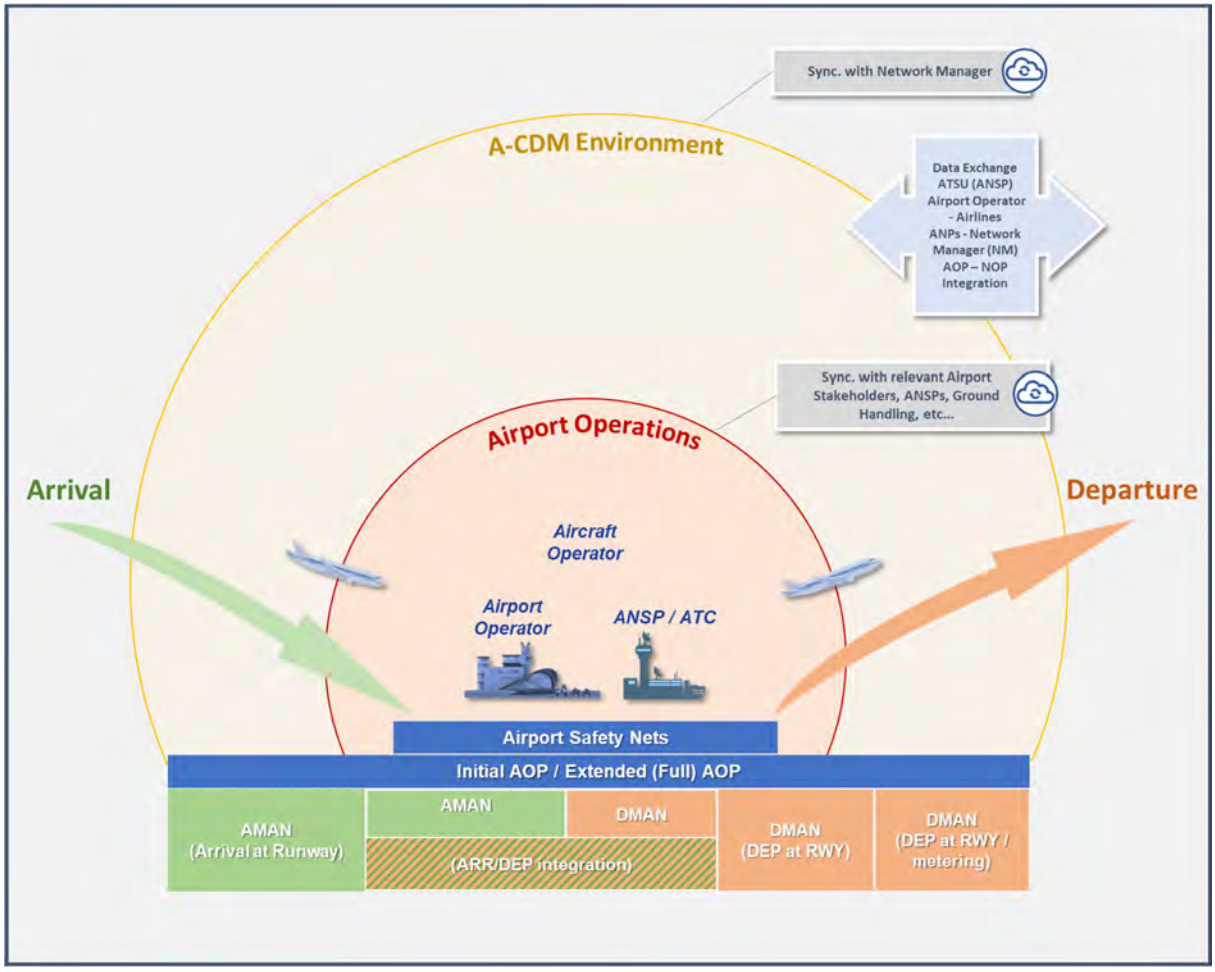

Figure 13 - AF2 synchronisation needs

Synchronisation is also vital for the harmonisation of operational procedures linked to arrival/departure management as well as safety net appliance. It is also paramount to harmonise operational procedures linked to airport safety nets so ATCOs use the same approach at all concerned airports and thus crews follow the same instructions.

Synchronisation needs of AF2:

Between Member States	Between air and ground stakeholders	Between civil and military stakeholders
	✓	

3.2.3. CNS Enablers for AF2

CP1 requires that a DMAN-AMAN integration is implemented. As such, the dependency of AF1 on surveillance data as discussed in the previous chapter, is inherited to AF2 as well.

Furthermore, CP1 requires that Airport Safety Nets comprise of RMCA, CATC and CMAC, where A-SMGCS is a system requirement. A-SMGCS build on accurate and reliable surveillance data provided by surveillance systems (MLAT, SMR, ADS-B, etc.).

This ATM Functionality can be supported by the Data-Link tower services (e.g., Departure Clearances, D-TAXI, etc.). These DL tower services are currently implemented in a large part of Europe over ACARS, and they are also standardised as part of CPDLC v2. These services are using the current DL technologies (PoA,

AoA over VDL M2). If these services are implemented over ATN VDL M2, an uncoordinated deployment should be avoided in order to prevent a fragmented implementation (i.e., different protocols and/or technologies). Other communication technologies could be considered in the future to support the services required.

Sub-AF 2.1 – Departure Management Synchronised with Pre-departure sequencing

Family 2.1.1 - Departure Management Synchronised with Pre-departure sequencing

Target Date	31/12/2022

Description

Departure management, synchronised with pre-departure sequencing, is a means to improve departure flows at one or more airports.

Departure Management (DMAN) system is calculating and metering the departure flow to a chosen runway by managing Off-block-Times (via Start-up-Times), obtained from the turn-round process and from A-SMGCS services if available. This ensures flights depart from their stands in a more efficient and optimal order taking account of the available runway capacity and updated taxi-times.

DMAN automatically calculates in real-time and proposes a sequence of departures to be handled by ATC. DMAN integrated with electronic clearance input (ECI) system will instantly update the departure sequence based on A-CDM information and A-SMGCS system input if available.

Pre-departure sequencing is calculated based on Target Take Off Time (TTOT) and Taxi-times resulting in Target Start Approval Time (TSAT) for each flight, taking account of multiple constraints, such as configuration of taxiways and runways, environmental conditions, construction and maintenance on movement area etc. Pre-departure sequencing is also taking into account concerned Stakeholders operational preferences.

By monitoring progress of aircraft turnaround processes based on adherence to Target Off-Block Times (TOBT), as well as the operational traffic situation on aprons, taxiways and runways, ATC can provide a TSAT which positions each aircraft in an efficient pre-departure sequence (off-block).

DMAN is an automated enabler delivering TTOT for departures on mixed mode runway and requires close coordination/integration with AMAN to deliver conflict free planning or sequencing.

Airport Stakeholders working according to the principles of A-CDM shall jointly establish pre-departure sequences, taking account of agreed principles to be applied for specific circumstances such as but not limited to runway holding time, slot adherence, departure routes, airspace user preferences, night curfew, evacuation of stand/gate for arriving aircraft, adverse weather conditions including de-icing, actual taxi/runway capacity, local constraints.

Departure management synchronised with pre-departure sequencing reduces taxi times, increases Air Traffic Flow Management-Slot adherence (ATFM-Slot) and predictability of departure times. Departure management aims at maximising and optimising traffic flow on the chosen runway by setting up a sequence of departing traffic with optimised separations.

System requirements

Systems supporting A-CDM (including DMAN) shall be integrated supporting optimised pre-departure sequencing with appropriate information/data for airspace users (Target Off Block Time (TOBT)) and concerned airport stakeholders (contextual data feeding).

DMAN systems shall elaborate and calculate a collaborative sequencing and provide both TSAT and TTOT, taking into account variable taxi times and shall be updated according to the actual aircraft

take-off time (ATOT). DMAN system shall provide the controller with the list of TSAT and TTOT for the aircraft metering.

An Electronic Clearance Input (ECI) system shall be implemented, allowing the controller to input all clearances given to aircraft or vehicles into the ATC system. The system shall have appropriate interfaces with systems such as A-SMGCS with ref. Sub-AF 2.3 “Safety nets” ensuring the integration of the instructions given by the controller with complementary data such as flight plan, surveillance, routing, published routes and procedures.

Dependencies

There are interdependencies with:

AF1 - Extended arrival management and integrated arrival management/departure management in the high-density terminal manoeuvring areas:

- Family 1.1.1 (Arrival Management Extended to En-route airspace), unless AMAN/DMAN integration is already implemented;
- Family 1.2.1 (AMAN/DMAN integration).

DMAN is supported by sharing the airport’s arrival management information in real time. AMAN calculates the optimum arrival flow to the airport. Integration of runway arrival and departure sequence, respecting AMAN and DMAN constraints, allows for optimum utilisation of runways.

The interdependency and integration with AMAN, enables sequencing of arrival traffic much earlier than is currently the case. Where such integration interferes with the 180 nautical miles requirement for extended AMAN, the system is tuned to allow as large horizon as possible.

AF4 - Network collaborative management:

- Family 4.2.2 (Collaborative NOP for initial AOP/NOP integration);
- Family 4.4.1 (AOP/NOP integration).

The alignment between planned and executed operations at airports is continuously monitored, with changes in departure flows being made in real time to the AOP as required. When concerned stakeholders update their intentions, based on local circumstances, changes in sequencing of departure flows, or accurate flight progress information is received (DPIs/FUMs) the AOP is refined and used to manage resources and coordinate operations. Integration with the NOP extends the planning activities to include air traffic demand and improved target time coordination.

Network Manager (NM) must share the arrival demand with the AOP and establish a collaborative decision-making process at local ATFM level (e.g., including FMP) to allow amendments to the TTAs based on the AOP.
The Collaborative NOP must be updated through continuous data exchanges between NM and operational stakeholder systems updating the initial AOP in order to cover the entire trajectory lifecycle and to reflect priorities as required. Full AOP/NOP integration will be reached when Extended AOP (Family 2.2.2) is implemented.

Family 5.5.1 Cooperative Network exchanges. The systems identified in the deployment milestones shall be able to consume DPI and NOP/AOP SWIM service from Network Manager.

Civil / Military Coordination

Applicable to airports covered by the CP1 Regulation for GAT operations. It is considered that for this particular Family and for the 18 airports identified in the applicability list there is no specific civil/military coordination required. The outcome of the functionality (TSAT/TTOT) will be included in the ATC clearances issued to all GAT traffic operating on the 18 airports.

Stakeholders impacted	ANSPs, Airport Operators.

Geographical scope	Departure Management Synchronised with Pre-departure sequencing shall be operated at the airports below and their associated En-route sectors: • Adolfo Suárez Madrid-Barajas; • Amsterdam Schiphol; • Barcelona El Prat; • Berlin Brandenburg Airport; • Brussels National; • Copenhagen Kastrup; • Dublin; • Düsseldorf International; • Frankfurt International; • Milan-Malpensa; • Munich Franz Josef Strauß; • Nice Cote d'Azur; • Palma De Mallorca Son Sant Joan; • Paris-CDG; • Paris-Orly; • Rome-Fiumicino; • Stockholm-Arlanda; • Vienna Schwechat.
ATM Master Plan reference	Essential Operational Change (EOC): Airport and TMA performance AOP19
Cyber security Requirements	SPECIFIC Family 2.1.1: No external access to local safety critical systems, such as DMAN synchronised with pre-departure sequencing, must be permitted.

Family Deployment Approach[8]

ANSP	**DM1** Develop appropriate procedures for synchronisation of initial DMAN with pre-departure sequencing	Specific procedures and processes must be implemented to be able to handle, calculate and sequence departing traffic. This activity must be synchronised with all involved stakeholders. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Operational Procedures for Synchronisation of initial DMAN with pre-departure sequencing have been developed, tested and approved.

[8] The Milestones listed under this section should be addressed to air navigation service providers as well as to airport operators. This is due to the fact that some airports operate their own ground control units for specific areas of responsibility at the airport. Airport operators providing air traffic control services qualify as ANSPs and are therefore covered by the milestones. It is up to each implementer to check and select what is relevant to them, depending on local areas of responsibilities.,

DM2 Integrate upgraded DMAN system with ECI system	An ECI system must be implemented as a pre-requisite for implementing Family 2.1.1. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Data integration of DMAN synchronised with pre-departure sequencing system with ECI system is installed and tested.
DM3 Integrate upgraded DMAN systems with A-CDM systems	Initial DMAN system needs to be updated/upgraded to meet requirements for pre-departure sequencing and to feed A-CDM processes. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** A-CDM processes and appropriate systems are updated/upgraded to take into account data from upgraded DMAN synchronised with pre-departure sequencing.
DM4 Integrate DMAN with A-SMGCS	Integration with A-SMGCS services supports enhanced measuring of variable taxi times as aircraft location and movement on the manoeuvring area is monitored. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Integration of DMAN with pre-departure sequencing with A-SMGCS have been developed, tested, and approved.
DM5 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
DM6 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.

	DM7 Operational use	DMAN synchronised with pre-departure sequencing is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** DMAN with pre-departure sequencing is put into service.
AO	**DM1** Provide relevant additional data to A-CDM systems to feed DMAN synchronised with pre-departure sequencing	Local A-CDM processes must guarantee that appropriate data necessary for establishing a pre-departure sequencing will be provided from concerned stakeholders in real time to feed DMAN. De-icing data, RWY/TWY availability data etc. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Provision of additional relevant data to A-CDM to feed DMAN synchronised with pre-departure sequencing.
	DM2 Develop appropriate procedures for synchronisation of initial DMAN with pre-departure sequencing	Specific procedures and processes must be implemented to be able to handle, calculate and sequence departing traffic. This activity must be synchronised with all involved stakeholders. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Operational Procedures for Synchronisation of initial DMAN with pre-departure sequencing have been developed, tested and approved.
	DM3 Integrate upgraded DMAN systems with A-CDM systems	Initial DMAN system needs to be updated/upgraded to meet requirements for pre-departure sequencing and feed A-CDM processes. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** A-CDM processes and appropriate systems are updated/upgraded to take into account data from upgraded DMAN synchronised with pre-departure sequencing.
	DM4 Integrate upgraded DMAN system with ECI system	An ECI system shall be implemented as a pre-requisite for implementing Sub AF 2.1. This DM needs to be synchronised between ANSPs and AOs.

		Milestone achievement conditions: Data integration of DMAN synchronised with pre-departure sequencing system with ECI system is installed and tested.
	DM5 Integrate DMAN with A-SMGCS	Integration with A-SMGCS services supports enhanced measuring of variable taxi times as aircraft location and movement on the manoeuvring area is monitored. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Integration of DMAN with pre-departure sequencing with A-SMGCS have been developed, tested and approved.
	DM6 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM7 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.
	DM8 Operational use	DMAN synchronised with pre-departure sequencing is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** DMAN with pre-departure sequencing is put into service.

Performance impact – Family 2.1.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 2.2 - Airport Operations Plan

Family 2.2.1 - Initial AOP

Target Date	31/12/2023

Description

Airport Operations Plan (AOP) means a single, common and collaboratively agreed rolling plan used by all involved airport stakeholders whose purpose is to provide common situational awareness and to form the basis upon which airport stakeholder decisions relating to process optimisation for operations can be made.

The AOP shall make all the information that is relevant for the network available to the NOP in real time.

The AOP is the principal source of information used and shared by all involved airport stakeholders. It requires individual stakeholders to make changes within their own sphere of operations. These changes must be synchronised in order to be consistent and provide common situational awareness.

The AOP supports operations at airports with an increased scope and sharing of data between the airport and the Network Manager, building upon the airport collaborative decision making (A-CDM) supporting systems.

The AOP is a rolling plan comprising different phases including Planning, Execution and Monitoring and Post-operations, that interacts with a number of services, systems and stakeholders gathering information from several systems. A description of those phases can be found in the reference documents included in the Supporting Material.

Main stakeholders are Airport Operators. Stakeholders also impacted are all the other involved airports stakeholders such as but not limited to:

- Aircraft operators;
- Ground handlers;
- De-icing handlers;
- ANSPs;
- Network Manager;
- MET services providers;
- Support services (police, customs, and immigration, etc.).

The AOP can be implemented in two steps: Initial AOP (iAOP) and Extended AOP.

Family 2.2.1 initial AOP (iAOP) focuses on the short-term planning phase and the execution phase. The iAOP comprises the basic elements to exchange the data elements with the NOP and paves the way to Extended AOP.

The following data are part of the initial AOP:

- Flight trajectory data: Information sharing related to Flight Progress Information Elements of an Inbound/Outbound/Airport transit Trajectory to/from/at Airport;
- Airport Resources data: resources such as but not limited to runway capacity and configuration, or parking stands;
- Local weather data: Information sharing related to MET Information Elements of airport.

The iAOP shares flight trajectory data and some airport resources data with the NOP via Arrival Planning Information (API) and Departure Planning Information (DPI) messages.

System requirements

To support the Initial AOP implementation, the following elements shall be taken into account:

- A-CDM (a pre-requisite for iAOP);
- Arrival planning information and extended departure planning information (in addition to A-CDM DPI messages) for iAOP/NOP exchange;
- MET-data: to allow outcome of weather impact assessment;
- Airport Operations Plan management tool containing the rolling plan of the airport operations and capabilities for short-term time frame;
- The AOP shall be connected to the NOP via SWIM service(s) when available, at the latest by December 2025, and shall make available to the network all the network-relevant data[9].

Dependencies

There are interdependencies with following Families:

- DMAN synchronised with PDS as specified in Family 2.1.1;
- Collaborative NOP for initial AOP/NOP integration as specified in Family 4.2.2;
- Full AOP/NOP integration as specified in Family 4.4.1[10];
- Family 5.4.1 meteorological information exchange. The systems identified in the deployment milestones must be able to consume Aerodrome meteorological information exchange services when available, at the latest by December 2025;
- Family 5.5.1 Cooperative Network exchanges. The systems identified in the deployment milestones must be able to consume DPI and NOP/AOP SWIM service from Network Manager.

Civil / Military Coordination

Applicable to airports covered by the CP1 Regulation where military operations are performed in GAT.

The coordination depends on the role of the military, e.g.: ANSP, AU.

Stakeholders impacted	ANSP, Airport Operators
Geographical scope	The Initial Airport Operations Plan (iAOP) shall be operated at the following airports: • Adolfo-Suarez Madrid-Barajas; • Amsterdam Schiphol; • Barcelona El Prat; • Berlin Brandenburg Airport; • Brussels National; • Copenhagen Kastrup; • Dublin; • Düsseldorf International; • Frankfurt International; • Milan-Malpensa; • Munich Franz Josef Strauß; • Nice Cote d'Azur; • Palma De Mallorca Son Sant Joan;

[9] Until the SWIM service is available the iAOP will work without it

[10] Not all information will immediately be available under Family 4.4.1. It will be further refined in following updates of the SDP and of its supporting material.

- Paris-CDG;
- Paris-Orly;
- Rome-Fiumicino;
- Stockholm-Arlanda;
- Vienna Schwechat.

ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected Network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: AOP11.1 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This Family can be exposed to cybersecurity risks. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach[11]

ANSP	**DM1** iAOP Data/Operational elements implementation	For the iAOP data that is centralised by the ANSP (e.g., flight trajectory or MET data), the ANSP ensures coordination, collection, and integration of iAOP data in the system with all airport stakeholders involved. This activity is performed with the airport operator and all airport stakeholders involved, defining a Memorandum of Understanding (MOU)/Memorandum of Cooperation (MOC) if necessary. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** iAOP data have been integrated into the system.
	DM2 Data quality service	Set up a service (systems and procedures) to ensure iAOP data quality (accuracy and integrity). This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Data Quality Service has been tested and validated.
	DM3 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs.

[11] The Milestones listed under this section should be addressed to air navigation service providers as well as to airport operators. This is due to the fact that some airports operate their own ground control units for specific areas of responsibility at the airport. Airport operators providing air traffic control services qualify as ANSPs and are therefore covered by the milestones. It is up to each implementer to check and select what is relevant to them, depending on local areas of responsibilities.

		Milestone achievement conditions: Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.
	DM5 Operational use	iAOP is in operational use once the data have been integrated into the systems, their integrity ensured, the safety assessment has been delivered and accepted, and the training has been completed. ***Milestone achievement conditions:*** iAOP is put into service.
AO	**DM1** iAOP Data/Operational elements implementation	AO ensure coordination, collection and integration in the system of the following iAOP data: • Flight trajectory data; • Airport Resources data; • MET data. This activity is performed with all airport stakeholders involved, defining a Memorandum of Understanding (MOU)/Memorandum of Cooperation (MOC) if necessary. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** iAOP data have been integrated into the system.
	DM2 Data quality service	Set up a service (systems and procedures) to ensure iAOP data quality (accuracy and integrity). This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Data Quality Service has been tested and validated.
	DM3 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:***

		Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.
	DM5 Operational use	iAOP is in operational use once the data have been integrated into the systems, their integrity ensured, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** iAOP is put into service.

Performance impact – Family 2.2.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 2.2 - Airport Operations Plan

Family 2.2.2 Extended AOP

Target Date	31/12/2027

Description

The iAOP and Extended AOP are so interdependent and sharing the same operational “philosophy” that it is relevant to also include information about iAOP.

Airport Operations Plan (AOP) means a single, common, and collaboratively agreed rolling plan used by all involved airport stakeholders whose purpose is to provide common situational awareness and to form the basis upon which operational stakeholder decisions relating to process optimisation for operations can be made.

The AOP shall make all the information that is relevant for the network available to the NOP in real time.

The AOP is the principal source of information used and shared by all involved airport stakeholders. It requires individual stakeholders to make changes within their own sphere of operations. These changes shall be synchronised in order to be consistent and provide common situational awareness.

The AOP supports operations at airports with an increased scope and sharing of data between the airport and the Network Manager, building upon the airport collaborative decision making (A-CDM) supporting systems.

The AOP is a rolling plan comprising different phases including Planning, Execution and Monitoring and Post-operations, that interacts with a number of services, systems and stakeholders gathering information from several systems. A description of those phases can be found in the reference documents included in the Supporting Material.

Main stakeholders are Airport Operators. Stakeholders also impacted are all the other involved airport stakeholders such as but not limited to:

- Aircraft operators;
- Ground handlers;
- De-icing handlers;
- ANSPs;
- Network Manager;
- MET services providers;
- Support services (police, customs and immigration, etc.).

The AOP can be implemented in two steps: Initial AOP (iAOP) and Extended AOP.

The extended AOP supports landside and airside operations at airports with an increased scope and sharing of data between the airport and the Network Manager. The extended AOP is the fundamental tool supporting the following four operational services by improving the overall operational efficiency and increasing resilience of the airport and the network to resist disruptions such as but not limited to, adverse weather conditions, closure of a runway, security alerts.

The Extended AOP increases the iAOP scope beyond the airside operating environment and addresses processes within the landside and terminal infrastructure that have a performance impact on flight predictability and efficiency. In this case the Extended AOP monitors the progress of passengers through the airport from check-in to the gate. Monitoring data is stored in the AOP and allows stakeholders to increase their confidence around TOBT accuracy and stability.

The landside and airside airport stakeholders shall make changes within their own sphere of operations and shall use and share the AOP as the principal source of information for airport operations.

The Extended AOP comprises the following Performance Services:

- Steer Airport Performance Service:

This service develops the performance standard (i.e., goals, targets, rules, thresholds, trade-off criteria and priorities) for airport operations and sets an overall strategic direction. Airport stakeholders develop a mutually agreed performance standard in a collaborative manner on the basis of the performance of regional and/or national scheme(s) and post operations analysis reports. The Steer Airport Performance service is mainly performed in the long-term and medium planning phase and the post-operations phase.

- Monitor Airport Performance service:

This service maintains surveillance over airport operations, airport performance (against KPAs), airport surroundings (e.g., weather monitoring), supervising airport related information and any information that can impact the airport performance, providing observations, forecasts, alerts and warnings against predefined thresholds. It is performed from the medium-term planning phase until the execution phase.

This surveillance is based on the performance standard set by the Steer Airport Performance service. The Monitor Airport Performance service compares any new information created or updated in the AOP with the plan and raises warnings or alerts if a deviation is detected.

The Monitor Airport Performance service also provides the airport stakeholders with a common situational awareness of the airport operations processes and performance in real time.

- Manage Airport Performance service:

This service instantiates the AOP at the beginning of the medium-term planning phase. It uses the operational data provided by the airport stakeholders and the performance standard defined by the Steer Airport Performance service.

In the short-term planning phase and the execution phase, the Manage Airport Performance service also assesses the severity of the deviations from the plan detected by the Monitor Airport Performance service and their impact on the airport processes and on the airport performance. The assessment is not only for searching for reactive solutions but also for forecasting severe disruptions or adverse conditions and, hence, to implement proactive management. It uses the warnings and alerts and, more generally, the data contained in the AOP to make this impact assessment. This service also uses event reports from the stakeholders to perform the impact assessment.

Depending on the magnitude of the deviation and the severity of the impact on the airport processes and on the airport performance, the Manage Airport Performance service triggers the relevant collaborative decision-making processes. In particular, in adverse conditions, these processes take place in the Airport Operations Centre (APOC), where the representatives of the airport stakeholders can use simulation and decision support tools. The decisions are driven by the need to maintain an optimal performance level and to recover from a disruption as quickly and efficiently as possible. These processes result in an update of the AOP, made by the relevant airport stakeholders.

- Perform Post-Operations Analysis service:

This service records any planned and actual data used in the airport processes during the planning and execution phases.

This information is then used to produce post-operations analysis reports in the post-operations phase. These reports allow the airport stakeholders to:

- Fully understand the airport performance against the performance plan and identify the root causes of any deviation;
- Assess the continued relevance of the performance plan;
- Justify the need to improve the way the airport operations are run;
- Investigate any disruption in the operations;
- Analyse actions and decisions made during the planning and execution phases.

For the most complex and critical post-operations analysis reports, the airport stakeholders collaborate to produce an analysis and reach conclusions that will benefit the overall airport community.

System requirements

To support the Extended AOP implementation, the following elements shall be taken into account:

- Initial AOP system requirements as defined in Family 2.2.1;
- Airport Operations Plan management tools containing the rolling plan of the airport operations and capabilities (landside and airside) for each time frame (from medium term to post-Ops);
- Airport Performance Monitoring System to monitor performance against the goals;
- Airport Performance Assessment and Management Support System to assess the severity of the deviations from the plan detected by the Monitoring of Airport Performance service and their impact on the airport processes and on the airport performance;
- Airport Post-operations analysis tool to develop standard and ad-hoc Post-Ops Analysis reports.

Dependencies

There are interdependencies with following Families:

- Initial AOP which paves the way to Extended AOP as specified in Family 2.2.1;
- Collaborative NOP for initial AOP/NOP integration as specified in Family 4.2.2;
- Full AOP/NOP integration as specified in Family 4.4.1[12];
- Family 5.4.1 the systems identified in the deployment milestones shall be able to consume meteorological information exchange services when available, at the latest by December 2025;
- Family 5.4.1 meteorological information exchange. The systems identified in the deployment milestones must be able to consume Aerodrome meteorological information exchange services when available, at the latest by December 2025;
- Family 5.5.1 Cooperative Network exchanges. The systems identified in the deployment milestones must be able to consume DPI and NOP/AOP SWIM service from Network Manager.

Civil / Military Coordination

Applicable to airports covered by the CP1 Regulation where military operations are performed in GAT. The coordination depends on the role of the military, e.g., as ANSP, AU.

Stakeholders impacted	ANSPs, Airport Operators
Geographical scope	The extended Airport Operations Plan shall be operated at the following airports: • Adolfo-Suarez Madrid-Barajas; • Amsterdam Schiphol; • Athens Eleftherios Venizelos; • Barcelona El Prat; • Berlin Brandenburg Airport; • Brussels National; • Copenhagen Kastrup; • Dublin; • Düsseldorf International; • Frankfurt International; • Hamburg; • Helsinki Vantaa; • Humberto Delgado -Lisbon Airport; • Lyon Saint-Exupéry; • Malaga Costa Del Sol; • Milan-Linate; • Milan-Malpensa; • Munich Franz Josef Strauß; • Nice Cote d'Azur;

[12] Not all information will immediately be available under Sub-AF4.4. It will be further refined in subsequent annual versions of the SDP and its supporting material.

- Palma De Mallorca Son Sant Joan;
- Paris-CDG;
- Paris-Orly;
- Prague;
- Rome-Fiumicino;
- Stockholm-Arlanda;
- Stuttgart;
- Vienna Schwechat;
- Warsaw Chopin.

ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected Network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: AOP11.2 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This Family can be exposed to cyber security risks. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach[13]

DM1

Extended AOP Data/Operational elements implementation

ANSPs ensure the coordination, collection, and integration of AOP data in the system.

This activity is performed with all airport stakeholders involved, defining a Memorandum of Understanding (MOU)/Memorandum of Cooperation (MOC) if necessary.

These data comprise:

- iAOP data, including Flight trajectory Airport resources and MET data;
- Applicable to ANSPs that do not have an iAOP in operation;
- Extended AOP data including landside data that have a performance impact on flight predictability and efficiency.

This DM needs to be synchronised between ANSPs and AOs.

Milestone achievement conditions:

iAOP and extended AOP data have been integrated into the systems

DM2

ANSP support the AO in the implementation of the following four services:

[13] The Milestones listed under this section should be addressed to air navigation service providers as well as to airport operators. This is due to the fact that some airports operate their own ground control units for specific areas of responsibility at the airport. Airport operators providing air traffic control services qualify as ANSPs and are therefore covered by the milestones. It is up to each implementer to check and select what is relevant to them, depending on local areas of responsibilities.

ANSP	Airport Performance Services implementation	• Steer Performance Service: define common KPIs among all stakeholders • Monitoring Performance Service: develop a system of monitoring and providing alerts in case of a deviation to the scheduled plan • Manage Performance Service: implement tool to assess the severity and impact of the deviations from the scheduled plan. Propose a solution by triggering the relevant collaborative decision-making processes resulting in an update of the AOP, made by the relevant airport stakeholders. • Post-OPS analysis Service: produce post-operations analysis reports for comparing the airport performance against the performance plan and identify the root causes of any deviation. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Airport Performance Services have been developed and implemented.
	DM3 Data quality service	Set up a service (systems and procedures) to ensure iAOP data quality (accuracy and integrity). This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Data Quality Service has been tested and validated.
	DM4 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.

	DM6 Operational use	Extended AOP is in operational use once the data have been integrated into the systems, their integrity ensured, the safety assessment has been delivered and accepted, and the training has been completed. ***Milestone achievement conditions:*** Extended AOP is put into service.
AO	**DM1** Extended AOP Data/Operational elements implementation	AO ensure coordination, collection and integration of AOP data in the system. This activity is performed with all airport stakeholders involved, defining a Memorandum of Understanding (MOU)/Memorandum of Cooperation (MOC) if necessary. These data comprise: • iAOP data including Flight trajectory Airport resources and MET data. • Applicable to AOs that do not have an iAOP in operation; Extended AOP data including landside data that have a performance impact on flight predictability and efficiency. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** iAOP and extended AOP data have been integrated into the systems.
	DM2 Airport Performance Services implementation	AO implements the following four services: • Steer Performance Service: define common KPIs among all stakeholders; • Monitoring Performance Service: develop a system of monitoring and providing alerts in case of a deviation to the scheduled plan; • Manage Performance Service: implement tool to assess the severity and impact of the deviations from the scheduled plan. Propose a solution by triggering the relevant collaborative decision-making processes resulting in an update of the AOP, made by the relevant airport stakeholders; • Post-OPS analysis Service: produce post-operations analysis reports for comparing the airport performance against the performance plan and identify the root causes of any deviation. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Airport Performance Services have been developed and implemented.

	DM3 Data quality service	Set up a service (systems and procedures) to ensure iAOP data quality (accuracy and integrity). This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Data Quality Service has been tested and validated.
	DM4 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.
	DM6 Operational use	Extended AOP is in operational use once the data have been integrated into the systems, their integrity ensured, the safety assessment has been delivered and accepted, and the training has been completed. ***Milestone achievement conditions:*** Extended AOP is put into service.

Performance impact – Family 2.2.2:

SESAR Deployment Manager acknowledges that the existing CBA model reflects only the performance benefits of pure ATM processes, while the extended AOP aims to benefit the journey processes before and beyond the pure ATM processes. Extended AOP is considered to have a strong multiplier effect and benefit on the end-to-end service chain, so to large parts of the door-to-door journey. This cannot be reflected properly in the pure ATM KPIs on which the CBA is based. As stakeholders update their intentions, or accurate flight progress information is received, the extended AOP is refined and used to manage resources and coordinate operations. Integration with the NOP extends the scope and time horizon of planning activities to include air traffic demand and improved target time coordination for the whole 4D flight trajectory under a holistic service perspective, balancing airspace/airside with terminal/landside operations. The aim is to provide processes and tools to maintain airport performance in all operating conditions, and to share information with the wider network. Ultimately, the extended AOP makes airports more resilient to disruptions, allowing more efficient management of airport demand capacity balancing and operations during adverse weather conditions or any other circumstance that might jeopardise smooth operations.

More seamless and smooth processes lead to higher predictability in operations thus minimising the negative impact on all stakeholders and ultimately the passenger.

Through increased predictability in airport and network operations the extended AOP and the AOP management support tool(s) contributes to a better and more cost-efficient use of existing/available network and airport resources (runways, taxiways, aprons and terminal/landside), thus paying a significant contribution to efficiencies, as well as optimisation of resources usage, in a more sustainable manner (greater environmental benefits).

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 2.3 – Airport Safety Nets

Family 2.3.1 – Airport Safety Nets

Target Date	31/12/2025

Description

The scope of this sub-functionality covers the Aerodrome Movement Area as defined by the ICAO documents (see the Supporting Material reference documents) and the EUROCONTROL Specification for A-SMGCS.

The A-SMGCS Airport Safety Support Service contributes to airside operations as a safety improvement, enabling Controllers to prevent hazards/incidents/accidents resulting from Controller, Flight Crew or Vehicle Driver operational errors or deviations. This Service depends on the Surveillance Service being in operation.

The Airport Safety Support Service supports Controllers by:

- Anticipating potential conflicts (e.g., hazardous situations between aircraft or aircraft and vehicles);
- Detecting conflicts and incursions;
- Detecting mobiles that are not following given Clearances;
- Providing alerts.

The Airport Safety Support Service is designed on the basis of one or more of the following three functions. These functions may be partially introduced depending on local requirements e.g., not all CATC or CMAC alerts may be suitable depending on the aerodrome layout:

- Runway Monitoring and Conflict Alerting (RMCA);
- Conflicting ATC Clearances (CATC);
- Conformance Monitoring Alerts for Controllers (CMAC).

The RMCA function acts as a short-term alerting tool, whereas the CATC and CMAC serve to be more predictive tools that aim at preventing situations where an RMCA alert may be triggered.

For the CATC and CMAC alerts to function correctly, it is important the system receives the Controller's Clearances, therefore, the Controller shall be provided with an Electronic Clearance Input (ECI) means e.g., Electronic Flight Strips (EFS).

Some of the CMAC alerts work on the assumption that every mobile entering the Runway Protected Area (RPA) or Restricted Area shall have received Clearance from the Controller.

The Airport Safety Support Service may be partially introduced depending on local requirements e.g., not all CATC or CMAC alerts may be suitable depending on the aerodrome layout.

The clearances to be addressed by the Air Traffic Controllers in the context of the Airport Safety Nets service, are described in the EUROCONTROL A-SMGCS Specification Ed. 2.0. This EUROCONTROL reference document, and this document, also cover the issues linked to potential local limitations that may arise.

Depending on the local implementation strategy, this Family could also affect other stakeholders subject to using vehicles on the movement area, such as but not limited to Handling Companies, De-Icing Agents, often operating under the coordination of the airport operator that is responsible for the safeguard of all the stakeholders involved.

System requirements

The detection of Conflicting ATC Clearances (CATC), the Conformance Monitoring of Alerts for Controllers (CMAC) shall be performed by the ATC system (e.g., A-SMGCS) based on the knowledge of:

- Data related to the aircraft or vehicle e.g., identity, type, flight plan, SSR code, stand, Clearances, planned route, cleared route, assigned runway, timing information, de-icing information, aircraft status (e.g., assumed, pending, transferred);
- Airport Operations data e.g., aerodrome maps, reference points (runway thresholds, holding points, stop bars etc.), operational use of runways, ATC procedures, activation/de-activation of LVP etc.

The detection of CMAC alerts requires in some cases the ATC system to know the aircraft route e.g., Route deviation.

The air traffic controller shall input all clearances given to mobiles into the ATC system using an Electronic Clearance Input (ECI) means.

The Airport Safety Support Service may be partially introduced depending on local limitations due to airport specificities, e.g., not all CATC or CMAC alerts may be suitable depending on the aerodrome layout. In these cases, some systems requirements contained in the two documents referred to above may have to be adapted to meet the local needs.

Dependencies

A connection between A-SMGCS services and Families 1.2.1, 2.1.1, 2.2.1 and 2.2.2 as well as other airport systems elements such as but not limited to A-CDM, A-SMGCS Surveillance service, airport operations status data and mobile information data can ensure better predictability of traffic movement, hence improving safety.

Civil / Military Coordination

Applicable to airports covered by the CP1 Regulation for GAT operations

Although implementation of Family 2.3.1 Airport Safety Nets does not impact the civil/military coordination in place at airports, coordination is applicable to those airports mentioned in the CP1 and open to civil and military operations. Please note that for the military, only GAT flights are concerned.

Stakeholders impacted	ANSPs, Airport Operators
Geographical scope	Airport Safety Support Service shall be operated at the following airports: • Adolfo-Suarez Madrid-Barajas; • Amsterdam Schiphol; • Barcelona El Prat; • Berlin Brandenburg Airport; • Brussels National; • Copenhagen Kastrup; • Dublin; • Düsseldorf International; • Frankfurt International; • Milan-Malpensa; • Munich Franz Josef Strauß; • Nice Cote d'Azur; • Palma De Mallorca Son Sant Joan; • Paris-CDG; • Paris-Orly; • Rome-Fiumicino; • Stockholm-Arlanda; • Vienna Schwechat.

ATM Master Plan reference	Essential Operational Change (EOC): Airport and TMA Performance: https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: https://www.atmmasterplan.eu/depl/essip_objectives/monitoring. AOP12.1
Cyber security Requirements	SPECIFIC S-AF 2.3: no external access to the local airport safety systems must be permitted.

Family Deployment Approach[14]

ANSP	**DM1**  Supporting RMCA systems implemented	Active RMCA alerts must be triggered according to the alert's parameters tailored for the local environment and displayed on Controller CWP with a distinction of colours between alarms alerts and information alerts, alarm alerts must trigger audio warning. RMCA alarm alerts must have the highest priority when displayed on Controller CWP. Installed RMCA System must demonstrate the compliance to the EUROCAE ED-87D performance requirements and pass the tests described in paragraph 5.5. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** RMCA supporting systems have been installed and tested.
	DM2  Supporting CATC and CMAC systems implemented	Implement appropriate systems allowing the detection of CATC and CMAC, integrated with A-SMGCS surveillance data and ECI. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** CATC and CMAC supporting systems have been installed and tested.
	DM3  Operational procedures developed	The Airport Safety Support Service Operational Procedures must be elaborated. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:***

[14] The Milestones listed under this section should be addressed to air navigation service providers as well as to airport operators. This is due to the fact that some airports operate their own ground control units for specific areas of responsibility at the airport. Airport operators providing air traffic control services qualify, qualified as ANSPs, are therefore covered by the milestones. It is up to each implementer to check and select what is relevant to them, depending on local areas of responsibilities.

		Operational Procedures have been developed, tested and approved.
	DM4 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.
	DM6 Operational use	Airport Safety Nets are in operational use once the procedures are in place, systems have been implemented, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Airport Safety Nets are put into service.
AO	**DM1** Supporting RMCA systems implemented	Active RMCA alerts must be triggered according to the alert's parameters tailored for the local environment and displayed on Controller CWP with a distinction of colours between alarms alerts and information alerts, alarm alerts must trigger audio warning. RMCA alarm alerts must have the highest priority when displayed on Controller CWP. Installed RMCA System mustdemonstrate the compliance to the EUROCAE ED-87D performance requirements and pass the tests described in paragraph 5.5. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** RMCA supporting systems have been installed and tested.
	DM2 Supporting CATC and CMAC systems implemented	Implement appropriate systems allowing the detection of CATC and CMAC, integrated with A-SMGCS surveillance data and ECI. ***Milestone achievement conditions:*** CATC and CMAC supporting systems have been installed and tested.

	DM3 Operational procedures developed	The Airport Safety Support Service Operational Procedures must be elaborated. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Operational Procedures have been developed, tested and approved.
	DM4 Safety assessment	The safety assessment of the changes must be developed in coordination and synchronisation with all concerned stakeholders. This safety assessment must be delivered to the competent authority. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. This DM needs to be synchronised between ANSPs and AOs. ***Milestone achievement conditions:*** Training has been completed.
	DM6 Operational use	Airport Safety Nets are in operational use once the procedures are in place, systems have been implemented, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Airport Safety Nets are put into service.

Performance impact – Family 2.3.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

3.3. AF3 - Flexible Airspace Management and Free Route Airspace

3.3.1. Work Breakdown Structure and SESAR Solutions

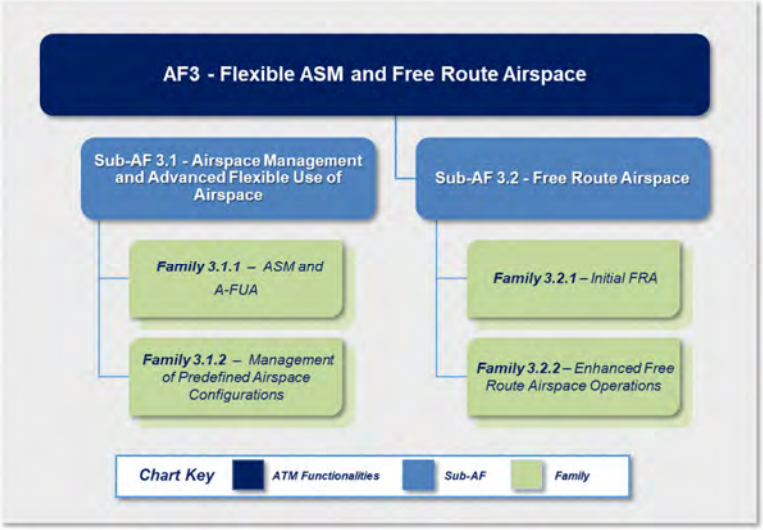

Figure 14 – AF3 Work Breakdown Structure

Combined operation of flexible airspace management and free route airspace is expected to enable airspace users to fly as closely as possible to their preferred trajectory without being constrained by fixed airspace structures or fixed route networks.

This ATM Functionality is composed of two Sub-ATM Functionalities and each Sub-ATM Functionality is addressed by two Families. The links between the Families and the SESAR Solutions can be found in the table below:

Family	SESAR Solutions	EOC
Family 3.1.1 – ASM and A-FUA	Solution #31 “Variable profile military reserved areas and enhanced (further automated) civil-military collaboration” Solution #66 “Automated Support for Dynamic Sectorisation”	Fully dynamic and optimised airspace
Family 3.1.2 – Management of Predefined Airspace Configurations	Solution #31 “Variable profile military reserved areas and enhanced (further automated) civil-military collaboration” Solution #66 “Automated Support for Dynamic Sectorisation”	Fully dynamic and optimised airspace
Family 3.2.1 – Initial FRA	Solution #32 “Free Route through the use of Direct Routing for flights both in cruise and vertically evolving in cross ACC/FIR borders and in high complexity environments" Solution #33 “Free Route through the use of Free Routing for flights both in cruise and vertically evolving in cross ACC/FIR borders and within permanently low to medium complexity environments" Solution #66 “Automated Support for Dynamic Sectorisation”	Fully dynamic and optimised airspace

Family	SESAR Solutions	EOC
Family 3.2.2 – Enhanced Free Route Airspace Operations	Solution #32 "Free Route through the use of Direct Routing for flights both in cruise and vertically evolving in cross ACC/FIR borders and in high complexity environments" Solution #65 "User Preferred Routing" Solution #33 "Free Route through the use of Free Routing for flights both in cruise and vertically evolving in cross ACC/FIR borders and within permanently low to medium complexity environments" PJ.06-01 "Optimised traffic management to enable Free Routing in high and very high complexity environments" Solution #66 "Automated Support for Dynamic Sectorisation"	Fully dynamic and optimised airspace

3.3.2. Deployment Approach and Synchronisation Needs

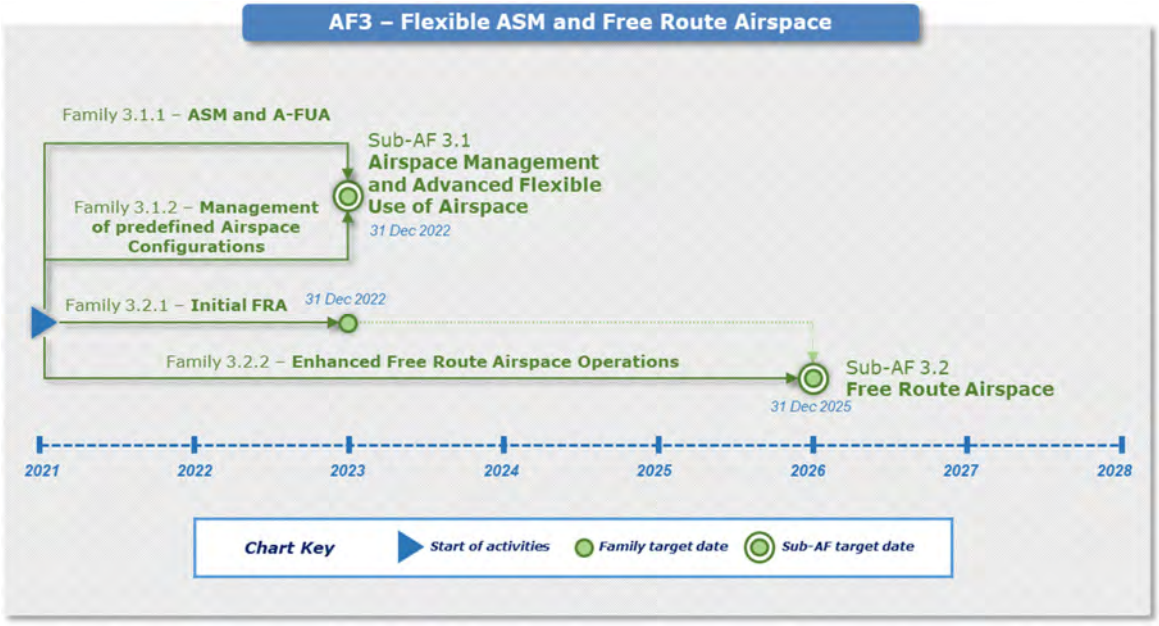

Figure 15 - AF3 Deployment Approach

Airspace should be considered as a single continuum, planned, and used in a flexible way on a day-to-day basis by all categories of airspace users.

Airspace Management is the result of strategic, pre-tactical and tactical coordination between civil/military authorities and ANSPs (ASM at level 1, 2 and 3). Coordination aims at creating dynamic use ofairspace to allow operations that require segregation, for example military activities, tailored in time and size considering other airspace users' needs.

Airspace Management and Free Route Airspace implementations need to be synchronised among ANSPs, Airspace Users and the Network Manager to offer the opportunity of flying preferred trajectories, without being subject to flow measures/restrictions in order to reduce delays.

This is key when implementing cross-border Free Route, where different Operational Stakeholders (in different Member States) need to synchronise its implementation in order to have a continuous and harmonised Free Route Airspace. The deployment of targeted systems and procedural changes that involve civil ANSPs, the Network Manager, military stakeholders and airspace users need to be coordinated and

synchronised in order to achieve the expected benefits in good time, e.g., for the SWIM Technical Infrastructure (TI) Yellow profile[15] in the context of ASM. This will not only ensure efficient deployment, but also interoperability, enabling efficient exchange of information among different Operational Stakeholders. The Baseline security level for SWIM TI Yellow profile enabling secured exchange of information between civil and military stakeholders has to be defined.

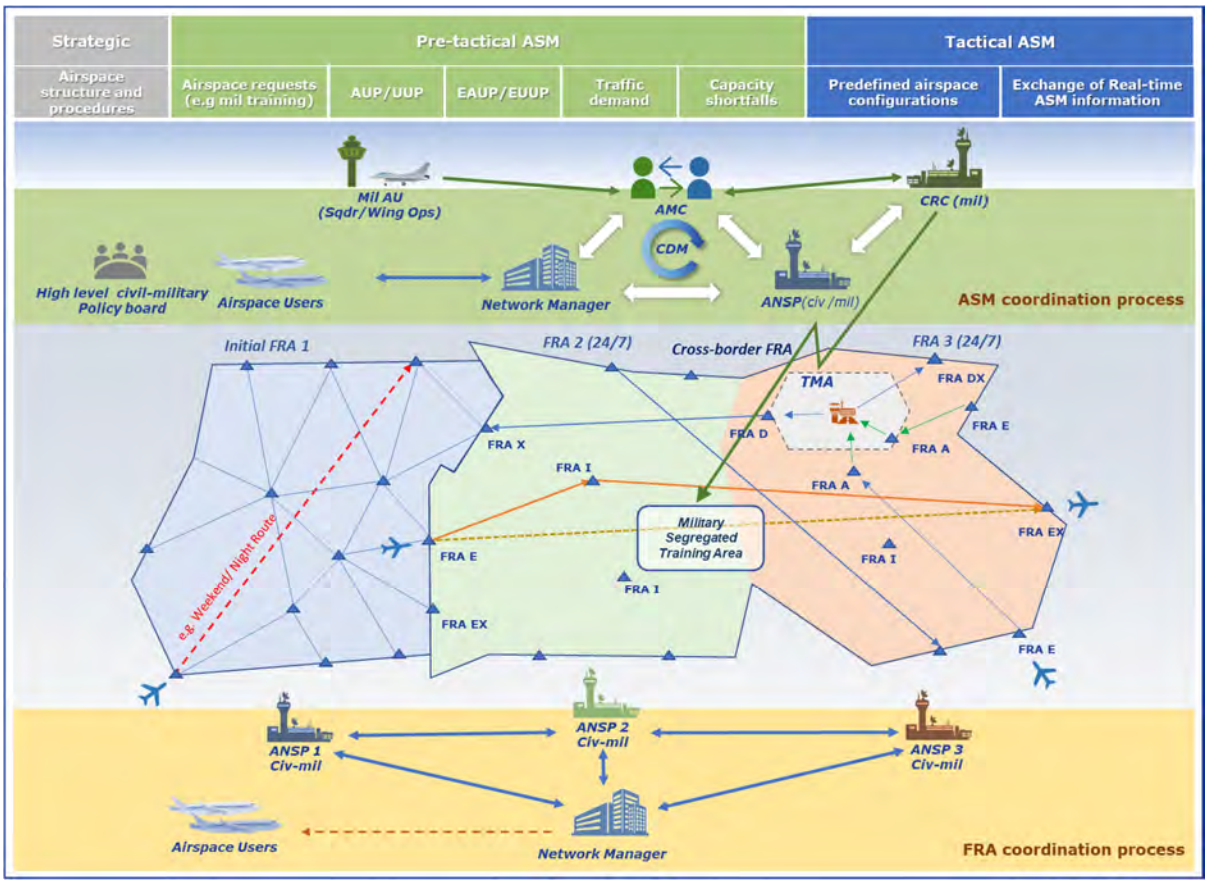

Figure 16 - AF3 synchronisation needs

Synchronisation needs of AF3:

Between Member States	Between air and ground stakeholders	Between civil and military stakeholders
✓	✓	✓

[15] As defined in EUROCONTROL Specifications for SWIM Technical Infrastructure Yellow Profile

3.3.3. CNS enablers for AF3

Free Route implementation requires a gradual transition from en-route operations operated on a network of published routes, to an environment characterised by the free choice of routing without the constraints of a fixed route network structure.

The underlying communications, navigation and surveillance infrastructure which supports the implementation of AF3 (voice communication systems, VoIP, CPDLC, VOR, DME, NDB, MSSR, MLAT/WAM, ADS-B, etc.), is expected to evolve depending on external drivers. In order to ensure the infrastructure can support the transition to free route operations, both under nominal and contingency circumstances, it is necessary that the underlying CNS infrastructure evolves in a coordinated fashion with the implementation of AF3, and in particular its civil-military and cross-border aspects. As part of their implementation projects, ANSPs should ensure that:

- COM architecture (VCS, ATN) is optimised for cross-border operations and does not expose the operational staff to undue complexity arising from coordination-and-transfer.
- COM architecture supports the implementation of ASM and A-FUA (link to VOIP)
- COM architecture is sufficiently robust and resilient so that technical outages do not lead to safety incidents.
- NAV architecture provides sufficient coverage, e.g., for TMA connecting routes, conventional or RNAV navigation, for FRA-linking routes from neighbouring ANSPs, etc.
- SUR architecture provides sufficient coverage to support the required separation minima.

Sub-AF 3.1 – Airspace Management and Advanced Flexible Use of Airspace

Family 3.1.1 – ASM and A-FUA

Target Date	31/12/2022

Description

Airspace Management (ASM) and Advanced Flexible Use of Airspace (A-FUA) aim to provide the most efficient airspace organisation and management in response to civil and military airspace users' requirements after completion of an enhanced CDM process among all concerned partners. ASM with A-FUA provides a solution for dynamically managing airspace users' demands in various operating environments regardless of national boundaries.

ASM procedures and processes shall facilitate dynamic management of airspace structures, such as variable profile area ('VPA'), temporary reserved/restricted area ('TRA') and temporary segregated area ('TSA').

The ASM process must promote cross border operations, e.g., establishment of Cross-border areas, to improve the efficiency in airspace utilisation (more flexible solutions available), satisfying civil and military requirements. The ASM system shall support cross-border activities resulting in shared use of volume of airspace regardless of national boundaries.

The process starts at strategic level (ASM level 1) with the involvement of the relevant civil and military ATM partners to ensure optimal airspace organisation and efficient rules, including priority rules, for the management of airspace structures during pre-tactical (ASM level 2) and tactical (ASM level 3) phases[16].

Along all phases, local and NM systems will use and exchange coherent and updated aeronautical/airspace data, made available to airspace users. This enables planning to be undertaken on the basis of accurate information relevant to the time of the planned operations.

A rolling process in the pre-tactical and tactical phase will support the continuous exchange of ASM data among all concerned ATM partners. A CDM process between all involved operational stakeholders will enhance the daily Network Operations Plan (NOP) by identifying the most suitable solutions for the allocation of airspace structures to satisfy both civil and military requirements aimed at improving the performance of the European route network.

In the pre-tactical phase, an enhanced notification process to AOs/CFSPs will ensure common awareness of the airspace availability and provide the opportunities for more efficient flight trajectories, contributing to environment performance achievements.

In the tactical phase, ASM information, such as pre-notification of activation, notification of activation, de-activation, modification and release of airspace structures, is shared between ASM systems and affected civil and military ATS units/systems in order to enhance ATCOs' situational awareness regarding the actual status of airspace reservations and thus, to ensure safety.

System requirements

[16] In accordance with Commission Regulation (EC) No 2150/2005 of 23 December 2005 laying down common rules for the flexible use of airspace.

- The ASM support systems (LARA or equivalent) shall support cross-border activities resulting in shared use of volume of airspace, regardless of national boundaries;
- The ASM support systems shall be interoperable with neighbouring ASM systems, whenever required, to support cross-border operations;
- As an alternative to deploying ASM support systems, States may decide to fully rely on NM applications and system capabilities such as CIAM and its further developments and migration to NES;
- The ASM support systems shall support the continuous exchange of ASM information with NM system for the rolling AUP and UUP;
- The ASM support systems shall support the new AUP template content and format containing additional information such as NPZ and FUA group restrictions;
- The Network Manager system shall reflect the changes in the status of airspace structures such as VPA, TSA, TRA, as well as routes, in order to notify updated information to ANSP systems, AUs/CFSPs in a timely manner;
- The NM System shall provide EAUP/EUUP information;
- The NM system shall provide a centralised airspace data information supporting the ASM process;
- The ASM support system shall ensure the utilisation of airspace data aligned with the centralised airspace data provided by the NM system;
- AU systems shall be interoperable with the NM system to retrieve up-to-date airspace status information, and to file and modify flight plans based on timely and accurate information;
- ATC systems shall correctly depict the activation and de-activation of configurable airspace reservations;
- Aeronautical/airspace data shall be used and exchanged in a coherent way between local and NM systems;
- The ASM support systems shall exchange airspace status data with ATC systems;
- The relevant ASM system shall support the exchange of airspace data according to SWIM requirements as described in AF5.3.1, where SWIM is available.

Dependencies

- Family 3.1.2 Management of predefined airspace configurations enhances and integrates the advanced flexible use of airspace concept;
- Family 3.2.1 Initial FRA and Family 3.2.2 Enhanced FRA Operations take into account airspace availability to manage traffic demand;
- Family 4.1.1 Enhanced Short Term ATFCM Measures using cooperative decision-making improves traffic flow management;
- Family 4.2.1 Interactive rolling NOP enhances the airspace management and the advanced flexible use of airspace by making available a rolling view of the network situation and supporting the collaborative processes;
- Family 4.3.1 Automated Support for Traffic Complexity Assessment and Flight Planning Interfaces enhances the airspace management and the advanced flexible use of airspace;
- Family 5.3.1 Aeronautical Information Exchange, such as airspace availability, airspace structures and ARES information SWIM services;
- Family 5.4.1 Meteorological Information: Network Manager meteorological information SWIM service shall be consumed to improve airspace availability coordination;
- Family 5.5.1 Cooperative Network Exchange: NM B2B services shall be consumed to enhance ANSP/NM systems in order to collaborate on the provision of traffic regulation proposals, on the definition and application of STAM measures, and on ATFCM tactical and pre-tactical updates for the hotspots
- Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM shall be consumed making available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data;
- Family 6.1.2 Initial Air-Ground Trajectory Information Sharing (Ground Domain): air-ground trajectory exchange improves trajectory information which enhances ATCOs' situational awareness together with the display of activated airspace reservations at the CWP.

Civil / Military Coordination

Civil-military coordination is key for airspace management, procedural and operational purposes, as well as for systems interoperability in order to process airspace structures data.

Stakeholders impacted	ANSPs (Military included, where applicable), Network Manager, Airspace Users (Military included, where applicable)
Geographical scope	ASM and A-FUA must be provided and operated in the Single European Sky airspace as defined in Article 3(33) of Regulation (EU) 2018/1139 with the following local limitations: - the Dutch airspace below FL245 (LVNL)
ATM Master Plan reference	Essential Operational Change (EOC): Fully dynamic and optimised airspace https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: AOM19.5 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach

ANSP	**DM1a** Deploy automated ASM support systems (LARA or equivalent)	Deploy automated Airspace Management (ASM) support systems (LARA or equivalent) to support the local or sub-regional airspace planning and allocation. This DM needs to be synchronised between civil and military ANSPs and NM. Note: There is an alternative option in DM1b by using NM system capabilities. ***Milestone achievement conditions:*** ASM systems supporting the airspace planning and allocation have been deployed.
	DM1b Adopt the NM system (CIAM) for ASM capabilities	As an alternative to deploying ASM support systems, States may decide to fully rely on NM applications and system capabilities such as CIAM and its further developments and migration to NES. This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** ASM unit has started the exchange of AUP/UUP data with NM through the ASM NM system capabilities.
	DM2	Implement procedures and processes for: • a full rolling ASM/ATFCM process;

	Implement procedures and processes for a full rolling ASM/ATFCM process	• a CDM process; This DM needs to be synchronised between civil and military ANSPs, AUs and NM. ***Milestone achievement conditions:*** Processes/procedures have been defined, validated and approved.
	DM3 Adapt ASM systems (LARA or equivalent) to support a full rolling ASM/ATFCM process	Implement the following actions supporting a full rolling and dynamic ASM/ATFCM process: Upgrade the ASM System (LARA or equivalent) to comply with the new AUP template content and format including additional information (NPZ and FUA group restrictions); Adapt ASM System changes for full management of airspace structure via AUP/UUP accordingly; Adapt ASM System changes for CDM. This DM needs to be synchronised between civil and military ANSPs, AUs and NM. ***Milestone achievement conditions:*** ASM systems have been adapted to allow data sharing to all operational stakeholders through rolling ASM/ATFCM process.
	DM4 Implement interoperability of ASM support systems with NM system	Implement interoperability of ASM support systems with NM system comprising the following: Adapt ASM support systems to make them interoperable with the NM system; Conclude the Operational Access Acceptance Activities required to validate the ASM tool interfacing the NM system. This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** ASM support systems have been upgraded. A Positive Access Acceptance Criteria validation report is available. Exchange of AUP/UUP data with NM system has started.
	DM5 Implement interoperability between ASM support systems to facilitate cross border operations	Where applicable, implement interoperability of local ASM support system with adjacent ASM systems whenever cross border operations are in place. This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** LoA for cross border operations are in force; Exchange of ASM data has started.
	DM6 Optimise planning and	Improve planning and allocation of airspace structures at pre-tactical ASM level 2 by:

	allocation of airspace booking	Planning airspace structures utilisation in accordance with actual need. This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** Planning and allocation of airspace structures have been optimised according to the procedures in place.
	DM7 Implement procedures related to ASM level 3 (tactical) information exchange	Develop and implement the ASM/ATFCM and ATC procedures for ASM data exchanges with all operational stakeholders in ASM level 3: • release airspace structures as soon as activity stops or when areas are not used; • use available airspace structures that have not been allocated in AUP. This DM needs to be synchronised between civil and military ANSPs, AUs and NM. ***Milestone achievement conditions:*** Procedures related to ASM level 3 (tactical) information exchange have been promulgated.
	DM8 Adapt ASM and ATC systems for automatic ASM data exchanges	• Adapt ASM systems (LARA or equivalent) to automatically provide status of airspace structures to ATC support systems. • Adapt ATC systems to receive airspace status data and to display airspace status data on CWPs. • If ASM data are provided through NM system capabilities (DM1b), ATC systems could be manually triggered to display the airspace status on CWP. This DM needs to be synchronised between civil and military ANSPs. ***Milestone achievement conditions:*** ASM and ATC systems have been adapted to enable the automatic exchange of airspace status data.
	DM9 Adapt ASM system to manage airspace data information aligned with centralised airspace data provided by NM system	ASM support system (LARA or equivalent) must be adapted to support airspace data improvements utilised for the AUP/UUP process. This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** ASM support system is updated and manages improved airspace data processed via AUP/UUP.

	DM10 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authorities. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM11 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed.
	DM12 Operational use	Family 3.1.1 is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Family 3.1.1 is put into service.
AU	**DM1** Adapt airspace users' systems for processing EAUP/EUUP information	Adapt airspace users' systems (Computer Flight Plan Software Providers (CFSP) to process any EAUP/EUUP information provided. This DM needs to be synchronised between AUs and NM. ***Milestone achievement conditions:*** AUs systems have been adapted for processing EAUP/EUUP information automatically.
	DM2 Adapt airspace users' system to process RRP messages or enhanced utilisation of opportunity tool application	Adapt airspace users' systems (Computer Flight Plan Software Providers (CFSP) to enhance processing of FPL improvements notified by NM via RRP or Opportunity tool application. This DM needs to be synchronised between AUs and NM. ***Milestone achievement conditions:*** Systems have been adapted to increase processing of opportunities notified by NM.
	DM3 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM4 Operational use	Family 3.1.1 is in operational use once the systems have been implemented, the procedures are in place, and the training has been completed. ***Milestone achievement conditions:*** Family 3.1.1 is put into service

NM	**DM1** Adapt NM systems to support a full rolling ASM/ATFCM process	The following system upgrades supporting a full rolling ASM/ATFM process to be performed by the Network Manager: • System upgrade supporting a full rolling ASM/ATFCM and dynamic ASM/ATFCM process; • System changes supporting rolling AUP; • Full implementation of new AUP template; • System changes for CDM; • System changes for initial NIA. ***Milestone achievement conditions:*** NM system has been updated.
	DM2 Implement procedures and processes for a full rolling ASM/ATFCM process	The following processes have to be developed and implemented by the Network Manager in coordination with the concerned stakeholders: • Process supporting a full rolling ASM/ATFCM and dynamic ASM/ATFCM process; • Process for a full management of airspace structure and related features via AUP/UUP; • Process for CDM; • Process for initial NIA. This DM needs to be synchronised between ANSPs, AUs and NM. ***Milestone achievement conditions:*** Processes have been implemented by NM in coordination with concerned stakeholders.
	DM3 Improve ASM notification process	The following actions supporting an improved ASM notification process shall be taken by the Network Manager: • Improvements to the European AUP/UUP enhanced information; • Enhanced process to provide automatic information of airspace opportunity (RRP, opportunity tool). This DM needs to be synchronised between ANSPs, AUs and NM. ***Milestone achievement conditions:*** Processes have been promulgated by NM.
	DM4 Provide a centralised airspace data information to support ASM process	Improve centralised airspace data information availability according to the ASM process improvements, namely additional set of data exchanged via AUP/UUP. This DM needs to be synchronised between ANSPs, AUs and NM. ***Milestone achievement conditions:*** NM system updated to support the exchange of additional airspace information data.
	DM5	The safety assessment of the changes must be developed and delivered to the competent authority.

	Safety Assessment	***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM6 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM7 Operational use	Family 3.1.1 is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Family 3.1.1 is put into service.

Performance impact – Family 3.1.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety[17]	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

[17] Real-time and automatic transmission of airspace status data between all ATM actors increases safety by reducing manual interventions and therefore human error.

Sub-AF 3.1 – Airspace Management and Advanced Flexible Use of Airspace

Family 3.1.2 – Management of Predefined Airspace Configurations

Target Date	31/12/2022

Description

Predefined Airspace Configuration is a predefined and coordinated organisation of routes and their associated airspace structures, temporary airspace reservations and predefined ATC sectorisation, to meet civil/military airspace users' needs and increase performance in terms of capacity and/or flight efficiency, applicable both in free route (FRA) and fixed route network environments.

Predefined Airspace configurations are activated for a specific geographic area and/or time period at pre-tactical level through a CDM process involving the AMCs, NM, ATFCM, ATC and airspace users.

The notification of predefined Airspace Configurations will be based on automatic flows of information between the different stakeholders provided by Network Manager.

The optimal organisation of airspace structures, such as the allocation of temporary airspace reservations, is achieved through the ASM solutions process that aims at delivering options that can fulfil military needs while improving flight efficiency and alleviating capacity problems identified in any specific area within European airspace.

This collaborative process is based on the partnership between ANSPs, NM, AUs and military collaboration to make the best decision to satisfy civil and military requirements and improve performance achievements.

One of the ASM options is the utilisation of airspace scenarios composed of different predefined airspace configurations.

The identification and development of predefined airspace configurations and scenarios is executed by relevant actors, at strategic level: the High-Level Airspace Policy Body (HLAPB or its equivalent; at national and sub-regional level), with participation of the civil and military airspace users as appropriate, supported by the Network Manager. The detailed predefined airspace configurations and scenarios will be implemented in the framework of the ASM level 2 in accordance with the conditions and procedures defined at strategic level.

System requirements

The scope of this Family encompasses:

- The Network Manager and local ATM system shall facilitate an automatic flow of information between the different stakeholders for the identification of optimal predefined Airspace Configurations;
- NM systems shall facilitate the management of predefined airspace scenarios among ATM partners and the notification to AUs/CFSPs of the temporary airspace reservations;
- The Network impact assessment shall be carried out by NM systems before the application of predefined airspace configurations and scenarios;
- The NM systems shall support the predefined airspace configurations in any fixed route or FRA environment;
- ASM/ATFCM systems and ATC systems shall support the full sharing of the airspace configuration inputs and outputs in any fixed route or FRA environment;
- In alternative to local ASM/ATFCM systems and ATC systems, stakeholders may use NM systems and applications (CHMI, CIAM) to support sharing of predefined airspace configuration.
- The ATC system shall support dynamic configuration of sectors in order to optimise their dimensions and operating hours in accordance with the traffic demands of the NOP.

Dependencies

- Family 3.1.1 Dynamic Advanced Flexible Use of Airspace embraces the management of predefined airspace configurations concept;
- Family 3.2.1 Initial FRA and Family 3.2.2 Enhanced FRA Operations take into account applicable airspace configurations to manage traffic demand;
- Family 4.1.1 Enhanced Short Term ATFCM Measures using cooperative decision-making improves traffic flow management;
- Family 4.2.1 Interactive rolling NOP enhances the management of predefined airspace configurations by making available a rolling view of the network situation and supporting the collaborative processes;
- Family 4.3.1 Automated Support for Traffic Complexity Assessment and Flight Planning Interfaces enhances the management of predefined airspace configurations;
- Family 5.3.1 Aeronautical Information Exchange, such as airspace availability, airspace structures and ARES information SWIM services;
- Family 5.4.1 Meteorological Information: Network Manager meteorological information SWIM service must be consumed to improve airspace availability coordination;
- Family 5.5.1 Cooperative Network Exchange: NM B2B services must be consumed to enhance ANSP/NM systems in order to collaborate on the provision of traffic regulation proposals, on the definition and application of STAM measures, and on ATFCM tactical and pre-tactical updates for the hotspots;
- Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM must be consumed making available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data.

Civil / Military Coordination

Civil-military coordination is key for procedural and operational purposes, as well as for systems improvements, to grant interoperability is a safe and secured environment, including cyber security.

Stakeholders impacted	ANSPs (Military included, where applicable), Network Manager
Geographical scope	ASM and A-FUA must be provided and operated in the Single European Sky airspace as defined in Article 3(33) of Regulation (EU) 2018/1139 with the following local limitations: - the Dutch airspace below FL245 (LVNL)
ATM Master Plan reference	Essential Operational Change (EOC): Fully dynamic and optimised airspace https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: AOM19.4 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach

ANSP	**DM1**	Define and implement procedures supporting ASM solutions process for the management of predefined Airspace

	Define and Implement procedures in support of an improved ASM solution process	configurations and scenarios, through a CDM process in coordination with NM and concerned stakeholders. This DM needs to be synchronised between civil and military ANSPs, AUs and NM. ***Milestone achievement conditions:*** The predefined airspace configuration and scenario concepts and related modus operandi are defined and approved by the national and sub-regional (FAB) High Level Airspace Policy Bodies (HLAPB or its equivalent).
	DM2a Adapt ATC/ASM systems to support the management of predefined airspace configurations and scenarios	Adapt ATC/ASM systems including: • system changes and technical solutions required for predefined airspace configurations; • sharing of predefined airspace configuration inputs and outputs, including: o ATC sector configurations; o selected temporary airspace structures This DM needs to be synchronised between civil and military ANSPs. ***Milestone achievement conditions:*** ATC/ASM systems have been adapted
	DM2b Use NM systems and application	Use NM systems and applications (CHMI, CIAM) for the provision of airspace configuration and scenarios inputs (ATC sector configurations and ASM scenarios). This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** NM systems and applications are being used
	DM3 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed.

	DM5 Operational use	Management of Predefined Airspace Configurations is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Management of Predefined Airspace Configurations is put into service.
NM	**DM1** Define and implement procedures in support of an improved management of predefined airspace configurations and scenarios	Once ANSPs DM1 and DM2 have been completed, define and implement procedures supporting ASM solutions process for the management of predefined Airspace configurations and scenarios (e.g., by updating the ASM Handbook). This DM needs to be synchronised between civil and military ANSPs, AUs and NM. ***Milestone achievement conditions:*** Procedures have been defined and promulgated.
	DM2 Adapt NM systems to support the management of predefined airspace configurations and scenarios	Adapt NM systems including: • system changes and technical solutions required for predefined airspace configurations and scenarios; • sharing of predefined airspace configuration and scenarios inputs and outputs. ***Milestone achievement conditions:*** NM systems have been adapted.
	DM3 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM5 Operational use	Management of Predefined Airspace Configurations is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Management of Predefined Airspace Configurations is put into service.

Performance impact – Family 3.1.2:

Benefit areas	Capacity	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety[18]	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

[18] Real-time and automatic transmission of airspace status data between all ATM actors will increase safety by reducing manual interventions and therefore human error (CIV+MIL ASM Tool)

Sub AF 3.2 - Free Route Airspace

Family 3.2.1 – Initial FRA

Target Date	31/12/2022

Description

Free Route is an operational concept that enables airspace users to fly as close as possible to what they consider their optimal trajectory without the constraints of a fixed route network structure. Free Route Airspace (FRA) is a specified airspace within which users may freely plan a route between a defined FRA entry point and defined FRA exit point, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

The Initial FRA implementation may be achieved with some limitations, for example:

- laterally and vertically;
- during specific time periods.

System requirements

The Initial FRA deployment shall be based on the following system improvements:

NM systems:

- FPL processing and checking
- Dynamic rerouting
- Calculation and management of traffic load
- IFPS routing proposal
- Specific ASM improvements for FRA
- Network impact assessment for FRA
- CACD adaptations for FRA Initial deployment

AU systems:

- FPL route planning for a complete flight taking into account the differences of limitations (e.g., in terms of opening time and/or flight level constraints) throughout the entire flight
- Long DCT with or without calculated intermediate points
- Capability to take into account different constraint e.g.: ATS, FRA, RAD, scenarios, FL constraints on part of the route only, etc.
- FPL route planning for a complete flight taking into account the differences of implementations (FRA with or without partial implementation) throughout the entire flight.

ANSPs may decide which system improvements are required for Initial FRA. The list below addresses the potential improvement to ATC systems. The choice of the appropriate tool/function to achieve Initial FRA remains a stakeholder decision based on the operational environment and may include any of the following tool/functions as follows:

- FDPS supporting the airspace structure and managing trajectories according to the flight plan;
- CWP and HMI supporting appropriate display and functions as required by operational needs;
- FDPS to calculate ground 4D trajectories within AoI and editing function for 4D trajectories including Cross AoR Points (Coordination Point COP management);
- ASM/ATFCM for FRA management;
- MTCD (detecting conflicts between A/C and A/C, and between A/C and airspace);
- CORA (conflict probe and passive conflict resolution advisor);
- MONA (conformance monitoring aids);
- ATC clearances beyond AoR;
- ATC to ATC Flight Data Exchange (OLDI and/or SYSCO);
- Dynamic sectorisation and constraint management;

- Dynamic Area Proximity Warning (APW) –Integrated with ASM tools;
- Provision/integration of FPL and real-time data related to the FRA traffic to the Military ATS units and or air defence organisations;
- Conflict Detection Tools, which include the Tactical Controller Tool (TCT), using the tactical trajectory and managing the clearances along that trajectory.

Dependencies

- Family 3.1.1 Dynamic Advanced Flexible Use of Airspace and Family 3.1.2 Management of predefined airspace configurations to meet civil/military airspace users' needs and increase performance in terms of capacity and/or flight efficiency;
- Family 3.2.2 Enhanced FRA Operations represent the following objective for FRA implementation;
- Family 4.1.1 Enhanced Short Term ATFCM Measures Tactical using cooperative decision-making improves traffic flow management;
- Family 4.3.1 Automated Support for Traffic Complexity Assessment and Flight Planning Interfaces enhances FRA by the interface of ANSP/AU systems with NM systems;
- Family 5.3.1 Aeronautical Information Exchange, such as airspace availability, airspace structures and ARES information SWIM services;
- Family 5.4.1 Meteorological Information Exchange: the availability of MET information helps forecasting and managing traffic flows;
- Family 5.5.1 Cooperative Network Exchange: to enhance ANSP/NM systems in order to collaborate on the provision of traffic regulation proposals, on the definition and application of STAM measures, and on ATFCM tactical and pre-tactical updates for the hotspots, when used;
- Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM must be consumed making available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data.

Civil / Military Coordination

Civil-Military Coordination is key for the exchange of data on airspace availability and on flight trajectories, i.e., Basic Flight Data (BFD) and Change Flight Data (CFD), other. Civil and military ATC Systems, as relevant, shall be capable of processing all relevant FRA Information, notably for the accomplishment of their security missions, e.g., to provide a 24/7 recognised air picture.

Stakeholders impacted	ANSPs (Military included, where applicable), Network Manager, Airspace Users (CFPSs)
Geographical scope	Initial FRA shall be provided and operated within the SES airspace for which the European Member and committed States are responsible above FL305.
ATM Master Plan reference	Essential Operational Change (EOC): Fully dynamic and optimised airspace https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: AOM21.2, ATC02.8, ATC12.1 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach		
ANSP	DM1 Implement Initial FRA procedures and processes in support of Network Dimension	Conduct the following actions: • Identify the FRA airspace volume (Lateral and Vertical) and applicable time; • Identify FRA entry and exit points, arrival transition point and departure transition point, and intermediate points; • Adapt Airspace design and ensure FRA horizontal and vertical connectivity; • Validate airspace design with NM; • Network overview - connectivity consistency of FRA application; • ATFCM FRA procedures; • Adapt RAD applicability; • Validate RAD with NM. This DM needs to be synchronised between ANSPs and NM. ***Milestone achievement conditions:*** The local FRA airspace has been identified in coordination with the Network Manager and neighbouring States and the RAD has been updated accordingly. The local ATFCM procedures have been updated in cooperation with the network to take on board the FRA impact.
	DM2 Implement Initial FRA system improvements	Upgrade ATC systems and/or deploy the ATC functions deemed appropriate to support initial FRA: • FDPS/CWP and HMI upgrades • COP management • ASM/ATFCM for FRA management • MTCD • MONA • ATC clearances beyond AoR • ATC to ATC Flight Data Exchange (Basic OLDI and SYSCO) • Dynamic sectorisation and constraint management • Dynamic Area Proximity Warning (APW) • Tactical Controller Tool (TCT) ***Milestone achievement conditions:*** The ATC system has been upgraded according to the specifications representing the identified necessary changes

	DM3 Implement Initial FRA procedures and processes in support of the local dimension	Take the following actions: • Adapt the LoA with adjacent ATS units; • Publish relevant data for FRA in AIP; • Chart FRA operations; • Develop airspace management procedure for the implementation of free routes operation; • Review ASM Procedures for 'Free Route' areas; • Develop ATC procedures to cover free route co-ordination and transfer of control, trajectory change in a free route environment, alignment of procedures for conflict detection in FRA environment; • Validate airspace design, RAD and ASM procedures with NM. This DM needs to be synchronised between ANSPs and NM. ***Milestone achievement conditions:*** The FRA airspace has been described and published in the AIP and the charts. The Letters of Agreement have been updated if necessary. The ASM and ATC procedures have been updated to take on board the FRA impact.
	DM4 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM6 Operational use	Initial FRA is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed, ***Milestone achievement conditions:*** Initial FRA is put into service.
AU	**DM1** Implement Initial FRA system improvements	Adapt the flight Planning system as necessary to support FRA as follows: • Provide the capability to take into account the different constraints, e.g.: ATS, FRA, RAD, scenarios, FL constraints on part of the route only; • Ensure FPL route planning for a complete flight taking into account the differences of implementation (FRA with or without partial implementation) throughout the entire flight.

		Milestone achievement conditions: Flight Planning system has been adapted as necessary.
	DM2 Implement Initial FRA procedures and processes	Take the following actions: • Develop and apply operational Procedures for free route; • Develop and apply operational Procedures to take into account airspace and traffic constraints when planning a route. ***Milestone achievement conditions:*** Procedures taking into account Free Route Airspace operations have been promulgated.
	DM3 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM4 Operational use	Initial FRA is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed, ***Milestone achievement conditions:*** initial FRA is put into service.
NM	**DM1**  Implement Initial FRA system improvements	Upgrade NM system to support the following: • IFPS routing proposal • Specific ASM improvements for FRA • Network impact assessment for FRA • CACD adaptations for FRA Initial deployment This DM needs to be synchronised between ANSPs, AUs and NM. ***Milestone achievement conditions:*** The required adaptations of NM systems (IFPS and Airspace Management tools) to FRA have been deployed.
	DM2  Implement Initial FRA procedures and processes	Take the following actions in coordination with ANSPs: Identify the FRA airspace volume (Lateral and Vertical) and applicable time; Identify FRA entry and exit points, arrival transition point and departure transition point, and intermediate points; • Adapt Airspace design and ensure FRA horizontal and vertical connectivity; • Network overview-connectivity consistency of Initial FRA application; • ATFCM FRA procedures; • Adapt RAD applicability; • Validate airspace design, RAD and ASM procedures with ANSPs.

		This DM needs to be synchronised between ANSPs and NM.
	DM3 Safety Assessment	***Milestone achievement conditions:*** European Airspace has been updated with the integration of the coordinated FRA definition. Route Availability Document has been updated accordingly. The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM5 Operational use	Initial FRA is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed, ***Milestone achievement conditions:*** Initial FRA is put into service.

Performance impact – Family 3.2.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 3.2 - Free Route Airspace

Family 3.2.2 – Enhanced Free Route Airspace Operations

Target Date	31/12/2025

Description

This Family addresses the following three elements:

- Final FRA implementation
- Cross-border FRA implementation
- FRA connectivity with TMAs.

The **Final FRA** implementation will eliminate the structural limitations that are permissible for Initial FRA in terms of timing limitations (night FRA, weekend FRA, seasonal FRA) and lateral and vertical limitations. RAD restrictions should be applied to the minimum extent possible where unlimited free route airspace operations would endanger airspace capacity (e.g., in high-density, complex airspaces).

Cross-border FRA operations provide further benefits of the FRA concept to Airspace Users. Cross-border FRA must be implemented with at least one neighbouring State. However, it should be considered by the implementing ANSPs, that maximum benefits for airspace users in terms of time, fuel and CO_2 emissions savings will be achieved when cross-border FRA is implemented among all neighbouring states from the lowest mutual flight level upwards. For the time being, there are several cross-border FRA implementations, in some cases addressing the airspace controlled by several ANSPs within FAB and between FABs.

FRA connectivity with TMAs must be ensured by one of the following options:

- lowering the FRA vertical limit until the TMAs upper vertical boundaries;
- linking appropriate arrival/departures points;
- defining FRA connecting routes;
- extending the existing standard arrival and departure routes;
- connecting with the underlying fixed ATS routes via a set of waypoints reflecting the typical climbing/descending profiles.

System requirements

The system requirements for implementation of the 3 elements of this Family shall encompass the system upgrades listed for Initial FRA and additional system upgrades as:

NM systems:

- Environmental database adaptations for cross-border FRA operations and FRA connectivity with TMAs;
- Data exchange for cross border FRA and FRA connectivity with TMAs.

AU systems:

- Optimisation of free routing trajectories taking into account the ATM constraints, including possible differences of FRA lower limit implementations throughout the flight.

ANSPs may decide which system improvements are required in addition to those required for Initial FRA. The choice of the appropriate tool/function remains a stakeholder decision based on the operational environment and may include the tools listed for Initial FRA plus additional tool/functions as for example:

- COP management for FRA supporting Cross Border COP handling;
- Tactical Controller Tool (TCT), managing the Cross-Border clearances;
- Multi-Sector Planner/Extended ATC Planner (MSP/EAP) function.

Dependencies

- Family 3.1.1 Dynamic Advanced Flexible Use of Airspace and Family 3.1.2 Management of predefined airspace configurations to meet civil/military airspace users' needs and increase performance in terms of capacity and/or flight efficiency;
- Family 3.2.1 Initial FRA represents the first step towards enhanced FRA operations;
- Family 4.1.1 Enhanced Short Term ATFCM Measures, using cooperative decision-making, improves traffic flow management;
- Family 4.3.1 Automated Support for Traffic Complexity Assessment and Flight Planning Interfacesenhances FRA by creating the interface of ANSP/AU systems with NM systems.

Civil / Military Coordination

Civil-Military Coordination is key for the exchange of data on airspace availability and on flight trajectories, i.e., Basic Flight Data (BFD) and Change Flight Data (CFD), other. Civil and military ATC Systems, as relevant, shall be capable of processing all relevant FRA Information, notably for the accomplishment of their security missions, e.g., to provide a 24/7 recognised air picture.

Stakeholders impacted	ANSPs (Military included, where applicable), Airspace Users, Network Manager
Geographical scope	Final FRA implementation, Cross-border FRA with at least one neighbouring State and FRA connectivity with TMAs shall be provided and operated in the entire airspace within SES airspace for which the European Member and committed States are responsible at least above flight level 305.
ATM Master Plan reference	Essential Operational Change (EOC): Fully dynamic and optimised airspace https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: AOM21.3
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach

ANSP	**DM1** Implement Enhanced FRA process and procedures in support of Network Dimension	Conduct the following actions: • Identify the Final FRA airspace volume (Lateral and Vertical); • Identify the cross-border FRA airspace volume (Lateral and Vertical); • Identify the airspace foreseen for cross-border FRA operations (Lateral and Vertical); • Adapt Airspace design and ensure cross-border FRA horizontal and vertical connectivity; • Validate airspace design with NM; • Network overview connectivity consistency of FRA application; • ATFCM FRA procedures; • Adapt RAD applicability; • Validate RAD with NM.

		This DM needs to be synchronised between ANSPs and NM. ***Milestone achievement conditions:*** The local FRA airspace supporting Final FRA, Cross-border and TMA connectivity has been identified in coordination with the Network Manager and neighbouring States and the RAD has been updated accordingly. The local ATFCM procedures have been updated in cooperation with the network to take on board the Final FRA, Cross-border, and TMA connectivity impact.
	DM2 Implement Enhanced FRA system improvements	If needed, upgrade ATC systems and/or deploy the ATC functions deemed appropriate to support Initial FRA, plus additional functions might be considered for cross-border FRA and FRA connectivity with TMA as: • COP management for FRA supporting Cross Border COP handling; • Tactical Controller Tool (TCT), managing the Cross-Border clearances; • Multi-Sector Planner/Extended ATC Planner (MSP/EAP) function. ***Milestone achievement conditions:*** The ATC system has been upgraded according to the specifications representing the identified necessary changes.
	DM3 Implement Enhanced FRA procedures and processes in support of the local dimension	Take the following actions: • Adapt the LoA with adjacent ATS units; • Publish relevant data for cross-border FRA in a single or for multiple AIPs; • Chart the Cross-border FRA and FRA connectivity with TMA operations; • Develop airspace management procedure for the implementation of cross border FRA and FRA connectivity with TMAs operations; • Identify and apply ASM Procedures for Cross-border FRA areas; • Develop ATC procedures to cover Cross-border FRA and FRA connectivity with TMAs co-ordination and transfer of control, trajectory change in a free route environment, conflict detection; • Validate airspace design, RAD and ASM procedures with NM.

		This DM needs to be synchronised between ANSPs and NM. ***Milestone achievement conditions:*** The Final FRA, Cross border FRA and TMA connectivity airspace has been described and published in the AIP and the charts. The Letters of Agreement have been updated if necessary. The ASM and ATC procedures have been updated to take on board the impact of Final FRA, Cross border FRA and TMA connectivity.
	DM4 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM6 Operational use	Enhanced Free Route Airspace Operations is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Enhanced Free Route Airspace Operations is put into service.
AU	**DM1** Implement Enhanced FRA system improvements	Adapt the flight Planning system as necessary to support cross-border FRA as: • Optimisation of free routing trajectory taking into account the ATM constraints including possible differences of FRA lower limit implementations throughout the flight. ***Milestone achievement conditions:*** Flight Planning system has been amended as necessary.
	DM2 Implement Enhanced FRA procedures and processes	Take the following actions: Develop and apply operational Procedures for Cross-border FRA and FRA connectivity with TMAs;

	DM3 Training	Develop and apply operational Procedures to take into account airspace and traffic constraints when planning a route. ***Milestone achievement conditions:*** Procedures have been updated to take into account Final FRA, Cross border FRA and TMA connectivity. All relevant staff shall be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM4 Operational use	Enhanced Free Route Airspace Operations is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Enhanced Free Route Airspace Operations is put into service.
NM	**DM1** Implement Enhanced FRA system improvements	Upgrade NM system to support: • Environmental database adaptations for FRA cross-border operation and FRA connectivity with TMA; • Data exchange for cross border FRA and FRA connectivity with TMA; This DM needs to be synchronised between ANSPs, AUs and NM. ***Milestone achievement conditions:*** The required adaptations of NM systems (IFPS and Airspace Management tools) to Final FRA, Cross border FRA and TMA connectivity have been deployed.
	DM2 Implement Enhanced FRA procedures and processes	Take the following actions in coordination with ANSPs: • Identify the cross-border FRA airspace volume (Lateral and Vertical); • Identify Cross-Border FRA entry and exit points, TMAs connection points, and intermediate points; • Adapt Airspace design and ensure FRA horizontal and vertical connectivity; • Network overview-connectivity consistency of FRA cross-border application; • ATFCM Cross-border FRA procedures; • Adapt RAD applicability; • Validate airspace design, RAD and ASM procedures with ANSPs. ***Milestone achievement conditions:***

		European Airspace has been updated with the integration of the coordinated Final FRA, Cross border FRA and TMA connectivity definition. Route Availability Document has been updated accordingly.
	DM3 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM5 Operational use	Enhanced Free Route Airspace Operations is in operational use once the systems have been implemented, the procedures are in place, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Enhanced Free Route Airspace Operations is put into service.

Performance impact – Family 3.2.2:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

3.4. AF4 - Network Collaborative Management

3.4.1. Work Breakdown Structure and SESAR Solutions

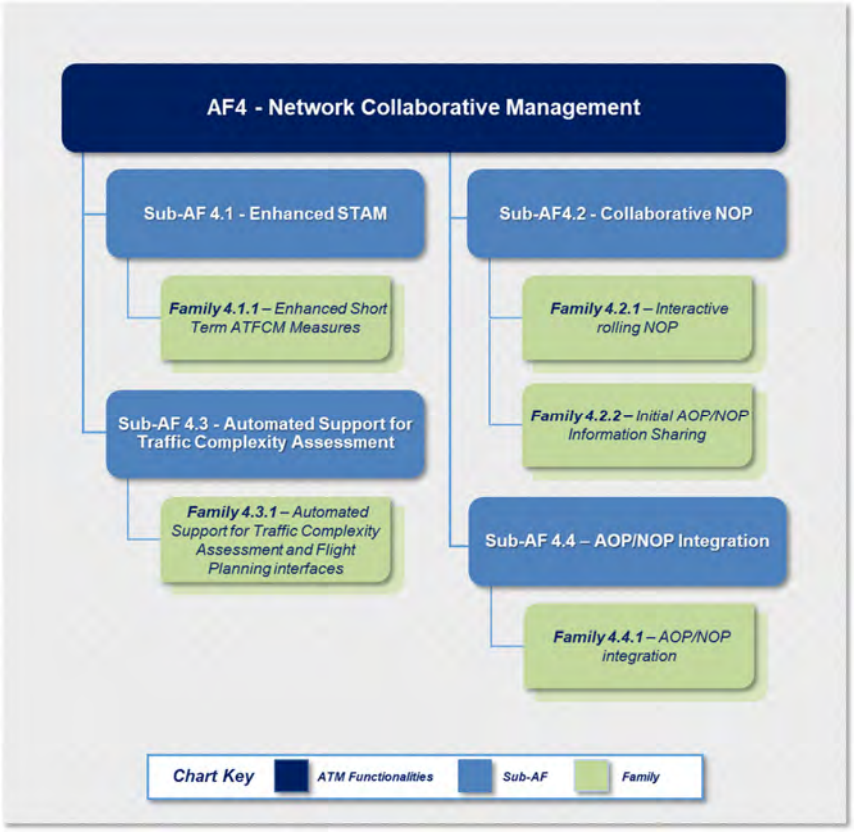

Figure 17 - AF4 Work Breakdown Structure

Network collaborative management should improve the performance of the European ATM network, notably by increasing the airspace capacity and flight efficiency through exchange, modification and management of trajectory information.

This ATM Functionality is composed of four Sub-ATM Functionalities and each Sub-ATM Functionality is addressed by one Family, except Sub-AF 4.2 which is addressed by two Families. The links between the Families and the SESAR Solutions can be found in the table below:

Family	SESAR Solutions	EOC
Family 4.1.1 – Enhanced Short Term ATFCM Measures	Solution #17 “Advanced Short ATFCM Measures (STAM)”	ATM interconnected network
Family 4.2.1 – Interactive Rolling NOP	Solution #20 “Collaborative NOP for Step 1” Solution #18 “CTOT and TTA”	ATM interconnected network
Family 4.2.2 – Initial AOP/NOP Information Sharing	Solution #20 “Collaborative NOP for Step 1” Solution #21 “Airport Operations Plan and AOP-NOP Seamless Integration”	ATM interconnected network

Family	SESAR Solutions	EOC
Family 4.3.1 – Automated Support for Traffic Complexity Assessment and Flight Planning Interfaces	Solution #19 "Automated support for Traffic Complexity Detection and Resolution" PJ.18-02C "eFPL Distribution to ATC" Solution #37 "Extended Flight Plan"	ATM interconnected network
Family 4.4.1 – AOP/NOP Integration	Solution #21 "Airport operations plan and AOP-NOP seamless integration" Solution #20 "Collaborative NOP for Step 1" Solution #18 "CTOT and TTA"	ATM interconnected network

3.4.2. Deployment Approach and Synchronisation Needs

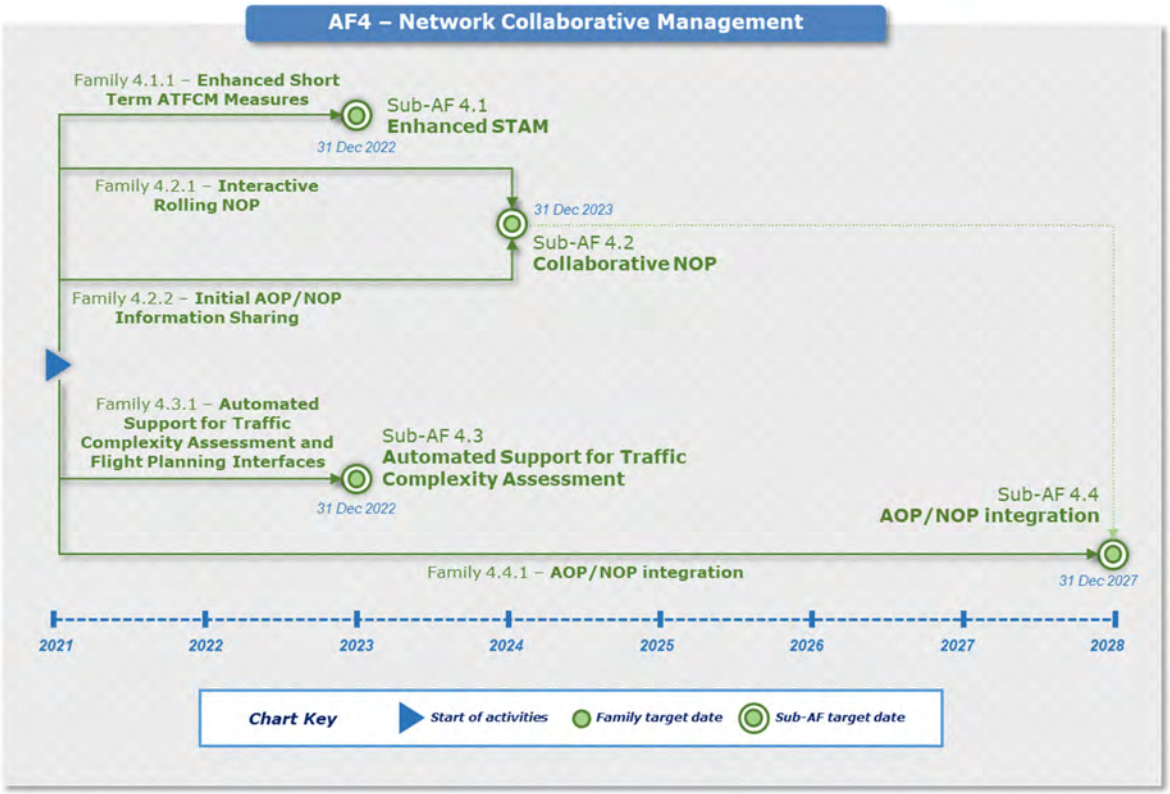

Figure 18 - Deployment Approach

The implementation of network collaborative management functionality must be coordinated due to the potential network performance impact of the delayed implementation in a wide geographical scope involving a number of stakeholders.

Network collaborative management is optimising 4D trajectories for the totality of the flight profile for any flight across the EU: in order to have the same level of accuracy and improve the network usage, the synchronisation of the functionality needs to be done in planning between the Network Manager, the airspace users, all the ANSPs of the zone, and the main airports; and between the Network Manager and the ANSP during the execution phase, in coordination with the main airports and airspace users. For some functionality like Flight planning, the coordination needs to be provided at world-wide level via FF-ICE. Network collaborative management also addresses the common network situational awareness for the

benefit of all Network actors, coordinated application of flow measures, restrictions and complexity indicators that require close coordination and synchronised deployments among many operational stakeholders (Network Manager, AU, ANSPs, CFSPs, airports). Finally, the integration of the Airport Operation Plan (AOP) with the Network Operation Plan (NOP) for optimisation and synchronisation of planning for big airports at the network level is paramount to increase the Network performance (see also AF2 synchronisation needs section above).

The Network Manager will provide tools for any usersto be able to interact with it (such as the NOP portal and CHMI), even the non-European or very small airspace users and small airports or not constrained ANSPs.

It is very important that full coordination at requirement level occurs to ensure the data exchange requested by NM would be fully understood and ready by the other stakeholders in time.

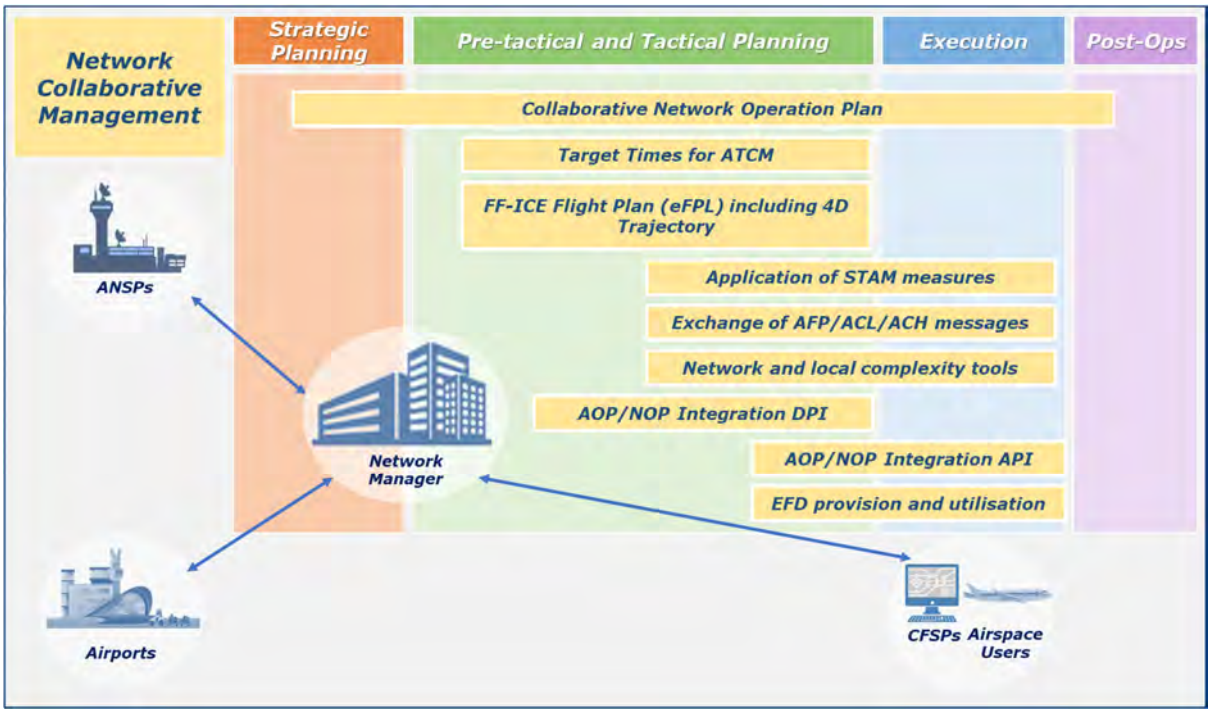

Figure 19 - AF4 synchronisation needs

Synchronisation needs of AF4:

Between Member States	Between air and ground stakeholders	Between civil and military stakeholders
✓	✓	✓

Sub-AF 4.1 – Enhanced Short Term ATFCM Measures

Family 4.1.1 - Enhanced Short Term ATFCM Measures

Target Date	31/12/2022

Description

ATFCM is coordinated at network level by the Network Manager and at local level by the flow management position to support hot-spot detection, execution of Short-Term ATFCM Measures (STAM), network assessment and continuous monitoring of network activity. STAM is established requiring coordination between Air Traffic Control, Airport, Airspace Users, and the Network Manager.

Tactical capacity management using STAM shall ensure close and efficient coordination between ATC and the network management function. Tactical capacity management shall implement STAM using cooperative decision-making to manage flow before flights enter a sector.

Additional tasks relevant to the STAM scope should encompass:

- utilisation of approved STAM concept of operations
- development of operational guidance documentation;
- development of training package;
- development of harmonised operational procedures.

ANSP, AU and airport will apply harmonised operational procedures, taking into account the STAM prerequisites such as the traffic information and flight predictability.

As a minimum, airspace Users should update their flight plans, manage the slot and the mandatory rerouting, but could also provide simple priorities, participate in the CDM process, and manage rerouting proposals.

System requirements

NM systems shall implement the STAM functionalities and shall support the coordination of STAM measures implementation, including Network Impact assessment capabilities.

The STAM tool should include occupancy traffic monitoring values (OTMV), hotspot detection and coordination. The enhancements should mainly focus on:

- enhanced monitoring techniques (including hotspot management and complexity indicators);
- coordination systems (including interfaces with local tools);
- what-if function (local measures, flight based, flow based and multiple measure alternative);
- network impact assessment.

ANSP and AU shall use either NM provided STAM application, or deploy local tools, which shall interact with the NM systems using SWIM services as described in AF5, where and when available, at the latest by December 2025.

Dependencies

- There are interdependencies with Family 1.1.1 Extended AMAN, Family 2.2.1 and 2.2.2 AOP, Family 3.1.1 Flexible Airspace Management, Family 3.2.1 and 3.2.2 Free Route Airspace and Family 5.5.1 Upgrade/Implement Cooperative Network Information exchange
- The Network Manager must support stakeholders mandated to deploy AF4 with the choice of pre-defined online access wherever possible or connect their own applications using system-to-system data exchange. Data exchange between stakeholders mandated to deploy AF4 shall be implemented using System Wide Information Management (SWIM) services when and where SWIM is available. The concerned systems shall be able to provide or utilise SWIM services. Until SWIM is available, existing data exchange technology may be used.

- Family 5.5.1 Cooperative Network Exchange to enhance ANSP/NM systems in order to collaborate on the provision of traffic regulation proposals, on the definition and application of STAM measures, and on ATFCM tactical and pre-tactical updates for the hotspots.

Civil / Military Coordination

Local coordination between civil and military ACC will further optimise the usage of the airspace

Stakeholders impacted	ANSPs, Airspace Users, Network Manager
Geographical scope	Network Collaborative Management shall be deployed by the EATMN.
ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: FCM04.2 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This Family can be exposed to cyber security risks. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. The Stakeholders need to assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

ANSP	**DM1** Develop STAM procedure	Decide, based on specific operational needs, if a local STAM system is required, or whether use of tools provided by NM is sufficient. Develop the associated procedures to ensure ATFCM planning at local level allows the STAM coordination process. This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** The local procedures for STAM have been developed, either with a local tool or NM tool
	DM2a Upgrade and use the local systems	Ensure ATFCM planning at local level allows the STAM coordination process (system based), involving all actors and Procure/Upgrade the local STAM systems, if required and justified with specific operational needs, and develop the connectivity with NM by using the NM B2B Services that support the STAM processes (INAP function). This DM needs to be synchronised between ANSPs, AUs and NM ***Milestone achievement conditions:*** Local STAM tool has been used and connected to NM tool

	DM2b Use of NM STAM application	Use of STAM application and services provided by NM HMI. Additional STAM features as the enhanced monitoring techniques, what-if functionality for local measures and system-based coordination are required. This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** NM STAM tool has been used.
	DM3 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM5 Operational use	Enhanced Short Term ATFCM Measures is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Enhanced Short Term ATFCM Measures is put into service.
AU	**DM1** Follow the validity of the flight plan and ATFM slot vs STAM measure	Follow the implementation of STAM measure either automatically or manually by reception of mandatory rerouting and/or modification of slot. This DM needs to be synchronised between ANSPs, AUs and NM ***Milestone achievement condition:*** The flight has a valid flight plan and the amended slot, if any, is transmitted to the crew.
NM	**DM1** Develop STAM procedures and upgrade the local systems	Update the NM systems and develop the associated procedures so as to ensure that the ATFCM planning at network level supports hot-spot detection, what-if function, STAM CDM, execution of STAM, network impact assessment and continuous monitoring of network activity. ***Milestone achievement conditions:*** Tools supporting STAM are available
	DM2 Provide interface between NM and local tool	Upgrade the NM system to provide the NM B2B Services interfaces necessary to support the local ANSP tool This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:***

		NM B2B Services supporting the local STAM ANSP tool are available
	DM3 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM5 Operational use	Enhanced Short Term ATFCM Measures is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Enhanced Short Term ATFCM Measures is put into service.

Performance impact – Family 4.1.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 4.2 – Collaborative NOP

Family 4.2.1 – Interactive rolling NOP

Target Date	31/12/2023

Description

The rolling view of the network situation and the support to the collaborative processes is based on an information management platform, accessible online by all stakeholders for consultation, (not only passive but including dialogue opportunities) and updated as and when needed, in a secure and tailored way.

An initial implementation of the Interactive Rolling NOP was achieved through the deployment of the NOP Portal. The scope of this Family consists of the implementation of a platform that uses state-of-the-art technologies.

This platform supports the network collaborative rolling processes from strategic to real-time operations, including capabilities for online performance monitoring integrated and feeding back into the collaborative network planning. The platform provides both a workplace tool, as well as system interfaces to allow integration in the stakeholders' own systems. Access to information is provided in a secure way, tailored according to the stakeholders needs, and subject to access control rules, to ensure only those who have an operational need to access particular information are able to do so.

The platform allows building the Rolling NOP through a continuous exchange between the Network Manager and the operational stakeholders.

The Target Time (TT) management is an important part of Collaborative NOP. NM systems shall be able to derive the TT from the trajectory and the constraint and adjust calculated take-off times ('CTOT') based on refined and agreed TTs. NM shall assess the network impact of TT proposals, facilitate the coordination process if required, and transmit (updated) CTOT/TT messages to operational stakeholders. This process will be limited to the planning phase and transmission of updated CTOT. Operational Stakeholders need to be capable of receiving and processing these TT's.

ANSPs/AUs might foresee some adaptation of their systems for the reception and handling of TTs. Where agreed, TT information will be used by flight crew and ATC in executive operations.

System requirements

For NM:

- Provision of the NM technical platform and services for supporting collaborative NOP;
- Development of required NM B2B Services;
- Develop procedures handling the collaborative NOP updates (e.g., capacities values, runway configurations);
- Provision of TT by slot allocation and revision messages.

For ANSPs, Airports and AUs:

- Use of NM technical platform and services for supporting collaborative NOP;
- Use of the NM B2B Services (if required) for interaction with collaborative NOP;
- Develop procedures to provide updates to collaborative NOP (e.g., capacities values, runway configurations);
- Reception and handling of TT for ATFCM purposes.

Dependencies

Family 3.1.1 will be enhanced by the Interactive Rolling NOP.

Families 4.2.2 AOP/NOP information sharing, and 4.4.1 AOP/NOP integration will be enhanced by the Interactive Rolling NOP and sharing TTA.

Family 4.1.1 - STAM needs the NM technical platform and coordination with TT originator.

Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM makes available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data.

Family 5.5.1 Cooperative Network Information Exchange, all Family 5.5.1 NM B2B SWIM Services must be used for exchanges.

Civil / Military Coordination

Yes, especially for interface requirement at Network level

Stakeholders impacted	ANSPs, Airport Operators, Airspace Users (CFSP), Network Manager
Geographical scope	The Collaborative NOP shall be implemented by all Network actors (Network manager, ANSPs, AUs, CFSPs, Airport Operators - possibly via AOP/NOP integration) in EATMN.
ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: FCM10 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This Family can be exposed to cyber security risks. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. The Stakeholders need to assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

ANSP	**DM1** Use of NM technical platform and NM B2B service	Utilisation of NM technical platform for collaborative NOP (for manual access to NM platform) and NM B2B services (if system to system data exchange is deemed necessary) This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** Technical connection to NM platform has been established.
	DM2 Develop and implement procedures for interaction with the NOP	Definition, validation and deployment of the new/changed operational procedures related to information updates to collaborative NOP This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** Operational procedures for the interaction with the NOP have been established.

	DM3 Adapt systems to receive TT for ATFCM purposes	Adapt ATC systems for handling of SAM/SRM messages and extraction of Target Times (TTs) This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** Systems have been updated to receive TT
	DM4 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM6 Operational use	Interactive rolling NOP is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Interactive rolling NOP is put into service.
AO	**DM1** Use of NM technical platform and NM B2B service	Utilisation of NM technical platform for collaborative NOP (for manual access to NM platform) and NM B2B services (if system to system data exchange is deemed necessary) This DM needs to be synchronised between AOs and NM ***Milestone achievement conditions:*** Technical connection to NM platform has been established.
AU	**DM1** Implement procedures and processes in reception of Target Time	Receive Target Times and inform the crew This DM needs to be synchronised between ANSPs, AUs and NM ***Milestone achievement conditions:*** Procedures and processes for reception and transmission of TT have been developed and implemented
NM	**DM1** Enhance the NM technical platform and services	The enhancement of NM's technical platform and services will address the following: • Improvement and integration of the different functionalities/interfaces in support of the Interactive Rolling NOP • Improved usability • Technical support for the capabilities required by the other families • Enhancements of post-analysis tools and process ***Milestone achievement conditions:***

		Implementation of technical platform and services upgrades is completed.
	DM2 Develop Network Manager B2B services	Development and implementation of NM B2B Services in support of the information exchanges required by this Family ***Milestone achievement conditions:*** Implementation of additional NM B2B interfaces related to services in DM1 is completed.
	DM3 Implement the Collaborative NOP procedures	Definition, validation and deployment of the new/changed operational procedures related to information updates to collaborative NOP ***Milestone achievement conditions:*** Operational procedures related to information updates to collaborative NOP have been implemented
	DM4 Adapt NM systems to support Target Time sharing	NM to provide the Target Times related to the most penalised regulation as part of the Slot Allocation Message (SAM) sent to ATSUs concerned by the flight and to the airline's Flight Operations Centre. NM to include the Target Times information as part of SAM/SRM messages via the NM B2B Services (e.g., flight updates). This DM needs to be synchronised between ANSPs, AUs and NM ***Milestone achievement conditions:*** Target times have been incorporated into SAM and equivalent NM B2B services
	DM5 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM6 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM7 Operational use	Interactive rolling NOP is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Interactive rolling NOP is put into service.

Performance impact – Family 4.2.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 4.2 – Collaborative NOP

Family 4.2.2 – Initial AOP/NOP Information Sharing

Target Date	31/12/2023

Description

The AOP is a single, common and collaboratively agreed rolling plan available to all airport stakeholders whose purpose is to provide common situational awareness and to form the basis upon which stakeholder decisions relating to process optimisation can be made. The AOP can be implemented in two steps: Initial AOP (iAOP) and Extended AOP, as described in Families 2.2.1 and 2.2.2.

The collaborative NOP is the continuous data exchanges between the Network Manager and operational stakeholder systems in order to cover the entire flight trajectory lifecycle and to reflect priorities as required.

In order to improve the European ATM network performance, notably capacity and flight efficiency through exchange, modification and management of trajectory information, there is a clear need for information sharing between the AOP and the NOP. The initial AOP/NOP integration is the technical data layer for the collaborative NOP information sharing.

The integration of AOP and NOP provides a rolling picture of the network and airport situation used by stakeholders to prepare and update their plans and inputs to the network CDM processes, with a focus on the availability of shared operational planning and real-time data.

The iAOP/NOP integration focuses on exchanging the Arrival Planning Information (API) and Departure Planning Information (DPI) messages between Airports/Airports Operational stakeholders' systems and NM systems; those messages are an add-on to DPI messages currently provided by CDM Airports. The procedures to generate those messages and their detailed contents have to be defined in collaboration between NM and the implementing stakeholders. NM has an implementation work plan with Airports in CEF projects for deployment of the Family.

Stakeholders also impacted are all the other involved airports stakeholders such as but not limited to:

- Aircraft operators
- Ground handlers
- De-icing handlers
- ANSPs
- MET services providers

System requirements

- Network Manager systems shall handle arrival planning information and departure planning information from the iAOP via NM B2B services.
- In Airports, iAOP shall provide arrival and departure planning information to the NOP via NM B2B services. DPI messages might still be provided in ADEXP format until 2025, while P-DPI and API interfaces are available only via NM B2B services. Operational stakeholders ground systems shall be adapted to directly interface with Network Manager systems via NM B2B services.
- Arrival and departure planning information for iAOP/NOP integration consist of the following mandatory messages:
    - P-DPI
    - DPI used in CDM process

- General-API
- The other API messages (e.g., TTO, TTA) are considered for optional deployment in the iAOP/NOP integration

Dependencies

There are interdependencies with:

- Initial AOP as specified in Family 2.2.1 (it contains the basic data elements that are exchanged with the NOP)
- Collaborative NOP and TT for ATFCM purposes as specified in Family 4.2.1 (AOP/NOP information sharing will be enhanced by the information provided via the Interactive Rolling NOP. For Target Time management, TTO/TTA information will be shared with operational stakeholders via API messages)
- Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM makes available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data.
- Family 5.5.1 Cooperative Network Information Exchange, FUM, API and DPI NM B2B SWIM Services must be used for exchanges.

Civil / Military Coordination

Applicable to airports covered by the CP1 regulation where military operations are performed in GAT.

Stakeholders impacted	ANSPs, Airport Operators, Network Manager
Geographical scope	Network collaborative management shall be deployed in the EATMN. 'Collaborative NOP' shall be implemented at the following airports list: • Adolfo Suárez Madrid-Barajas; • Amsterdam Schiphol; • Barcelona El Prat; • Berlin Brandenburg Airport; • Brussels National; • Copenhagen Kastrup; • Dublin; • Düsseldorf International; • Frankfurt International; • Milan-Malpensa; • Munich Franz Josef Strauß; • Nice Cote d'Azur; • Palma De Mallorca Son Sant Joan; • Paris-CDG; • Paris-Orly; • Rome-Fiumicino; • Stockholm-Arlanda; • Vienna Schwechat.
ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected Network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: FCM11.1 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	Exchanges between iAOP systems and NM systems are through NM B2B services, compliant with SWIM TI Yellow Profile, security protocols are defined there.

Family Deployment Approach[19]		
ANSP	**DM1** Arrival and Departure Plan Information implementation	ANSP in coordination with NM, AO and all relevant local implementing stakeholders have to coordinate on procedures and content related to the content of API and DPI messages. ANSP has to ensure collection and integration of data with all airport's operational stakeholders, as necessary. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** API and DPI content and procedures have been agreed and data for those messages has been integrated into the system.
	DM2 Implement Network Manager B2B services	ANSP technically implement the creation and exchange of API and DPI messages in their local system via NM B2B Services. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** NM B2B services have been implemented in the systems for iAOP/NOP data exchange
	DM3 Data validation	ANSP in coordination with Airport Opertors and NM ensure the validation of API and DPI data performing a process of systems testing of the data exchange. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** Systems have been tested and validated.
	DM4 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed

[19] The milestones listed under this section should be addressed by airport operators as well as air navigation service providers, according to local areas of responsibilities.

	DM6 Operational use	Initial AOP/NOP Information Sharing is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Initial AOP/NOP Information Sharing is put into service.
AO	**DM1** Arrival and Departure Plan Information implementation	AO in coordination with NM, ANSP and all relevant local implementing stakeholders have to coordinate on procedures and content related to the content of API and DPI messages. AO has to ensure collection and integration of data with all airport's operational stakeholders, as necessary. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** API and DPI content and procedures have been agreed and data for those messages has been integrated into the system.
	DM2 Implement Network Manager B2B services	AO technically implement the creation and exchange of API and DPI messages in their local system via NM B2B Services. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** NM B2B services have been implemented in the systems for iAOP/NOP data exchange
	DM3 Data validation	AO in coordination with ANSP and NM ensure the validation of API and DPI data performing a process of systems testing of the data exchange. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** Systems have been tested and validated.
	DM4 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM5	All relevant staff must be duly trained.

	Training	***Milestone achievement conditions:*** Training has been completed
	DM6 Operational use	Initial AOP/NOP Information Sharing is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Initial AOP/NOP Information Sharing is put into service.
NM	**DM1** Develop API and DPI operational requirements	In the context of CDM process, NM in coordination with Airport operational stakeholders develops the requirements for API and DPI messages. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** API and DPI messages requirements have been agreed and developed
	DM2 Enhance the NM technical platform and services for Collaborative NOP	NM develop API and DPI messages and provide improvements upgrades in subsequent NM software releases to incorporate this data into NM services. NM also support the requirements of user interfaces and additional data requirements from other Families (e.g., iAOP data) in the context of Collaborative NOP. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** API and DPI are ready to be integrated into the NM systems
	DM3 Develop Network Manager B2B services	Development and implementation of NM B2B Services in support of the information exchanges required by this Family. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** NM B2B services have been implemented in the systems for iAOP/NOP data exchange

	DM4 Data validation	NM ensures the validation of API and DPI data performing a process of systems testing of the data exchange. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** Systems have been tested and validated.
	DM5 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM6 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM7 Operational use	Initial AOP/NOP Information Sharing is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Initial AOP/NOP Information Sharing is put into service.

Performance impact – Family 4.2.2:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 4.3 – Automated Support for Traffic Complexity Assessment

Family 4.3.1 - Automated Support for Traffic Complexity Assessment and Flight Planning interfaces

Target Date	31/12/2022

Description

The Traffic Complexity tool continuously monitors and evaluates current and expected traffic loads and estimates the impact of traffic complexity on controllers' workload.

The predicted complexity enables ATFCM to take timely action to adjust capacity or request the traffic profile changes in coordination with the Network Manager, ATC and airspace users.

The rigid application of ATFCM regulations based on standard demand thresholds as the pre-dominant tactical capacity measure needs to be replaced by a dynamic working relationship between ANSPs and the Network Manager, which evolves towards monitoring of the real controller's workload, the resulting sector capacity and their dynamic management.

As the Trajectory predictability is crucial for complexity management, this Family also addresses the FF-ICE Release 1 implementation and message exchange between NM systems and operational Stakeholders in respect of collaborative flight planning, improving flight plan distribution and enhanced tactical flow management.

This encompasses the exchanges of following messages between NM systems, ATC systems and AU systems such as:

- ATC Flight Plan Proposal (AFP);
- ATC Flight Plan Change message (ACH);
- ATC Flight Plan message (APL);
- eFPL based on FF-ICE;

ANSPs will provide the automatic AFPs in cases of tactical trajectory changes and process the APL/ACH data from IFPS. The NM system needs to integrate the automatic AFPs from ATC systems. The eFPL will include the 4D trajectory of the flight, as well as flight performance data, in addition to ICAO 2012 FPL data. The first phase should address only the exchange of eFPL between AUs and NM.

The eFPL's distribution will be exploited when ANSP's transition to FF-ICE provisions is achieved, transition that is not considered as mandatory within this Family.

System requirements

Concerning the traffic complexity tools, it is suggested that ANSPs develop the concept for the complexity tools utilisation before considering the procurement/upgrades of ATM systems with this functionality.

ANSPs have two options:

- Use NM tools and systems
- Develop and install a local traffic complexity tool and connect with NM via the NM B2B Services;

The system requirements below are related to the second option of local traffic complexity tool:

- The Traffic Complexity tool continuously monitors and evaluates current and expected traffic loads and estimates controller's workload.
- It provides a support in the determination of solutions in order to plan airspace, sectors, and staff to handle the predicted traffic. It is suggested that ANSPs develop a concept for the complexity tools utilisation before considering the procurement/upgrades of ATM systems with this functionality;

- The local complexity tools need to receive, process and integrate the EFD (or the NM B2B Services flight updates) provided by NM. This is required in order to supplement the local traffic counts with the flight plan data from ETFMS;
- Additionally, the use of the NM B2B Services for the reception/processing of NM traffic counts and for the provision of traffic monitoring values to NM might also need to be envisaged;

The NM systems adaptation activities:

- Deal with improving the quality of the planned trajectory (processing of tactical ATC information, processing of eFPL, support to mixed mode operations, implementation of traffic count methodologies that do not impact trajectory calculation) thus enhancing NM complexity assessment.
- Implementation of tools in support of traffic complexity will rely on the planned trajectory and allows simulating options optimising the use of available capacity. This will help NM operations identify possible mitigation strategies to be applied at network or local level, in coordination with FMPs and airspace users if applicable.
- eFPL: NM systems shall be upgraded to support FF ICE/Release 1 services Filing Service and Trial Service.

AFP, APL and ACH

- ANSPs automatically provide AFP message to NM for the events referred to in the appropriate documentation and agreed between operational stakeholders and NM.
- The local ATC system shall be capable of processing APL and ACH messages sent by IFPS in order to exploit the full benefits of AFP distribution to NM.
- NM systems shall integrate the received AFP and provide APL/ACH messages.

Dependencies

- The scope of Families 3.1.1 and 3.1.2 will be enhanced by the traffic complexity tools.
- Families 3.2.1 and 3.2.2 will be enhanced by the interface of ANSP/AU systems with NM systems.
- Relationship with Family 4.1.1 as the complexity assessment will facilitate the resolution of overload, hence increase efficiency of STAM measure.
- Relationship with Family 4.4.1 concerning the interfaces of NM system with ATC systems and AOP/NOP integration. The provision of enhanced trajectory data will improve flight plan management.
- Families 3.2.1 and 3.2.2 Upgrade of ATM systems (NM, ANSPs, AUs) for FRA will be enhanced by the traffic complexity tools. Family 5.5.1 Cooperative Network Exchange; Flight NM B2B SWIM services;
- Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM makes available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data when available, at the latest by December 2025.

Civil / Military Coordination

Coordination is required depending on civil/military ATS organisation

Stakeholders impacted	ANSPs, Network Manager
Geographical scope	Automated Support for Traffic Complexity Assessment and Flight Planning interfaces must be implemented in the EATMN

ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: FCM06.1 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	This Family can be exposed to cyber security risks. It is therefore necessary to conduct a proper risk-based security assessment prior to any system update. The Stakeholders need to assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

ANSP	**DM1** Automatically provide AFP for airborne flights	Automatically provide IFPS with updated flight plan information on airborne flights by means of AFP message related to missing flights, change of route, diversion, change of flight rule, flight type, A/C type and equipment. This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** AFP messages are automatically provided to NM.
	DM2 Processing of APL and ACH messages	ATC systems automatically process the real time updates to flight plan information as provided by IFPS via APL and ACH messages. ***Milestone achievement conditions:*** APL and ACH messages are automatically processed.
	DM3a Use NM systems for traffic complexity management	Instead of procuring a separate traffic complexity tool, some ANSPs may opt to use the existing tools provided by NM (in the context of Network Collaborative Management) for the decomplification of traffic situation within their AoR. This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** NM complexity tool is used.
	DM3b Implement Local Traffic Complexity tool	Implement a local automated tool to support the continuous monitoring of the traffic loads for each network node (sector, waypoint, route, route segment) according to declared capacities, assess the current and future sector plans, and provide support to the local resource management. If deemed necessary, "sector" may include APP and/or TWR sectors. ***Milestone achievement conditions:*** Local complexity tool is implemented.
	DM4b Process and Integrate EFD for	The local traffic complexity tool to receive, process and integrate ETFMS Flight Data (EFD) or the flight data available via the NM B2B publish/subscribe mechanism. This activity is

	Local Traffic Complexity Tool	required to supplement the local traffic count with the flight plan data from ETFMS. This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** EFD data (the flight data available via the NM B2B publish/subscribe mechanism) are processed and integrated in the local complexity tool.
	DM5 Local Traffic Complexity procedures	Develop and implement local traffic complexity procedures ***Milestone achievement conditions:*** Local complexity procedures are developed and implemented.
	DM6 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM7 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM8 Operational use	Automated Support for Traffic Complexity Assessment and Flight Planning interfaces is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Automated Support for Traffic Complexity Assessment and Flight Planning interfaces is put into service.
NM	**DM1** Implement Traffic Complexity supporting tools	Implementation of tools in support of traffic complexity management in the pre-tactical phase. It is intended to support NM operations by identifying the possible mitigation strategies to be applied at network or local level, in coordination with FMPs and airspace users. This DM needs to be synchronised between ANSPs, AUs and NM ***Milestone achievement conditions:*** NM traffic complexity tool is implemented.
	DM2 Provide flight update information	Provide the dynamic flight updates via the EFD and via the NM B2B Services publish/subscribe mechanism to the local Traffic Complexity tool. This DM needs to be synchronised between ANSPs and NM

		Milestone achievement conditions: B2B services providing the dynamic flight updates via EFD is implemented and published to the local complexity tool.
	DM3 Integration of Automatic AFP in NM systems	The NM systems AFP integration activities related to trajectory improvement with ATC tactical updates, thus enhancing flight planning and complexity assessment. NM needs to ensure the correctness of AFP messages by testing and validating them. If the testing is correct, the received AFP messages from a specific ATC unit will be integrated in NM systems. This DM needs to be synchronised between ANSPs and NM ***Milestone achievement conditions:*** AFP messages are integrated in the NM system.
	DM4 Upgrade the NM systems related to FF-ICE Release 1	Upgrade the NM systems with FF-ICE Release 1 filing and trial service and support to mixed mode operations. ***Milestone achievement conditions:*** FF-ICE release 1 filing and trial services are implemented in NM systems
	DM5 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM6 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM7 Operational use	Initial AOP/NOP Information Sharing is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** Automated Support for Traffic Complexity Assessment and Flight Planning interfaces is put into service.

Performance impact – Family 4.3.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 4.4 – AOP / NOP integration

Family 4.4.1 - AOP / NOP integration

Target Date	31/12/2027

Description

As part of the evolution of processes and procedures, new data elements will be shared and also negotiated between AOP and NOP. These will have to be integrated in addition to the information that is shared in the iAOP-NOP exchange (Family 4.2.2). The processes, procedures and underlying concepts for the creation and integration will have to be agreed upon and/or adapted.

This will apply to arrival planning information (e.g., TTO/TTA via API) as well as departure information (e.g., P-DPI based on airport capacity information) and enhanced management of capacities (e.g., diversion capabilities).

System requirements

The Network Manager shall implement an increased integration of NOP and Airport Operations Plan (AOP) relevant information (for example, TTAs) resulting from a Cooperative Decision-Making Process (ref. Article 2.14 of the EC Regulation of the Network Function).

The AOP shall make data available to the NOP in real time; said data will be appropriate and relevant to inform actions by the Network Manager and to adjust capacity in the network where appropriate. Such data shall be mutually agreed by the Network Manager and the Airport.

For airports with AOP, NM shall share the arrival demand with the AOP and establish a collaborative decision-making process at local ATFM level to allow amendments to the TTAs based on the AOP.

AOP systems shall interface directly with the NOP systems:

- The AOP systems must consume and process the flight updates published by NM via the NM B2B Services
- The AOP systems must provide the Extended Departure Planning Information to NM via the NM B2B Services
- The AOP systems must provide the Arrival Planning Information to NM via the NM B2B Services
- If bilaterally agreed between NM and concerned airports, and defined in the respective ICD, the AOP systems should be capable of providing additional airport information (runway configurations, airport performance measurement) to NM.

NM systems shall interface directly with the the AOPs:

- The NM system must be upgraded to process the information provided by the AOP system concerning the Extended DPI and API
- The NM system must provide the necessary flight updates information to the AOP systems
- If bilaterally agreed between NM and concerned airports, and defined in the respective ICD, the NM systems must be capable of integrating additional airport information (runway configurations, airport performance measurement).

Dependencies

There are interdependencies with iAOP/NOP integration (see Family 4.2.2) and with AOP (Families 2.2.1 and 2.2.2)

Family 5.6.1 Flight Information Exchange: FF-ICE/R1 services over SWIM makes available AUs' detailed 4D runway-to-runway trajectory (including free route segments) and flight-specific performance data when available, at the latest by December 2025.

Family 5.5.1 Cooperative Network Information Exchange, NOP/AOP integration NM B2B SWIM Service must be used for exchanges.

Civil / Military Coordination

No civil-military coordination foreseen.

Stakeholders impacted	ANSPs, Airport Operators, Network Manager
Geographical scope	AOP/NOP integration shall be implemented at the following airports: • Adolfo-Suarez Madrid-Barajas; • Amsterdam Schiphol; • Athens Eleftherios Venizelos; • Barcelona El Prat; • Berlin Brandenburg Airport; • Brussels National; • Copenhagen Kastrup; • Dublin; • Düsseldorf International; • Frankfurt International; • Hamburg; • Helsinki Vantaa; • Lisbon; • Lyon Saint-Exupéry; • Malaga Costa Del Sol; • Milan-Linate; • Milan-Malpensa; • Munich Franz Josef Strauß; • Nice Cote d'Azur; • Palma De Mallorca Son Sant Joan; • Paris-CDG; • Paris-Orly; • Prague; • Rome-Fiumicino; • Stockholm-Arlanda; • Stuttgart; • Vienna Schwechat; • Warsaw Chopin;
ATM Master Plan reference	Essential Operational Change (EOC): ATM Interconnected network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: FCM11.2 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	Exchanges between AOP systems and NM systems will take place via NM B2B services, compliant with SWIM TI Yellow Profile, security protocols are defined there.

Family Deployment Approach[20]		
ANSP	DM1 Define AOP/NOP integration data and procedures	Coordinate the data that need to be exchanged between AOPs and NOP with Airport's community and the Network Manager. This includes precise definition, purpose, responsibility and procedure to use every data element exchanged. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** A Handbook is published with all the format, definition, purpose and procedure for all the exchanged data, including the performance requirements
AO	DM1 Define AOP/NOP integration data and procedures	Define, together with Airport's community and Network Manager the data that need to be exchanged between AOPs and NOP, coordinating with ANSP. This includes precise definition, purpose, responsibility, and procedure to use every data element exchanged. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** *A Handbook is published with all the format, definition, purpose and procedure for all the exchanged data, including the performance requirements*
	DM2 Prepare AOP for the exchange with NOP	Ensure AOP contains all the required data. Ensure all necessary data is received from NM. Perform data validation and system testing for new NM B2B services. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** *AOP is ready for information exchange.*
	DM3 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed

[20] The milestones listed under this section should be addressed by airport operators as well as air navigation service providers, according to local areas of responsibilities.

	DM5 Operational use	AOP/NOP Integration is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** AOP/NOP Integration is put into service.
NM	**DM1** Define AOP/NOP integration data and procedures	Define, together with Airport's community and the Network Manager the data that need to be exchanged between AOPs and NOP. This includes precise definition, purpose, responsibility and procedure to use every data element exchanged. This DM needs to be synchronised between ANSPs, AOs and NM ***Milestone achievement conditions:*** A Handbook is published with all the format, definition, purpose and procedure for all the exchanged data, including the performance requirements
	DM2 Prepare NOP for integration with AOPs	Ensure integration of new data received from exchange with AOPs into NOP. Perform system testing and data validation. ***Milestone achievement conditions:*** First AOP is integrated with NOP
	DM3 Safety assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** Safety assessment has been developed and delivered to the competent authority.
	DM4 Training	All relevant staff must be duly trained. ***Milestone achievement conditions:*** Training has been completed
	DM5 Operational use	AOP/NOP Integration is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** AOP/NOP Integration is put into service.

Performance impact – Family 4.4.1:

Benefit areas	Capacity	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

3.5. AF5 – SWIM

3.5.1. Work Breakdown Structure and SESAR Solutions

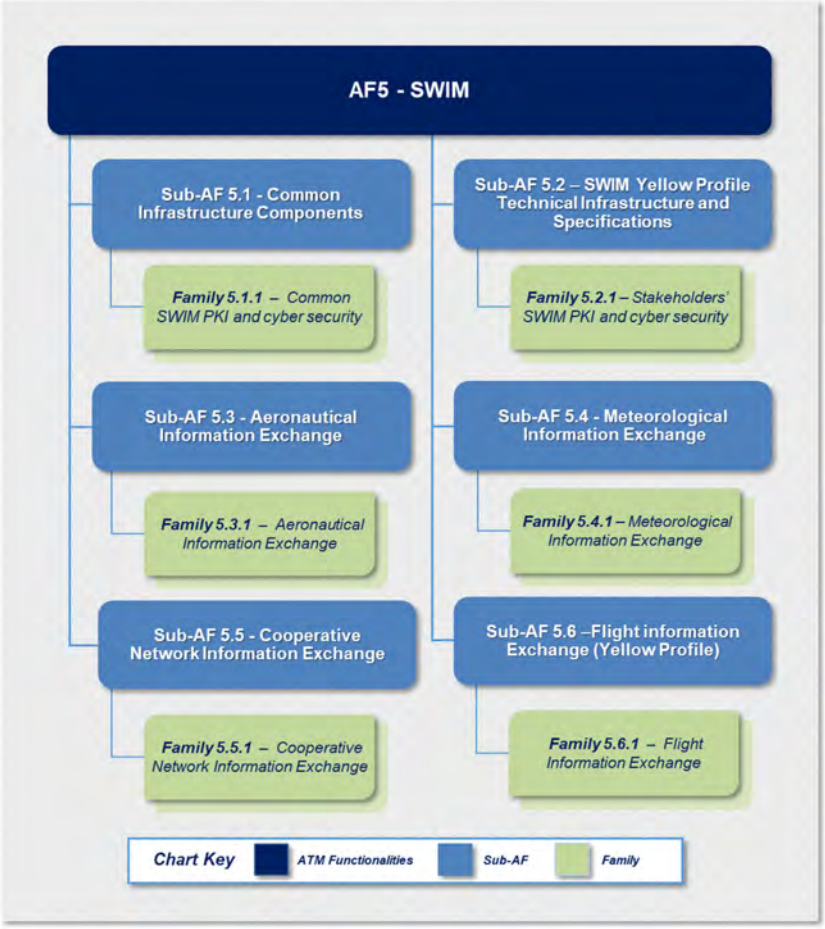

Figure 20 - AF5 Work Breakdown Structure

System Wide Information Management (SWIM) is a global Air Traffic Management (ATM) industry initiative to harmonise the exchange of Aeronautical, Weather, Network and Flight information for all Stakeholders.

SWIM supports implementation of a collaborative network for planning and decision-making. The ATM interconnected network will allow operational stakeholders to participate in CDM processes when timely exchange of information between ATM actors improves a common situational awareness, planning activities and operational performance. SWIM brings standards and best practices in information technology including service-oriented architecture to the European ATM systems, lowering integration costs, enhancing architectural flexibility, lowering complexity and maintenance cost.

This ATM Functionality is composed of six Sub-ATM Functionalities and each Sub-ATM Functionality is addressed by one Family. Given the complexity of this ATM Functionality, which comprises a number of services and dependencies with other ATM Functionalities, the Families under AF5 are broken down into services, which are detailed and described further below. The links between the Families and the SESAR Solutions can be found in the table below:

Family	SESAR Solutions	EOC
Family 5.1.1 – Common SWIM PKI and cybersecurity	Solution #46 “Initial system-wide information management (SWIM) technology solution”	ATM interconnected network
Family 5.2.1 – Stakeholders SWIM PKI and cybersecurity	Solution #46 “Initial system-wide information management (SWIM) technology solution"	ATM interconnected network
Family 5.3.1 – Aeronautical Information Exchange service	Solution #46 “Initial system-wide information management (SWIM) technology solution” Solution #34 “Digital integrated briefing” Digital integrated briefing”	ATM interconnected network Digital AIM and MET services
Family 5.4.1 – Meteorological Information Exchange service	Solution #34 “Digital integrated briefing” Digital integrated briefing” Solution #35 “MET Information Exchange” Solution #46 “Initial system-wide information management (SWIM) technology solution”	Digital AIM and MET services ATM interconnected network
Family 5.5.1 – Cooperative Network Information Exchange service	Solution #46 “Initial system-wide information management (SWIM) technology solution”	ATM interconnected network
Family 5.6.1 – Flight Information Exchange	Solution #46 “Initial system-wide information management (SWIM) technology solution”	ATM interconnected network

SWIM is essential to put interoperable global air traffic management systems in place. With SWIM deployed EU wide, complexity in the information exchanges will be heavily decreased.

SWIM services will enable digitalisation and allow systems to request and receive information when they need it, subscribe for automatic receipt, and/or publish information and services as appropriate. This will allow airspace users and controllers to access the most updated information that may be affecting their area of responsibility in a more efficient manner. SWIM will improve decision-making and streamline information sharing for improved planning and execution.

SWIM will also help to reduce infrastructure costs by decreasing the number of unique interfaces between systems. SWIM will provide a common interface framework, reducing the operation and maintenance costs of current interfaces. New systems will interface with each other via SWIM-compliant interfaces, thereby reducing future data interface development costs.

System-wide information management (SWIM) allows seamless information access and interchange between all providers and users of ATM information and services. SWIM services are a form of interaction between organisations. They are the means by which organisations exchange information with other organisations, thus they enable interoperability between ATM stakeholders. It allows an organisation to automate the access to information or to a particular functionality that is provided by another organisation via an application programming interface (API).

In addition to the implementation of SWIM Services, SWIM Common components are required to provide common capabilities to SWIM Services.

3.5.2. Deployment Approach and Synchronisation Needs

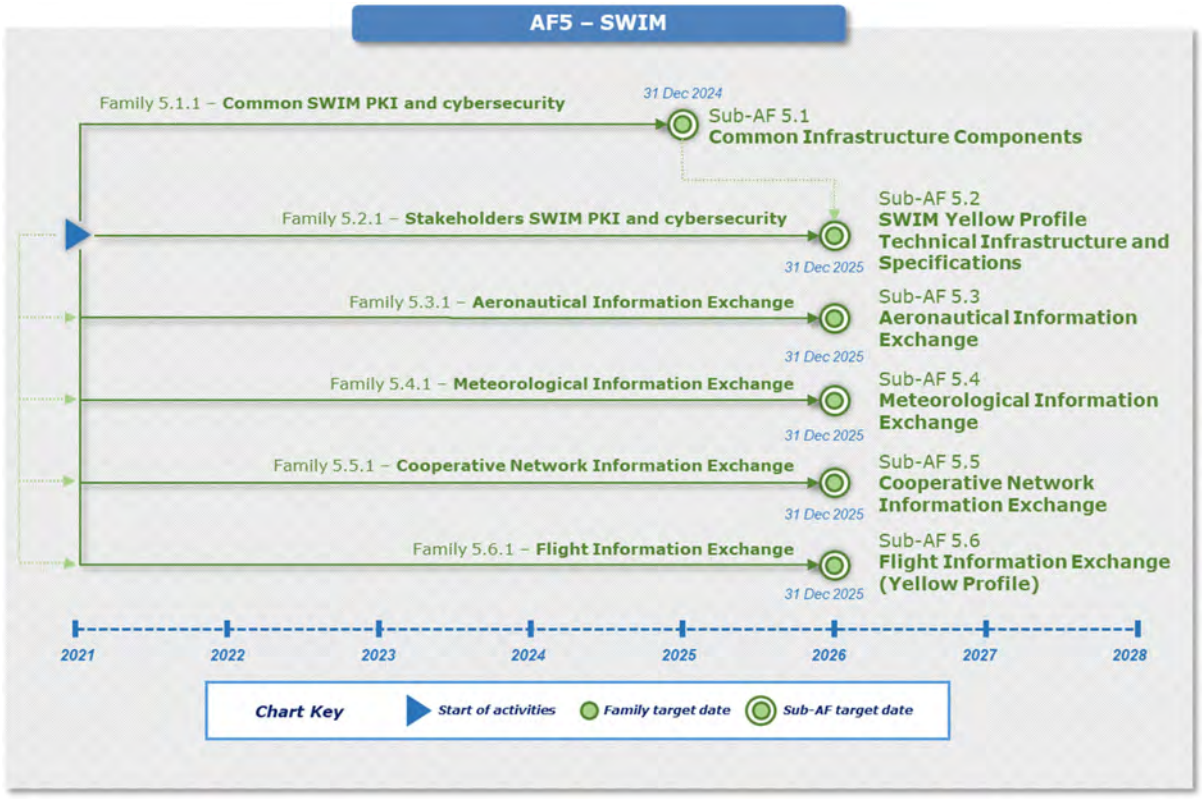

Figure 21 - AF5 Deployment Approach

The Implementation of SWIM services is a transversal activity, which must be coordinated and synchronised as much as possible with all the ATM Functionalities because delays in implementing SWIM compliant data-exchange could potentially impact network performance.

The synchronisation in AF5 shall involve all ATM stakeholders, such as the civil/military air navigation service providers, airspace users for AOC systems (i.e., flight planning, flight monitoring systems), airport operators, MET Service Providers and the Network Manager. Furthermore, synchronisation during the related industrialisation phase must start as soon as possible, in particular among the industry, including the manufacturer and the standardisation organisations. A deployment of the other AFs not using SWIM services in a harmonised way could result in a costly duplication in implementation and/or result in implementations that are not interoperable.

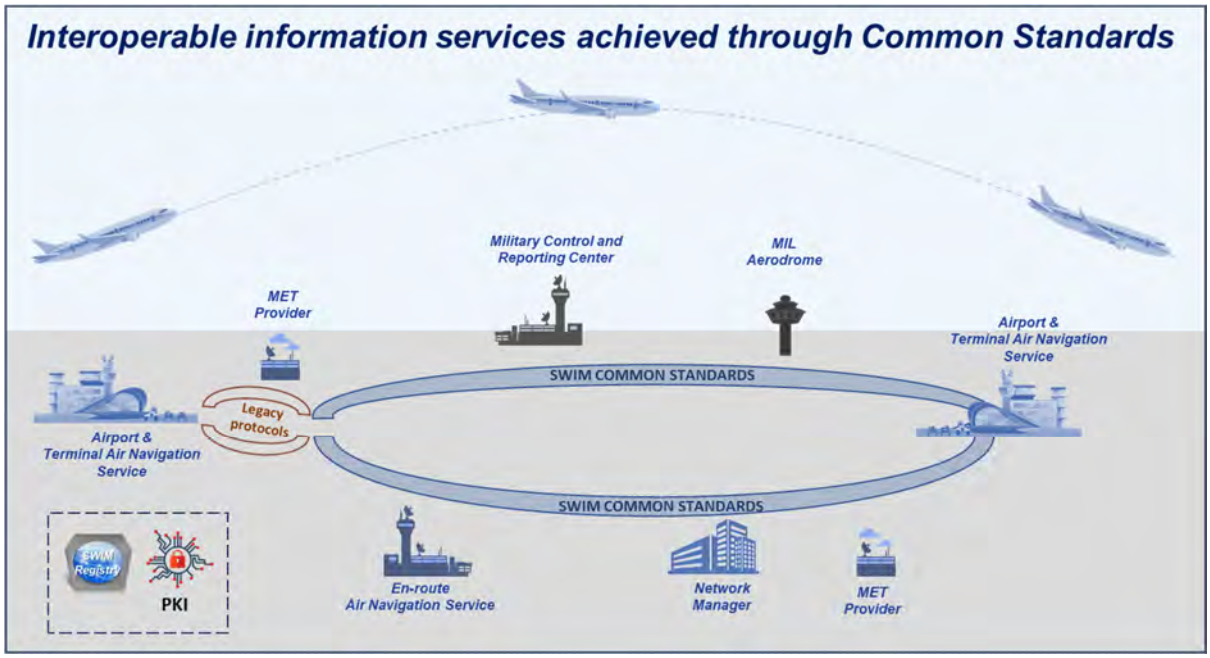

Figure 22 - AF5 synchronisation needs

Before the deployment of European Aviation Common PKI (EACP) certificates and EACP services to all providers and consumers of SWIM services, special security considerations must be taken as an outcome of a security risk assessment, in order to secure operations in the deployment period. Dedicated deployment plans will ensure the continuation of controlled and secure operations.

Synchronisation between all stakeholders providing and/or consuming SWIM services is required, especially in the case of a transition period for the use of digital certificates.

Synchronisation with AF3 and AF4 implementation shall be ensured in order to implement Aeronautical Information services. For services provided by the European Aeronautical Database (EAD), synchronisation will be required between the EAD consumers and providers to ensure the required functionality is available at the right point of time.

Regarding the MET services, synchronisation is required:

- Between MET service providers – some new MET services, particularly those for Network and ATFM applications, will require synchronisation between State designated MET providers, in order to deliver a harmonised and consistent “common weather picture” for the entire European domain. This will ensure the same information is used by NM as is used locally, thereby facilitating common situational awareness between actors in all geographical locations (in Europe) and user types e.g., pilot in the cockpit has the same MET information as the ATC and network.
  From a systems perspective the MET service providers will need to collaborate to ensure accuracy, reliability, accessibility, and seamlessness of these new services.
- Between MET service provider and user – new MET services which go beyond those mandated and described in Annex V to (EU) 2017/373, will require close coordination between users and providers to
  (a) elicit robust and practical user requirements for the MET information and
  (b) for users to understand what MET is available and is appropriate for each user's case. The development of new MET services will therefore require synchronisation between user and provider of MET information to jointly develop integrated systems and services.
- Between Users of MET Information services – in some cases, there is a need for users to synchronise their deployment of systems and processes that utilise MET information services. Specific examples could be ACDM, or Network operations (among many others), whereby sharing the same common information and decision processes will be necessary to maintain maximum efficiently and safety.

Finally, regarding Network Information Exchange, NM must coordinate and support the stakeholders for the deployment of the information exchange with NM via the NM B2B Services.

The Network Manager system must continue to support the legacy information exchanges and be adapted to support the yellow SWIM profile information exchange simultaneously, allowing for a progressive migration of the stakeholders to SWIM.

Synchronisation needs of AF5:

Between Member States	Between air and ground stakeholders	Between civil and military stakeholders
↘	↘	↘

3.5.3. CNS enablers for AF5

System Wide Information Management (SWIM) is a global Air Traffic Management (ATM) industry initiative to harmonise the exchange of Aeronautical, Weather, Cooperative Network and Flight information for all Stakeholders.

Transition to the SWIM environment and the Service Oriented Approach (SOA) are the backbone infrastructure components of the CNS roadmap identified in the ATM Master Plan. SWIM is a key enabler to implement interoperable global air traffic management systems. This means any information provided and/or consumed is relying on the capacity of Communication, Navigation and Surveillance (CNS) Systems to provide data that can easily be processed and distributed to the consumers.

Ground-ground ATM information exchanges will be supported by SWIM services linked to CNS, especially Surveillance and Communication; for instance, ASM (Airspace Management) and ATC (Air Traffic Control) systems will be able to exchange data based on SWIM standards.

Since the scope of the information exchanges over SWIM in this deployment programme is limited to ground-ground exchanges, aircraft originated information is not mandated to be shared over SWIM at this stage.

AF5 REQUIREMENTS AND INTRODUCTION

SWIM Overview

System Wide Information Management (SWIM) is a set of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services. It is identified as one of the main enablers for ATM modernisation. Its implementation is transversal across all systems and data domains since SWIM makes ATM information data accessible and easy to use.

SWIM supports the implementation of a collaborative network for planning and decision-making. The ATM interconnected network will allow operational stakeholders to participate in CDM processes when timely exchange of information between ATM actors improves a common situational awareness, planning activities and operational performance. SWIM brings standards and best practices in information technology including Service Oriented Approach (SOA) to the European ATM systems, lowering integration costs, enhancing architectural flexibility, lowering complexity and maintenance costs.

SWIM Services Implementation

The implementation of SWIM in ATM is achieved by the implementation of SWIM Services.

A SWIM Service is a mechanism that enables interoperability between ATM stakeholders representing different organisations. It allows an organisation to automate the access to information or to a particular functionality that is provided by another organisation via an application programming interface (API).

The implementation of a SWIM Service requires the fundamental role of a service provider responsible for the provision of the service ensuring the service performs as expected and conforms to the SWIM specifications. The implementation role of the service consumer requires the use of the provided service for the intended purpose.

A distinction between the provider of information and the provider of the service that enables the exchange of the information is required. The allocation of the service provision role is the subject of discussion between those exchanging information. Additional details about the responsibilities of the different roles are provided in the SWIM implementation steps section.

SWIM Specifications

In order to realise the benefits mentioned in the overview section, it is fundamental that implemented services conform with SWIM specifications.

There are two types of specifications, 1) the SWIM foundational specifications that are transversally applicable to all SWIM services and 2) the SWIM service definitions that provide requirements for a specific type of service to facilitate harmonisation among multiple implementers of that type of service.

The following list includes all the SWIM foundational specifications:

- EUROCONTROL specification for SWIM Service Description. It contains requirements that prescribe the minimum set of elements a service description has to contain. A service description is the information required to use, or consider using, a service.
- EUROCONTROL specification for SWIM Information Definition. Information definitions are the description of information exchanged by services. The requirements aim at documenting semantic correspondence to the ATM Information Reference Model (AIRM).
- EUROCONTROL Specification for SWIM TI Yellow Profile. It enables technical interoperability by specifying standardised technical interfaces (e.g., protocols) and the capabilities required to enable a reliable, secure, and efficient exchange of information.

The service definitions aim to provide consistency among multiple implementers of the same service type. Service definitions are published in the SWIM Registry. It is expected that, when service implementations start to occur, collaboration among stakeholders will result in commonalities and shared practices that will result in the creation of service definitions to be published in the SWIM Registry.

SWIM Infrastructure

The implementation of services enables interoperability between Organisations that interconnect their systems based on SWIM infrastructure requirements.

The implementation of SWIM as conceived by the foundational specifications in the scope of CP1 does not require a dedicated standalone infrastructure exclusive for SWIM purposes. Implementers are required to use certain communication protocols specified in the TI Yellow Profile specification that provides requirements for the technical infrastructure of other stakeholders that they manage independently.

The implementation of SWIM requires network connectivity among its stakeholders. This is realised based on private/public Internet Protocol (IP) networks. The network layer is considered outside the scope of SWIM; however, it is a mandatory pre-requisite for its implementation.

SWIM Common Components

In addition to the implementation of SWIM Services, SWIM Common components are required to provide common capabilities to SWIM Services. There are two components to be considered specifically during the implementation of SWIM Services:

- SWIM Common PKI. This is a service that enables Digital Certificate Lifecycle Management. When available, at the latest by December 2025, (currently an ongoing project), it will provide more efficient integration and management of the digital identities that are used to consume and provide SWIM services.
- SWIM Service Registry. This is a directory of information that supports the discovery of SWIM services. An EU SWIM Service Registry has been implemented and shall be used by the stakeholders to register their services.

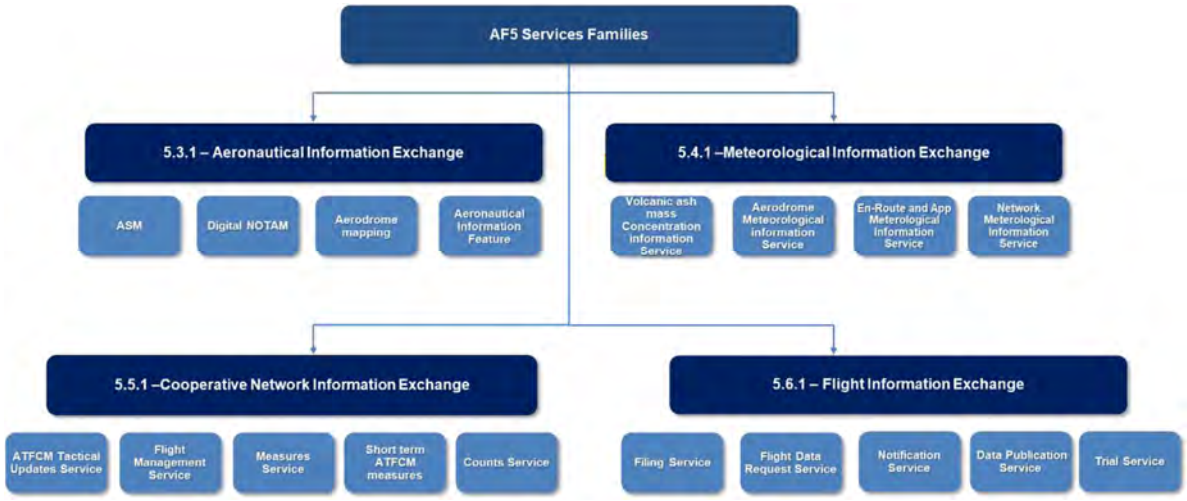

Figure 23 - AF5 Services Families

SWIM Implementation Steps

The following table is meant to provide step by step guidance to implementers.

Main Scenarios	Scenario 1 Adapting an existing service to provide a SWIM Service	Scenario 2 Providing a new SWIM Service	Scenario 3 Consuming a SWIM Service
Role	***SWIM Service provider***	***SWIM Service provider***	***SWIM Service consumer***
Description	In this scenario, the organisation already has an information service. The objective is to adapt an existing service to become a SWIM service. Several steps must be performed by service provider to make the service SWIM compliant.	The potential for providing information services exists. Various technologies are used which create data. However, data exchange is not yet based on information services.	Information service(s) are provided, and service descriptions are available from the European SWIM service registry. A service consumer has an information need, either as a provider or consumer of information, and wants to use the information service that will satisfy this need.
Steps			
#1	**Collect information about the service**; it will be used in a later step to create a service description. The information is based on documentation already available e.g., Interface Control Document (ICD), or documentation accompanying an API.	**Collect information about the intended service.** The information defines what data is to be exchanged and the purpose of the exchange. This analysis also includes assessing the service from a consumer point of view. Any limitations on the use of data must be identified and documented. This milestone also includes defining the overall SWIM implementation project. This step includes identifying other stakeholders that have implemented a similar service and identifying the need for collaboration on a common service definition.	**Collect application requirements describing the information exchange needs.** Finding the required information service depends on matching available information services to the SWIM enabled application information needs, intended function, and performance requirements.
2#	**Applicable SWIM requirements identified.** This activity is aimed at identifying the concrete requirements the service needs to fulfil in order to comply with SWIM requirements. Additional requirements may be applicable according to the type of service. European SWIM Registry must be explored in		**Available SWIM Services are identified.** European SWIM Registry must be explored in order to find matching service(s). The search

	order to find similar services (if any) to use the applicable service definitions.		for existing matching service(s) is based on the requirements defined in the previous step. This activity may trigger reassessment of the expected service requirements if a (perfect) match is not found.
#3	**Adapt and/or document the service in conformance with the EUROCONTROL Specification for SWIM Information Definition.** Conformance requires either using an information exchange model already aligned with the AIRM, providing dedicated evidence of the alignment of the information service payload with the AIRM, or issuing a Change Request to the AIRM.	**Design, document and implement the service** with a special focus on the information that is to be exchanged by the service considering semantic and syntactic interoperability (information exchange structure). This should be documented in conformance with the EUROCONTROL Specification for SWIM Information Definition.	**Implement interface to consume a service.** This may require access control granted by service provider and an agreement among the involved parties.
#4	**Adapt the interface of the service** to use a technical infrastructure that conforms to EUROCONTROL Specification for SWIM TI Yellow Profile.	**Design and implement the interface of the service** to use a technical infrastructure that conforms to EUROCONTROL Specification for SWIM TI YellowProfile.	**Integrate the information and/or functionality provided by the service within the application.**
#5	**Service description and deployment plan completed.** Service validation completed, including integration and validation of data exchange with information providing or consuming systems. The service description needs to conform to the EUROCONTROL Specification for SWIM Service Description.		**Deployment complete.**
#6	**Service deployment completed.** Bring the service into operation and make the service known to SWIM stakeholders using the European SWIM service registry https://eur-registry.swim.aero/		

SWIM requirements

This section consolidates what is expected as tangible outcomes when implementing a SWIM service.

Service Providers are required to deploy information services that:

- Enable the exchange of information in alignment with the intended scope, e.g., Scope as identified in CP1 and further elaborated in the Deployment Programme
- Use communication protocols and implement infrastructure requirements as defined in EUROCONTROL SWIM TI YP specification.
- In case confidentiality, integrity or authenticity is required, use digital certificates
- Are described based on
    - EUROCONTROL Service Description specification
    - EUROCONTROL Information Definition specification
- Conform to published service definitions (if available and applicable)
    - The service provider identifies whether applicable service definitions are publicised in the SWIM Registry and adapts its implementation to conform to this if required.
- Are publicised in the SWIM Service Registry.

Service Consumers are required to consume from information services that:

- Enable the exchange of information in alignment with the intended scope
- e.g., Scope as identified in CP1 and further elaborated in the following sections of Deployment Programme

Sub - AF 5.1 – Common Infrastructure Components

Family 5.1.1 – Common SWIM PKI and cyber security

Target Date	31/12/2024

Description

The Public Key Infrastructure (PKI) and cyber security are dealt with in two separate Families, Family 5.1.1 for the common part covering PKI governance, common PKI infrastructure ensuring regional and global interoperability and cyber security objectives, while Family 5.2.1 addresses the stakeholder implementation.

The scope of Family 5.1.1 is the implementation of the SWIM common components covering cyber security, common PKI, and its governance. This Family addresses the solution to be deployed: the overall European Aviation Common PKI (EACP) and its associated governance, which the local implementations must comply with.

The outcome of this Family must support users from all civil and military stakeholders.

The European Aviation Common PKI (EACP) solution to be deployed will cover:

- EACP operations Key Performance Indicators
- Processes related to signing, emitting, maintaining, and revoking certificates.
- Objectives and requirements for:
  - Confidentiality
  - Integrity
  - Non-repudiation
  - Accountability
  - Authenticity
- Rules and processes for accepting a stakeholder to use the EACP.
- Establishment and tasks to ensure interoperability (regional and inter-regional) via a bridge, cross-certification or certificate trust list.
- Establishment and tasks of a root certification authority.
- Establishment and tasks to validate certificates (Validation as a Service).
- Establishment and tasks to sign information (messages, documents, etc.) (Signing as a Service).

Global coordination to ensure secure information exchange on a world-wide scale is addressed by the contribution of European stakeholders involved in the European SWIM Common PKI project into the ICAO Trust Framework Study Group (TFSG), which aims to define the International Aviation Trust Framework (IATF). IATF aims to provide global services supporting the secure exchanges of aviation information.

The EACP can be operated once the following independent steps are implemented:

- a trust framework, which includes a catalogue/portfolio of services and products, internal governance to manage the EACP service access and delivery, membership criteria per category of users, a business model including an initial cost model, and the associated funding and charging schemes;
- high-level architecture and a set of technical requirements, the technical requirements to be included in a call for tenders (CFT) for the day-to-day operations to be contracted to a commercial PKI provider; the CFT material including the administrative and the technical parts;
- the results of the tests in order to assess the interoperability criteria with other regions PKI solutions.

The users' needs must be collected to select the products and services (and the extent of their use, e.g., number of certificates or interoperability "links") that are necessary as well as the date when they will be required.

Beyond the CP1 scope, non-European users such as Airspace Users (AUs) should be able to connect to protected European aviation services thanks to digital certificates, as the ones already existing for EUROCONTROL Network Manager B2B services.

System requirements

The European Aviation Common PKI proposed as an outcome of the SWIM Common PKI project must be compliant with established guidelines and industry standards for Public Key Infrastructure and the use of digital certificates (e.g., X.509 digital certificates). Furthermore, the use of digital certificates for aviation, the implementation must be following ICAO recommendations. Interoperability with major stakeholders on global level, e.g., FAA, must be ensured though prototype tests of target architecture and certificate structure.

The SWIM Common PKI project will develop all the necessary material for its users to adapt their systems in order to subscribe, use and benefit from the EACP solution.

A Trust Framework will be developed by the SWIM Common PKI project to allow the EACP solution to be governed and operated in an effective and satisfactory manner.

To use the EACP solution and commit to its rules, this Trust Framework will include all the elements (e.g., membership criteria, agreements, procedures) necessary for:

- Members (using the EACP Solution and involved in its governance),
- Users (simply using EACP certificates and its associated services) or
- Relying parties (simply using EACP validation service).

The funding scheme to operate EACP solution and the charging scheme to access and use EACP must be approved by the stakeholders concerned.

A deployment project to operate the EACP solution will have to conduct the following main actions:

- Set-up the EACP governance and operate it e.g., manage the membership, activate the agreed funding mechanisms, ensure the financial balance, manage the connections with non-European PKI solutions, manage the contractor, re-tender the day-to-day operations periodically, represent EACP in the International Aviation Trust Framework, manage the evolutions of the EACP solution;
- Using the CFT material developed by the 5.1.1 SWIM Common PKI project, launch a CFT, select a winner and sign a contract with the provider of the EACP day-to-day operations;
- Operate and manage the performance the EACP Solution (e.g., provide the EACP services in accordance with the Key Performance Indicators, collect users feedback).

Dependencies

All Stakeholders providing and/or consuming SWIM services must make use of digital certificates in order to ensure the information exchanged can be trusted and the information exchange parties are authenticated. This includes the use, at stakeholder level, of EACP certificates and certificate validation services, either EACP validation service or local implementation, as described in AF 5.2.1 Stakeholders' SWIM PKI and cyber security.

Civil / Military Coordination

It is recommended that data security and confidentiality is managed as an integrated requirement.

Stakeholders impacted	ANSPs[21], Airport Operators, Airspace Users[22], MET Service Providers, Network Manager
Geographical scope	SWIM services must be deployed in the EATMN (European Air Traffic Management Route Network).

[21] Military authorities included
[22] Military authorities included

ATM Master Plan reference	Essential Operational Change (EOC): • ATM Interconnected Network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: none
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them. These risk assessments and the resulting mitigations need to be documented.

This Family implements a common component for all stakeholders, therefore only one deployment project supported by all stakeholders can undertake this task. The milestones below are applicable to all stakeholders participating in the deployment project (Refer to system requirements) related to this Family to operate the European Aviation Common PKI.

Family Deployment Approach		
All stakeholders concerned[23]	**DM1** Trust framework agreed	Implementation of a trust framework that includes a catalogue/portfolio of services and products, an internal governance to manage the EACP service access and delivery, membership criteria per category of users, a business model including an initial cost model and the associated funding and charging schemes. It is coordinated and therefore consistent with ICAO/TFSG and its IATF solution. This DM needs to be synchronised between civil and military ANSPs, AUs, AOs, NM, MET and AISPs. ***Milestone achievement conditions:*** The trust framework is completed and released.
	DM2 Interop tests completed	Complete the tests using demonstrators to assess the interoperability criteria with other regions PKI solutions. This DM needs to be synchronised between civil and military ANSPs, AUs, AOs, NM, MET and AISPs. ***Milestone achievement conditions:*** Document Test Report is available
	DM3 CFT material available	Complete the material (technical and administrative) necessary to launch a Call for Tenders for the day-to-day operations of the EACP solution. This milestone also includes both award criteria and project internal award scoring tools. This DM needs to be synchronised between civil and military ANSPs, AUs, AOs, NM, MET and AISPs. ***Milestone achievement conditions:*** CFT is ready for publication
	DM4	Award and sign contract with the provider of the EACP.

[23] Milestones covered by the European Common PKI project

	Day-to-day operations contract signed	This DM needs to be synchronised between civil and military ANSPs, AUs, AOs, NM, MET and AISPs. ***Milestone achievement conditions:*** A contract is signed.
	DM5 Operational use	The EACP solution is operational. Provide a set-up acceptance report to ensure compliance with the requirements (including conformance with required standards). ***Milestone achievement conditions:*** The EACP is put into service

Performance impact – Family 5.1.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety[24]	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

[24] PKI is mainly supporting security

Sub - AF 5.2 – SWIM Yellow Profile Technical Infrastructure and Specifications

Family 5.2.1 – Stakeholders' SWIM PKI and cyber security

Target Date	31/12/2025

Description

This Family deals with the Stakeholders' SWIM PKI and cyber security while Family 5.1.1 covers governance and cyber security objectives. This aim of this Family is implementing basic/generic public key infrastructure management at each civil or military stakeholder in line with their own Security Management System approved by their National Supervisory Authority (NSA). The local implementation may differ depending on whether the stakeholders will become a CA (Certificate Authority) themselves or use the European Common Aviation PKI (EACP) as developed by Family 5.1.1 to generate certificates.

The stakeholder's local implementation includes:

- If the stakeholder decides to develop its own PKI:
  - definition of local policies and procedures for authorising and mandating a local organisation to do certificate management in compliance with EACP policies (Family 5.1.1);
  - implementation of audit programmes ensuring continuous compliance with common and local policies and standards;
  - implementation of its own local PKI while benefitting from interoperability with other PKIs by using the EACP solution;
  - adaptation of systems (equipment and procedures) to use local certificates and EACP services.
- If the stakeholder decides to use the EACP solution (Family 5.1.1)
  - Use of EACP policies and procedures for authorising and mandating local organisation to use EACP certificates and services (Family 5.1.1);
  - implementation of audit programmes ensuring continuous compliance with EACP policies and standards;
  - adaptation of systems (equipment and procedures) to use EACP solution;
- Whatever the decision will be, the following activities must be operated:
  - training of technical personnel if in scope of (EU) 373/2017;
  - monitoring and control, e.g., establish a local or multi-stakeholders Security Operations Centre (or equivalent) to monitor and protect IT systems against cyber-attacks.

System requirements

Stakeholders shall implement a Public Key Infrastructure (PKI) on the one hand and cyber-security monitoring and control means on the other. To implement the PKI, stakeholders have two main options:

The first option consists of using the EACP solution defined by Family 5.1.1 that will be deployed by the project in charge of its governance and operations. In such case, stakeholders must:

- define the local framework to use digital certificates (policies, procedures);
- implement audit programmes to ensure their organisation and its policies & procedures are auditable and that they can consequently be trusted to use EACP certificates and thus be trusted by parties with whom information exchanges are secured using EACP digital certificates;
- adapt their systems to use the EACP solution (e.g., access to EACP certificate publication and validation services);
- train their staff to ensure they have the required demonstrated level of competence to use EACP digital certificates and services.

The second option consists of deploying their own local PKI and to only benefit from the EACP solution to ensure the interoperability of their local PKI with other stakeholders. In such case, stakeholders must:

- define the local framework to deploy their local PKI (policies, procedures). If stakeholders want to benefit from the EACP interoperability and validation services, they will have to ensure the policies and procedures of their local PKI are also compliant with EACP framework trust framework;
- implement audit programmes to ensure their organisation and its policies & procedures are auditable and that they can consequently be trusted to benefit from EACP interoperability service and thus be trusted by parties with whom information exchanges are secured using EACP interoperability and validation services;
- adapt their systems to use their local PKI solution as well as EACP validation service;
- train their staff to ensure they have the required demonstrated level of competence to use their local digital certificates and EACP interoperability and validation services.

Combining both options is a valid and acceptable approach (they are not exclusive) as:

- National Regulations may impose the use of a national PKI for critical infrastructure or operator of essential service or government-related organisations;
- some stakeholders may already have a PKI that would have to be upgraded to be auditable and conform with EACP solution and they may wish to keep on using it;
- some stakeholders may decide to implement a local PKI for internal or specific uses and use EACP for other purposes.

With regards to the implementation of cyber-security monitoring and control means, stakeholders will have to define, develop and implement their local solution to ensure they can monitor, detect, analyse, respond and recover from cyber events impacting their systems and services.

Dependencies

In order to achieve interoperability and trust for data exchange between partners in the SWIM environment, all SWIM implementing partners will have to comply with the EACP Trust Framework defined in Family 5.1.1.

Civil / Military Coordination

Yes, civil/military coordination is required when necessary and depending on local organisation.

Stakeholders impacted	ANSPs[25], Airport Operators, Airspace Users[26], MET Service Providers, Network Manager
Geographical scope	SWIM services must be deployed in the EATMN (European Air Traffic Management Route Network).
ATM Master Plan reference	Essential Operational Change (EOC): • ATM Interconnected Network • CNS Infrastructure and services MP Level 3 objectives: • INF10.2
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them. These risk assessments and the resulting mitigations need to be documented.

[25] Military authorities included
[26] Military authorities included

Family Deployment Approach

All stakeholders concerned choosing option A	Option A: Using digital certificates issued by the Common PKI (EACP) on application level	All stakeholders concerned choosing option B	Option B: Using own PKI installation interacting with the Common PKI (EACP)
DM1a Local PKI framework	Use of EACP policies and procedures for authorising and mandating local organisation to use EACP certificates and services (AF 5.1.1) ***Milestone achievement conditions:*** PKI framework is completed	**DM1b** Local PKI framework	Define local policies and procedures for authorising and mandating local organisation to do certificate management in compliance with EACP policies (AF 5.1.1). ***Milestone achievement conditions:*** PKI framework is completed
DM2a Continuous PKI audit process has been set up	Implement audit programmes ensuring continuous compliance with EACP policies and standards. ***Milestone achievement conditions:*** PKI has been audited	**DM2b** Continuous PKI audit process has been set up	Implement audit programmes ensuring continuous compliance with common (EACP) and local policies and standards. ***Milestone achievement conditions:*** PKI has been audited
DM3a Adapt systems to use PKI	Adapt the systems (equipment and procedures) to use EACP solution. ***Milestone achievement conditions:*** System using PKI has been adapted	**DM3b** Adapt systems to use PKI	Adapt systems (equipment and procedures) to use local certificates and EACP services. ***Milestone achievement conditions:*** System using PKI has been adapted
DM4a Training	Training of technical personal is completed. ***Milestone achievement conditions:*** Staff has been certified	**DM4b** Implement local PKI	Implement its own local PKI while benefitting from the interoperability with other PKIs by using the EACP services. ***Milestone achievement conditions:*** System(s) is (are) upgraded
DM5a implement cyber monitoring and control	Implement monitoring and control to protect the IT systems against cyber-attacks ***Milestone achievement conditions:*** Cyber monitoring and control systems implemented	**DM5b** Training	Training of technical personnel is completed. ***Milestone achievement conditions:*** Staff has been certified

All stakeholders concerned choosing option A	Option A: Using digital certificates issued by the Common PKI (EACP) on application level	All stakeholders concerned choosing option B	Option B: Using own PKI installation interacting with the Common PKI (EACP)
		DM6b implement cyber monitoring and control	Implement monitoring and control to protect the IT systems against cyber-attacks ***Milestone achievement conditions:*** Cyber monitoring and control systems implemented

Performance impact – Family 5.2.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety[27]	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

[27] PKI is mainly supporting security

Sub-AF 5.3 – Aeronautical Information Exchange

Family 5.3.1 - Aeronautical Information Exchange

Target Date	31/12/2025

Description

The aim of this Family is upgrading or implementing systems to support the Aeronautical Information Exchange as a service provider and/or service consumer. The services shall be deployed in accordance with the SWIM requirements stated in the introduction section, as well as the system requirements provided in the section below.

Figure 24 - Aeronautical Information Exchange services

The following Aeronautical Information exchange services are to be implemented by operational stakeholders:

Services in support of Airspace Management and Advanced Flexible Use of Airspace

- ASM Level 1 is the strategic level of FUA, with the involvement of relevant civil and military stakeholders. ASM Level 1 establishes airspace structures and defines their conditions of use, it includes the exchange of long-term airspace planning e.g., major exercises and events. The management of airspace structures are applied during pre-tactical and tactical phases;
- ASM Level 2 deals with the pre-tactical reservation of the airspace structures. The following services support the ASM level 2:
  - Airspace Structure Service
    - Management of the AUP/UUP by the local ASM support systems requires the same airspace data to be used by both NM and ASM support systems. The airspace data is available via the NM B2B Airspace Structure Service, which allows it to obtain all the airspace data required (in AIXM 5.1) by the local ASM support systems for the management of the AUP (AIRAC data and the live updates)
  - Airspace Availability Service
    - The Airspace Availability Service, part of the NM B2B Services, allows the local ASM support systems to provide the AUP and its dynamic updates (UUP) to NM in a timely manner. It also allows NM to share the local AUPs/UUPs with all stakeholders involved in the ASM Level 2
    - The Airspace Availability Service, part of the the NM B2B Services, also allows the publication of the consolidated European AUP/UUP (EAUP/EUUP) to all stakeholders, AUs, for use in the flight planning systems
  - Airspace Reservation (ARES) information: this service allows the exchange of information regarding ARES between local ASM support systems and at FAB level, in particular to support cross-border operations

- ASM Level 3 deals with the tactical activation and deactivation of the airspace structures. The following services support the ASM level 3:
  - Notification of the activation of an Airspace Reservation/Restriction (ARES)
  - Notification of the de-activation of an Airspace Reservation/Restriction (ARES)
  - Pre-notification of the activation of an Airspace Reservation/Restriction (ARES)
  - Notification of the release of an Airspace Reservation/Restriction (ARES)
  - Query Airspace Reservation/Restriction (ARES) information

Aeronautical information feature Service

The Aeronautical Information Feature Service provides on-request aeronautical information features as a data service. It allows the query and retrieval of aeronautical data based on optional filters that may include feature type, feature name and spatial, temporal and logical operators.

Airspace users are not mandated by CP1 in AF5 but are recommended to implement an interface that consumes the information provided by the service and to use the information in daily operations.

Aerodrome Mapping Service

The Aerodrome Mapping Service provides on-request airport layout features and maps as a data service. The aim of the service is to deliver Aerodrome digital maps to operational stakeholders.

The service supports information filtering with spatial, temporal, and logical operators. Digital Aerodrome Map can be used to present actual/real-time information about the closure of a runway, taxiway, work in progress on aerodrome movement area, temporary erected obstacles.

Airspace users are not mandated to implement this, but it is recommended that Airspace Users system consume and use the information provided by the Airport Mapping Information Service provided by AISP in daily operations.

Digital NOTAM Service

The Digital NOTAM service provides event (Digital NOTAM) information as a data service. The service enables dynamic data sharing of aeronautical information updates, and to propose them for Digital NOTAM processing.

Digital NOTAM service output is a small data set that contains digitally coded data about changes related to aeronautical information of a temporary nature or provided on short notice. Digital NOTAM data can be formatted into textual or graphical formats for presentation to the end-user. The event information can be shared in a short loop when Digital NOTAM is not necessary but deemed relevant for users accessing SWIM.

CP1	Service
Notification of the activation of an airspace reservation / restriction ('ARES')	ASM: ARES
Notification of the de-activation of an ARES	
Pre-notification of the activation of an ARES	
Notification of the release of an ARES	
Aeronautical information feature on request; filtering possible by feature type, name and an advanced filter with spatial, temporal and logical operators	Aeronautical Information Feature
Query ARES information	ASM: ARES
Digital aerodrome charts	Aerodrome mapping
ASM level 1	ASM: Airspace Structure
Airspace use plans (AUP, UUP), ASM level 2 and 3	ASM: Airspace Availability
Digital NOTAM	Digital NOTAM

System requirements

The stakeholders' systems shall be upgraded to support the Aeronautical Information exchange through SWIM services as described in the introductory section and in conformance with the following system requirements.

System requirements related to the services in support of ASM:

- Local ASM support systems shall exchange ARES information with relevant civil and military stakeholders at local and FAB level via SWIM Services
- Local ASM support systems shall provide the AUP/UUP information to NM via the NM B2B Airspace Availability Service
- Local ASM support systems shall consume the airspace information required for interoperability with NM via the NM B2B Airspace Structure Service
- The AU systems shall use the EAUP/EUUP published by NM via the NM B2B Airspace Availability Service
- The NM system shall make the NM B2B Airspace Availability Service SWIM compliant
- The NM system shall make the NM B2B Airspace Structure Service SWIM compliant
- ATC systems shall consume the information related to real-time activation and deactivation of ARES provided by the local ASM support systems

System requirements related to the Aeronautical Information Feature Service: This service supports consumption of published AIP and AIP SUP data.

The aeronautical information feature exchange shall be implemented by:

- AISPs that are the primary provider of the service[28]
- Airports when aerodrome information is provided by an airport
- ANSPs that are the primary consumers of the service and the information it provides

The provider of the aeronautical information feature service ensures systems implementing the service:

- Shall allow the retrieval of aeronautical information features.
- Shall enable filtering by feature type and name.
- Shall allow advanced filtering based on spatial, temporal and logical operators.
- Shall provide the output expressed in the applicable version of AIXM.

System requirements related to the Aerodrome Mapping Service:

The Aerodrome Mapping information exchange shall be implemented by:

- Airports that are the primary data provider supporting the Aerodrome mapping service. AISPs[29] are the primary provider of the service
- AUs that are the recommended primary consumers of the service and the information it provides

The provider of the Aerodrome Mapping Service ensures that systems implementing the service:

- May allow selecting aerodrome features and maps as GIS layers.
- May allow information filtering with spatial, temporal and logical operators.
- May output data in formats based on Open Geospatial Consortium standards (e.g., simple GML features, SHAPE files, GeoJSON)
- May be based on the AMXM to facilitate GIS integration. Using AMXM will satisfy the related EUROCAE WG-44 Industry standards in terms of data formatting, as referenced in the Supporting Material.

System requirements related to the Digital NOTAM Service: The Digital NOTAM information exchange shall be implemented by:

[28] Airport operators providing aeronautical information services qualified as AISP are covered by this milestone

[29] Airport operators providing aeronautical information services that qualify as AISP are covered by the milestones.

- AISPs that are the intended provider of the service
- Airports that are the originator of the event data
- ANSPs (pre-flight bulletin) that are the intended consumers of the service and the information it provides

The provider of the Digital NOTAM Service ensures systems implementing the service:

- Shall enable the sharing of various event information
- Shall conform to EUROCONTROL Digital NOTAM specification
- Shall output event information encoded in the applicable version of AIXM

Dependencies

Family 5.3.1 is directly linked to Airspace management (ASM) and the FUA concept, which implies a close interdependency with Families 3.1.1, 3.1.2 and 3.2.1.

Furthermore, the full potential of improvement will be fully exploited by liaising with the rolling NOP as described in Family 4.2.2.

Finally, all the above interdependencies are also linked with Family 5.5.1 related to collaborative network information exchange.

Civil / Military Coordination

All ARES and Aeronautical information sharing needs coordination among civil and military stakeholders.

Stakeholders impacted	Aeronautical Information Service Providers (AISP), ANSPs, Airspace Users[30], Network Manager.
Geographical scope	SWIM services must be deployed in the EATMN (European Air Traffic Management Route Network).
ATM Master Plan reference	Essential Operational Change (EOC): • ATM Interconnected network • Digital AIM and MET services MP Level 3 objectives: • INF10.3, INF10.4, INF10.5, INF10.6, INF10.7, INF10.8
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders shall assess the risks and apply appropriate security checks and controls to mitigate them, which includes the implementation of Family 5.2.1 (digital certificates).. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach

Service implementation is the set of activities by which the information service is implemented in a target environment and technology context. Service implementation involves testing and validation.

Milestone achievement conditions

[30] Military authorities included

Aeronautical information exchanges are performed in conformance with the EUROCONTROL SWIM specifications.

The figure below provides a non-exhaustive description of the service providers and service consumers, either civil or military. On ASM, it is understood that these services will be made available to the stakeholders concerned after the civil and military authorities (National/regional Airspace Management Cells) will have coordinated together the national AUP/UUP, in cooperation with the Network Manager.

Service	Service Provider	Service Consumer
ASM: Airspace Availability	NM	ANSP, AU
ASM: Airspace Structure	NM	ANSP, AU (recommended)
ASM: ARES	ANSP	ANSP
Digital NOTAM	AISP	ANSP, AU (recommended)
Aerodrome mapping	AISP/AO (Depends on local Agreement)	AU (recommended)
Aeronautical Information Feature	AISP/AO	AU (recommended), ANSP

Airspace structure service

ANSP

DM1

Adapt local system to use NM airspace structure

The local ASM support system consumes the airspace information required for interoperability with NM via the NM B2B Airspace Structure Service in compliance with the "EUROCONTROL Specification for Airspace Management (ASM) Support System requirements supporting the ASM processes at local and FAB level"

This milestone supports Family 3.1.1 ANSP-DM1a "Deploy automated ASM support systems", ANSP-DM4 "Implement Interoperability of local ASM support system with NM system" and ANSP-DM9 "Adapt ASM system to manage airspace data information aligned with centralised airspace data provided by NM system".

This DM needs to be synchronised between civil and military ANSPs and NM.

Milestone achievement conditions:

The local ASM support system consumes the airspace structure provided by NM in the creation and management of the AUP/UUP

Final validation and preparation for operation.

DM2

Use the NM airspace structure information in operation

This DM needs to be synchronised between civil and military ANSPs and NM.

Milestone achievement conditions:

In operation, the local ASM support system uses the airspace structure provided by NM for the creation and management of the AUP/UUP

NM	**DM1**  Provide the NM airspace structure in support of local ASM systems	The NM system provides the airspace structure information required by the local ASM support systems for the AUP process; this information is provided via the NM B2B Airspace Structure Service, which is to be upgraded to be SWIM compliant This milestone supports Family 3.1.1 NM-DM4 "Provide a centralised airspace data information to support ASM process". This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The NM B2B Airspace Structure Service is SWIM compliant and available in the SWIM Registry as a SWIM compliant service

Airspace Availability Service

ANSP	**DM1**  Adapt/Implement ASM system to Provide the AUP/UUP to NM	The local ASM support system provides the AUP/UUP to NM via the NM B2B Airspace Availability Services This milestone supports Family 3.1.1 ANSP-DM4 "Implement Interoperability of local ASM support system with NM system" This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The local ASM tool provides the AUP/UUP to NM
AU	**DM1**  Consume the pan-European airspace availability information	The AU's flight planning system consumes and uses the European Airspace Use Plan (EAUP) and its updates (EUUP) are published by NM via the NM B2B Airspace Availability Service This milestone supports Family 3.1.1 AU-DM1 "Adapt airspace User's systems for processing EAUP/EUUP information" This DM needs to be synchronised between AUs and NM. ***Milestone achievement conditions:*** The AUs' system consumes and processes the EAUP/EUUP
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:***

		Information Exchanges are used for daily operations
NM	**DM1** Provide the AUP/UUP management services	The NM system provides services for the exchange of AUP/UUP information with the local ASM support systems; these services are part of the NM B2B Airspace Availability Service, which is to be upgraded to be SWIM compliant This milestone supports Family 3.1.1 NM-DM1 "Adapt ASM systems to support a full rolling ASM/ATFCM process" This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The NM B2B Airspace Availability service is SWIM compliant and available in the SWIM as an operational SWIM compliant service
	DM2 Provide pan-European airspace availability information	The NM system provides services for the publication of the European Airspace Use Plan (EAUP) and its updates (EUUP); these services are part of the NM B2B Airspace Availability Service, which is to be upgraded to be SWIM compliant This milestone supports Family 3.1.1 NM-DM3 "Improve ASM notification process" ***Milestone achievement conditions:*** The NM B2B Airspace Availability Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service
ARES		
ANSP	**DM1** Adapt/Implement ASM system to Provide ARES information to local civil/military stakeholders	The local ASM support system provides SWIM services for the exchange of ARES information with civil and military stakeholders at local and FAB level as required in support of ASM level 2 and level 3 processes and procedures and in line with the "EUROCONTROL Specification for Airspace Management (ASM) Support System Requirements supporting the ASM processes at local and FAB level Part II – ASM to ASM system interface requirements" This milestone supports Family 3.1.1 ANSP-DM1a "Deploy automated ASM support systems" ANSP-DM5 "Implement interoperability between ASM support systems to facilitate cross border operations" and ANSP-DM8 "Adapt ASM and ATC systems for automatic ASM data exchanges" This DM needs to be synchronised between civil and military ANSPs and NM.

		Milestone achievement conditions: SWIM compliant services for the exchange of ARES information are provided by the ASM support system.
	DM2 Publish ARES service in the Registry	A description of ARES information services is made available in the Registry. This DM needs to be synchronised between civil and military ANSPs. ***Milestone achievement conditions:*** The ARES information service is available in the SWIM Registry as an operational SWIM compliant service
	DM3 Consume ARES information	The local ATM system, when relevant, consumes ARES information made available via SWIM services by ASM support systems; in particular the ATC systems consume the information concerning the real-time activation and deactivation of ARES This milestone supports Family 3.1.1 ANSP-DM7 "Implement procedures related to real-time (tactical) ASM level III information exchange" and ANSP-DM8 "Adapt ASM and ATM systems for automatic real-time ASM data exchanges" ***Milestone achievement conditions:*** The ATM system consumes ARES information after technical capabilities are validated
	DM4 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
Digital Notam Service		
AISP	**DM1**[31] Provide Digital NOTAM Service	The AISP implements a SWIM Service that enables the provision of Digital NOTAM event information to other stakeholders Link to AF3 only if ARES information is provided by NOTAM This DM needs to be synchronised between civil and military ANSPs, AISPs and AOs. ***Milestone achievement conditions:***

[31] Airport operators providing aeronautical information services qualified as AISP are covered by this milestone

		The Digital NOTAM Event Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service
ANSP	**DM1** Consume Digital NOTAM Service	The system consumes and uses the information provided by the Digital NOTAM Service. Link to AF3 only if ARES information is provided by NOTAM ***Milestone achievement conditions:*** The system consumes the Digital NOTAM Event Service
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations

Digital Aerodrome Mapping information Exchange

AISP[32]	**DM1** Provide aerodrome Mapping information service	The AISP implements a SWIM Service that enables the provision of Aerodrome Mapping information to other stakeholders. This DM needs to be synchronised between civil and military ANSPs, AISPs and AOs. ***Milestone achievement conditions:*** The Aerodrome Mapping Information Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Aeronautical Information Features Exchange

AISP	**DM1** Provide aeronautical information features service	The AISP implements a SWIM Service that enables the provision of aeronautical information features to other stakeholders. This DM needs to be synchronised between civil and military ANSPs, AISPs and AOs. ***Milestone achievement conditions:*** The Aeronautical Information Feature Service is SWIM compliant and available in the SWIM Registry as a SWIM compliant service

[32] Airport operators providing aeronautical information services qualified as AISP are covered by this milestone

ANSP	**DM1** Consume Aeronautical Information Feature service	Implement an interface that consumes the information provided by the service ***Milestone achievement conditions:*** The system consumes the Aeronautical Information Feature Service
	DM2 Operational use	Integrate the information obtained via the service into an application that makes use of it ***Milestone achievement conditions:*** The Operational system uses the Aeronautical Information Feature Service

Performance impact – Family 5.3.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub–AF 5.4 – Meteorological Information Exchange

Family 5.4.1 –Meteorological Information Exchange

Target Date	31/12/2025

Description

The ability to establish a collaborative environment within ATM and to move to Trajectory Based Operations (TBO) depends on the sharing between all operational stakeholders of a similar picture of an environment in which flights operate. It requires a wide range of meteorological information to be shared and made available simultaneously to all ATM actors with minimum delay. The digitalisation of MET services will enable the implementation of SWIM services to provide dynamic meteorological information in digital format. These services will be useable by ATM systems and actors during all phases of flight.

Operational stakeholders will be able to consume operational MET information in IWXXM format when applicable (as of 5 NOV 2020 METAR, TAF, SIGMET, SPECI, VAA, TCA and SWA will be provided in IWXXM format in addition to TAC).

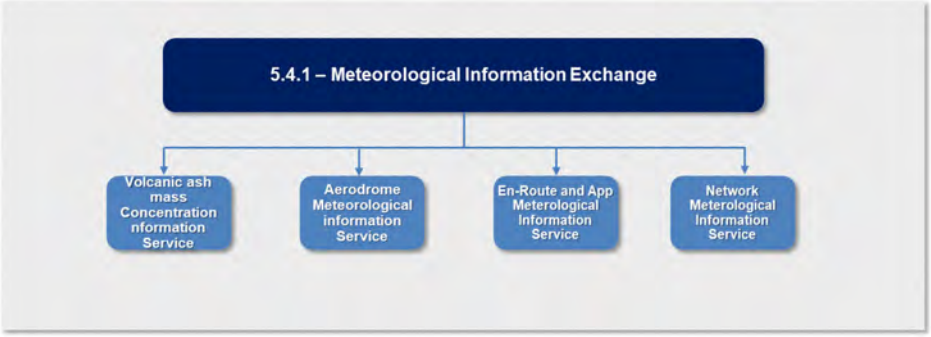

Figure 25 - Meteorological Information Exchange services

The following services shall be implemented by operational stakeholders to support the exchange of meteorological information:

Volcanic Ash Mass Concentration Information Service

The European Volcanic Ash Advisory Centre(s) (VAAC) are ICAO designated centres responsible for the provision of advisory information regarding volcanic ash clouds and are described in chapter 4 of Annex V to (EU) 2017/373. In addition, the centres designated as VAAC(s) also produce volcanic ash concentration information as a supplementary context to aid flight planning and operations during a volcanic ash event.

All volcanic ash advisory information and the supplementary ash concentration information shall be available as a service(s) in compliance with the EUROCONTROL SWIM specifications.

In the scope of CP1, the service shall be implemented to focus on the provision of volcanic ash concentration information. However, other related information concerning an operationally significant volcanic ash event will also be considered when implemented as a SWIM service. Volcanic ash SWIM services will be provided by the designated VAAC(s) and made available to all relevant stakeholders in Europe, including the military. Ideally, all stakeholders that use current VA advisory and VA concentration products will implement the same using the new SWIM service. Volcanic ash service must support exchange of volcanic ash information in IWXXM format when applicable.

Airspace Users are not mandated, but it is recommended that Airspace Users will be able to access and consume the volcanic ash SWIM information services published by the VAACs. This may require

cooperation from any entities that provide flight planning and monitoring functions and that the Airspace Users system uses the volcanic ash information Service.

Aerodrome Meteorological Information Service

The certified MET service provider for the aerodrome will be selected by the relevant competent authority. There may be more than one selected MET service provider for an aerodrome. As a minimum, the aerodrome MET service provider will execute the tasks related to the aerodrome meteorological office, as defined in chapter 2 of Annex V to (EU) 2017/373).

The aerodrome MET service provider(s) will liaise closely with the operational stakeholders at the aerodrome to determine and help define the local needs and requirements for MET information support, specific to that aerodrome. This may (for example) focus on unique weather constraints such as fog, snow, convection etc., or on particular operational constraints such as aerodrome capacity, winter procedures, noise abatement procedures etc., and their dependency on weather.

It shall be recognised that all the stakeholders concerned with the deployment of aerodrome meteorological information service will be involved in the implementation process and their implementation plans and efforts will be synchronised.

In the scope of CP1, the focus of these services is on the integration of existing and/or tailored weather information with operational processes to aid decision-making and improve understanding of the operational impact of adverse weather. An example could be Airport CDM tools. The services will support the operations of search and rescue and military, if deemed necessary by the competent authority.

Services could include only MET information e.g., to be used as input into another system or decision process, or visualisation of information critical to aerodrome operations. Ideally, services will integrate MET information with other types of aerodrome information, as driven by local requirements.

Airspace Users are not mandated to implement this, but it is recommended that Airspace Users be able to access and consume the aerodrome MET SWIM information services published by the certified MET provider(s) at airports. This may include enhanced information services that are agreed locally and that the Airspace Users system use the aerodrome MET information Service(s). It is also recommended that Airspace Users operating from an airport engage in any collaboration between the Airport's users/stakeholders and the MET provider(s) and contribute to the definition of requirements for new advanced MET service(s) to better support operations specific to that airport.

En-Route and Approach Meteorological information Service

The certified MET service provider for the En-route and approach ATC units will be those selected by the relevant competent authority and/or regional air navigation agreement. There may be more than one selected certified MET service provider. The certified MET service provider will be the aerodrome meteorological office, the MWO or WAFC, as defined in Annex V to (EU) 2017/373).

The MET service provider(s) will liaise closely with the operational stakeholders in the approach and En-route domains to determine and help define the needs and requirements for MET information support specific to that area. This may (for example) focus on unique weather constraints such as fog, snow, convection etc., or on particular operational constraints such as runway throughput, winter procedures, noise abatement procedures, free routing, etc. and their dependency on weather.

In the scope of CP1, the focus of these services is on the integration of existing or tailored weather information with operational processes to aid decision-making and improve understanding of the operational impact of adverse weather. An example could be CDO tools. The services will support the operations of search and rescue and military, if deemed necessary by the competent authority.

Services could include only MET information, e.g. to be used as an input into another system or decision process, or visualisation of information critical to aerodrome operations. Examples could be convection/TS risk, or En-Route turbulence. Ideally, services will integrate MET information with other types of aeronautical information, as driven by stakeholder requirements.

Airspace Users are not mandated to implement this, but it is recommended that Airspace Users System be able to access and consume the En-Route and approach MET SWIM information services published by

the certified MET provider(s) at airports. This may include enhanced information services that are agreed locally and use the En-Route and approach MET information Service(s).

Network Meteorological Information Service

The MET service provider(s) will liaise closely with the Network Manager in consultation with ANSP to determine and help define the needs and requirements for MET information support. This may (for example) focus on impactful weather events which affect En-Route flight phases and cross-border or affect the ability of critical/busiest aerodromes to maintain flow rates.

The Network Manager also liaises with other ATM stakeholders and synchronises their implementation plans and efforts according to the deployment programme.

In the scope of CP1 the focus of these services is on the integration of existing and/or tailored weather information with operational processes to aid decision-making and improve understanding of the operational impact of adverse weather. An example could be tools for forecasting the impact of convection on sector management and RAD relaxations, and balancing capacity/demand in adverse weather.

Services could include only MET information, e.g., to be used as the input into another system or decision process, or visualisation of information critical to network personnel briefings. Examples could be convection/TS risk or En-route turbulence. Ideally, services will integrate MET information with other types of aeronautical information, as driven by network requirements.

Airspace Users are not mandated to implement this but may decide to access and use network MET SWIM services. This is not essential, as other MET SWIM services will provide specific information to facilitate safe and efficient flight operations. The NM MET SWIM services will be designed for NM operations and not Airspace Users as consumers.

The service(s) shall comply with the EUROCONTROL SWIM specifications.

CP1	Service
Volcanic ash concentration	Volcanic ash mass concentration information service
Meteorological information supporting aerodrome processes or aids involving the relevant MET information, translation of processes to derive constraints for weather and convert such information in an ATM impact, where the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days	Aerodrome Meteorological Information Service
Meteorological information supporting en-route/approach ATC process or aids involving the relevant MET information, translation of processes to derive constraints for weather and convert such information in an ATM impact where the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days;	En-Route and Approach Meteorological information Service
Meteorological information supporting network information management process or aids involving the relevant MET information, translation of processes to derive constraints for weather and convert such information in an ATM impact where the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days and is implemented at a network level.	Network Meteorological Information Service

System requirements

Volcanic Ash Mass Concentration Information Service

The service(s) will allow for the processing and potential visualisation of safety critical information related to real-time volcanic activity within European airspace and forecasts of anticipated movement and concentration of ash in the atmosphere that is relevant to aviation.

VAACs shall implement service(s) supporting Volcanic Ash Mass Concentration information exchange in case of volcanic eruption and supporting activities provided in EUR/NAT VACP.

Aerodrome Meteorological Information Service

Will be determined by local agreement at the aerodrome. As a minimum, it is expected that the MET information specified in chapter 2 of Annex V to (EU) 2017/373, will be published as SWIM service(s).

En-Route and Approach Meteorological information Service

The system requirements will be developed between MET providers and the ATM users of the MET information by local agreement. As a minimum, it is expected that the MET information specific to this domain, as specified in Annex V to (EU) 2017/373, will be published as SWIM service(s).

Network Meteorological Information Service

The system requirements will be developed between MET providers and NM in consultation with ANSP.

Dependencies

All ATM operational stakeholders are users of weather services. Weather events have a significant impact on airport performance, flight planning and execution, ATC procedures and NM processes. Trajectory optimisation and Synchronisation shall consider the totality of the ATM situation including the actual weather conditions. The integration of weather information in ATM, airport and AU systems are crucial. The implementation of SWIM services will support an exchange of dynamic meteorological information, which will contribute to trajectory-based operations, airport operations, and the collaboration of decision-making at network level.

Therefore, Family 5.4.1 supports all ATM functionalities referred to in AF1 to AF6:

- AF1 Family 1.2.1: AMAN/DMAN
- AF2: airport integration and throughput
- AF3: flexible airspace management and free route (potentially to get information but not in the process itself)
- AF4: network collaborative management
- AF5 Families 5.3.1, 5.5.1 and 5.6.1: aeronautical, flight, cooperative information exchange
- AF6: initial trajectory information sharing

Civil / Military Coordination

Military stakeholders access aviation-MET information from civil sources, either as a supplement to their own more detailed briefing material, or exclusively. Consequently, it will be essential for military users to establish access to aviation MET information via SWIM services as this becomes the international standard replacing text, alphanumeric and graphical MET information.

Additionally, CP1 encourages civil users to introduce new MET SWIM services to support their operations, and many of these will have relevance to military users operating in these domains.

Stakeholders impacted	ANSPs, Airport Operators, MET Service Providers, Network Manager
Geographical scope	To be compliant with CP1, MET SWIM services must be deployed in the EATMN (European Air Traffic Management Route Network). The list of airports in CP1

	should be regarded as those where enhanced MET information services will be considered to offer more detailed decision support. In addition, consideration and publication of new and enhanced supplemental MET information is also encouraged as new MET SWIM Services specific for certain domains or users. These will be developed in cooperation between users and providers.
ATM Master Plan reference	Essential Operational Change (EOC): • ATM Interconnected network; • Digital AIM and MET services; MP Level 3 objectives: • INF10.9, INF10.10, INF10.11, INF10.12
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them, which includes the implementation of Family 5.2.1 (digital certificates).. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach

Service	Service Provider	Service Consumer
Volcanic Ash Mass Concentration Information Service	VAACs and/or other volcanic ash specialist MET providers	ANSPs, NM, AU (recommended), Certified MET providers (MWO, WAFC and other VAACs)
Aerodrome Meteorological Information Service	Certified MET providers and/or other specialist MET providers	ANSPs, AO, and AU (recommended)
En-Route and Approach Meteorological Information Service	Certified MET providers and/or other specialist MET providers	ANSPs, ATFM, and AU (recommended)
Network Meteorological Information Service	Certified MET provider(s) and/or other specialist MET providers	NM, ATFM, AU (recommended) and ANSP

Volcanic Ash Mass Concentration Information Service

ANSP	**DM1** Consume Volcanic Ash Mass concentration service(s) **DM2** Operational use	All ANSPsthat require volcanic ash information will be able to access and consume the volcanic ash SWIM information services published by the VAACs*. ***Milestone achievement conditions:*** The system consumes the volcanic ash information Service The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:***

		Information Exchanges are used for daily operations
MET	DM1 Provide Volcanic Ash Mass service(s)	The designated European VAACs implement SWIM Services for volcanic ash information commensurate with the products listed in chapter 4 of Annex V to (EU) 2017/373, and volcanic ash concentration information service(s). Additional or supplementary volcanic ash SWIM information services may also be considered in this milestone. The services will be available for operational use in the event of a volcanic event within the geographical area of responsibility. This DM needs to be synchronised between civil and military ANSPs, NM, MET and AUs. ***Milestone achievement conditions:*** The Volcanic Ash Service is SWIM compliant and available in the SWIM Registry.
	DM2 Consume Volcanic Ash Mass concentration service(s)	All MET service providers that require volcanic ash information, including those listed in section 3.5(c) of Annex V to (EU) 2017/373) i.e., MWOs and WAFC, will be able to access and consume the volcanic ash SWIM information services published by the VAACs, including ash concentration service(s). ***Milestone achievement conditions:*** The system consumes the volcanic ash information Service
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
NM	DM1 Consume Volcanic Ash Mass concentration service(s)	NM will be able to access and consume the volcanic ash SWIM information services published by the VAACs*. ***Milestone achievement conditions:*** The system consumes the volcanic ash information Service
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations

*In the case of volcanic ash information not specified in chapter 4 of Annex V to (EU) 2017/373, i.e., supplementary volcanic ash concentration, it may be produced by an entity other than the VAACs, so long as the consumer has a documented safety case for its use.

Aerodrome Meteorological Information Service		
ANSP	DM1 Determine and help define requirements for new aerodrome MET information services	The ANSPs at an airport will collaborate with other airport users and the MET provider(s) to jointly define requirements for new advanced MET service(s) to better support operations specific to that airport. As a minimum, this must be done at the airports listed in CP1 Annex section 1.2 This DM needs to be synchronised between civil and military ANSPs, MET and AOs. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Consume aerodrome MET information services	All ANSPs that require aerodrome-MET information will be able to access and consume the aerodrome MET SWIM information services published by the certified MET provider(s) at that airport. This may also include enhanced information services agreed locally under DM1. ***Milestone achievement conditions:*** The system uses the aerodrome MET information Service(s)
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
AO	DM1 Determine and help define requirements for new aerodrome MET information services	The Airport will collaborate with airport users/stakeholders and the MET provider(s) to jointly define requirements for new advanced MET service(s) to better support operations specific to that airport. As a minimum, this must be done at the airports listed in CP1 Annex section 1.2 This DM needs to be synchronised between civil and military ANSPs, MET and AOs. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Consume aerodrome MET information services	All Airports will be able to access and consume the aerodrome MET SWIM information services published by the certified MET provider(s) at that airport. This may include enhanced information services that are agreed locally. ***Milestone achievement conditions:*** The system(s) uses the aerodrome MET information Service(s)
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in

		place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
MET	**DM1** Determine and help define requirements for new aerodrome MET information services	The aeronautical meteorological stations (or other certified MET provider at the airport) will collaborate with airport users to jointly define requirements for new advanced MET service(s) to better support operations specific to that airport. This DM needs to be synchronised between civil and military ANSPs, MET and AOs. ***Milestone achievement conditions:*** The agreed requirements are documented
	DM2 Provide aerodrome MET information services	***Description:*** All aeronautical meteorological stations (or other certified MET provider at the airport) will have their information published and accessible as a SWIM service (either directly or indirectly). This DM needs to be synchronised between civil and military ANSPs, MET, NM and AOs. ***Milestone achievement conditions:*** The Aerodrome MET information service(s) is SWIM compliant and available in the SWIM Registry.
	DM3 Provide enhanced Aerodrome MET information services	Fulfilling the agreed local requirements for advanced MET information support services concluded in DM1, these additional or supplementary aerodrome meteorological information services will be published and accessible as a SWIM service. This DM needs to be synchronised between civil and military ANSPs, MET, NM and AOs. ***Milestone achievement conditions:*** The enhanced aerodrome MET information Service(s) is SWIM compliant and available in the SWIM Registry.
NM	**DM1** Consume aerodrome MET information services	NM will be able to access and consume the aerodrome MET SWIM information services published by the certified MET provider(s) at those airports. This may include enhanced information services that are agreed locally. ***Milestone achievement conditions:*** The system consumes the aerodrome MET information Service(s).
	DM2	The system is used to support daily operations once the systems have been implemented, the procedures are in

	Operational use	place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations

En-Route and Approach Meteorological information Service		
ANSP	DM1 Determine and help define requirements for new En-Route and/or approach MET information services	The ANSPs operating in the En-Route and approach domains will collaborate with each other, AUs and the MET provider(s) to jointly define requirements for new advanced MET service(s) to better support operations specific to that airspace. This DM needs to be synchronised between civil and military ANSPs, MET and NM. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Consume En-Route and approach MET information services	All ANSPs that require En-Route and approach MET information will be able to access and consume these MET SWIM information services published by the certified MET provider(s). This may also include enhanced information services that are agreed locally under DM1 ***Milestone achievement conditions:*** The system(s) consumes the En-Route and approach MET information Service(s).
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
MET	DM1 Determine and help define requirements for new En-Route and approach MET information services	The MWO's and WAFC (or other certified MET provider in the En-Route and approach domains) will collaborate with applicable ANSP users to jointly define requirements for new advanced MET service(s) to better support operations specific to that airspace. This DM needs to be synchronised between civil and military ANSPs and MET. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Provide En-Route and Approach MET information services	All MWO's and WAFC (or other certified MET provider in the En-Route or approach domain) will have their information published and accessible as a SWIM service (either directly or indirectly). This DM needs to be synchronised between civil and military ANSPs, MET and NM. ***Milestone achievement conditions:*** The En-Route and approach MET information Service is SWIM compliant and available in the SWIM Registry
	DM3	Fulfilling the agreed requirements for advanced MET information support services concluded in DM1, these additional or supplementary En-Route or approach

	Provide enhanced En-Route and approach MET information services	meteorological information services will be published and accessible as a SWIM service. ***Milestone achievement conditions:*** The En-Route and approach MET information Service is SWIM compliant and available in the SWIM Registry.
NM	**DM1** Determine and help define requirements for new En-Route and approach MET information services	It is recommended that AU engage in any collaboration between the En-Route and approach users/stakeholders and the MET provider(s) and contribute to the definition of requirements for new advanced MET service(s) to better support operations specific to that airspace. This DM needs to be synchronised between civil and military ANSPs, MET and NM. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Consume En-Route and approach MET information services	NM will be able to access and consume the En-Route and approach MET SWIM information services published by the certified MET provider(s) in these domains. This may include enhanced information services that are agreed locally. ***Milestone achievement conditions:*** The system(s) consumes the En-Route and approach MET information Service(s).
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
Network Meteorological Information Service		
ANSP	**DM1** Determine and help define requirements for new network MET information services	The ANSPs operating in the ATFM, and network domains will collaborate with NM, AUs and MET provider(s) to jointly define the requirements for new advanced MET service(s) to better support operations specific to NM This DM needs to be synchronised between civil and military ANSPs, MET, AUs and NM. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Consume network MET information services	All ANSPs that require network MET information will be able to access and consume these MET SWIM information services published by the MET provider(s). This may also include enhanced information services agreed under DM1. ***Milestone achievement conditions:*** The system(s) consumes the network manager MET information Service(s).

	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
MET	**DM1** Determine and help define requirements for new network MET information services	MET provider(s) will collaborate with NM to jointly define requirements for new advanced MET service(s) to better support operations specific to safe and efficient NM operations. This DM needs to be synchronised between civil and military ANSPs, MET, AUs and NM. ***Milestone achievement conditions:*** The agreed requirements are documented.
	DM2 Provide Network MET information services	All certified MET providers (including those operating in the airport, and En-Route domains) will have their information published and accessible as SWIM services (either directly or indirectly). This DM needs to be synchronised between civil and military ANSPs, MET, AUs and NM. ***Milestone achievement conditions:*** The network MET information Service is SWIM compliant and available in the SWIM Registry.
	DM3 Provide enhanced network MET information services	Fulfilling the agreed requirements for advanced MET information support services concluded in DM1, these additional or supplementary network meteorological information services will be published and accessible as SWIM service(s). This DM needs to be synchronised between civil and military ANSPs, MET, AUs and NM. ***Milestone achievement conditions:*** The enhanced network MET information Service is SWIM compliant and available in the SWIM Registry.
NM	**DM1** Determine and help define requirements for new network MET information services	NM will collaborate with ANSP stakeholders, AUs and the MET provider(s) to jointly define the requirements for new advanced MET service(s) to better support operations specific to NM. This DM needs to be synchronised between civil and military ANSPs, MET, AUs and NM. ***Milestone achievement conditions:*** The agreed requirements are documented by NM.
	DM2	NM will be able to access and consume the network MET SWIM information services published by the certified MET

	Consume network MET information services	provider(s) in this domain. This may include enhanced information services agreed in DM1 ***Milestone achievement conditions:*** NM will be able to access and consume MET SWIM information services in the airport, approach, network and En-Route domains as required operationally. The system(s) consumes the NM Meteorological Information Service
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations

Performance impact – Family 5.4.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub – AF 5.5 – Cooperative Network Information Exchange

Family 5.5.1 –Cooperative Network Information Exchange

Target Date	31/12/2025

Description

The Cooperative Network Information will be exchanged between the systems of the operational stakeholders and the Network Manager by means of cooperative network information SWIM services using the Yellow SWIM TI Profile for Air Traffic Flow and Capacity Management (ATFCM) purposes.

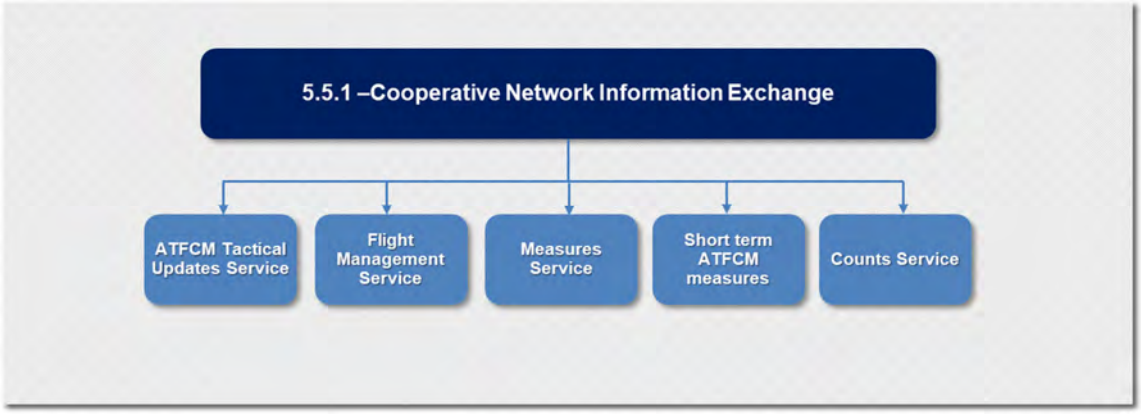

Figure 26 - Cooperative Network Information Exchange services

Operational stakeholders use the NM B2B Services, which support the exchange of the following cooperative network information:

a) Maximum airport capacity based on current and near-term weather conditions

- This information exchange is supported by the ATFCM Tactical Updates Service, which allows the airport capacity values and runway configuration to be updated dynamically.

b) Synchronisation of network operations plan (NOP) and all airport operations plans (AOP)

- This information exchange is supported by the Flight Management Service, which publishes flight information (Flight update messages) and allows the provision of the Predicted Departure Planning Information (P-DPI) and Arrival Planning Information to NM. Of note is that this service also supports the provision of the Departure Planning Information (DPI).

c) Traffic regulations

- This information exchange is supported by the Measures Service, which allows management of regulation proposals and publication of ATFCM measures updates.

d) Slots

- This information exchange is supported by the Flight Management Service, which publishes flight information, including the ATFCM slots for flights subject to regulations.

e) Short-term ATFCM measures (STAM)

- This information exchange is supported by the following three NM B2B Services:
  - The Measure Collaborative Decision Making (MCDM) Service, which supports the collaborative decision making for the implementation of a measure or individual flight actions
  - The eHelpdesk Service, for requesting NMOC to apply actions to individual flights

- The Measures Service, which allows proposals of cherry-picked regulations in support of STAM to be made.

f) ATFCM congestion points

- This information exchange is currently supported by the following NM B2B Services:
  - the Counts Service, which provides data supporting the assessment of the ATFCM congestions and hotspot detection.

g) Restrictions

- This information exchange is supported by the Airspace Structure Service, which allows the publication of restrictions.

h) Airspace structure, availability, and utilisation (Implemented through the Family 5.3.1)

i) Network and en-route approach operation plans

- This information exchange is supported by the ATFCM Tactical Updates Service, part of the NM B2B Services, which allows the dynamic update of the sector configuration plans, capacity values, monitoring values (OTMV), traffic volume activations and runway configurations.

CP1	Service
Maximum airport capacity based on current and near-term weather conditions	ATFCM Tactical Updates Service
Synchronisation of network operations plan and all airport operations plans	Flight Management Service
Traffic regulations	Measures Service
Slots	Flight Management Service
Short term ATFCM measures	• Measure Collaborative Decision Making (MCDM) Service • eHelpdesk Service • Measures Service
ATFCM congestion points	Counts Service
Restrictions	Airspace Structure Service[33]
Airspace structure, availability, and utilisation	Airspace Availability Service[34]
Network and en-route/approach operation plans	ATFCM Tactical Updates Service

System requirements

The Network Manager shall support all operational stakeholders in exchanging data electronically for cooperative network management activities by providing the necessary SWIM services.

Access to NOP *via* the NM HMIs is covered in Family 4.2.2 and 4.4.1. These Families only cover information exchanges between the stakeholders' local systems and the NM system. The Network Manager system and operational stakeholder systems shall be upgraded to support the exchange of information in compliance with the EUROCONTROL SWIM Specifications, either through the Public Internet and/or NewPENS. The choice of communication service depends on a business criticality assessment from where minimum performance requirements are identified.

The list of NM operational services in the scope of 5.5.1 is in the previous section. These NM B2B Services shall be upgraded for compliance with the EUROCONTROL SWIM Specifications.

[33] Implemented through the Family 5.3.1

[34] Implemented through the Family 5.3.1

ANSP systems shall be upgraded to use the NM B2B Services in order to:

- Provide the ATFCM tactical and pre-tactical updates to NM: sector configuration activation, capacity values, runway configuration activation, traffic volume activation (when applicable), OTMVs (when used) and hotspots (when used)
- Propose regulations to NM
- Collaborate on the definition and application of STAM
- Consume flight update information (FUM)
- If applicable, provide the Predicted and normal Departure Planning Information (DPI) to NM
- If applicable, provide the Arrival Planning Information to NM

Airport systems shall be upgraded to use the NM B2B Services in order to:

- Consume flight update information (FUM)
- Provide the Predicted and normal Departure Planning Information (DPI) to NM
- Provide the Arrival Planning Information to NM

AU systems shall be upgraded to use the NM B2B Services in order to:

- Consume Flights updates Including ATFCM Slots provided via Flight Management Service
- Consume Traffic Regulations provided via Measures Service
- Collaborate on the application of STAM

Dependencies

SWIM services enable all other ATM Functionalities but especially the Families below described:

- Family 2.1.1 (Departure Management Synchronised with Pre-departure sequencing), Families 2.2.1 (Initial AOP) and 2.2.2 (Extended AOP), which are interdependent with the Families 4.2.2 and 4.4.1 because the alignment between planned and executed operations at airports is continuously monitored and updated, with changes in departure flows made in real time.
- Families 3.1.1 and 3.1.2 on Dynamic Airspace Management, and Family 3.2.1 on Free Route Airspace, which is linked with the Traffic Regulation service.

Families 4.1.1, 4.2.1, 4.2.2 and 4.3.1 and 4.4.1 supporting and using Network Manager B2B services. This is possible thanks to the efficient interface between NM and local systems.

Civil / Military Coordination

Civil/military coordination aiming at keeping civil-military interoperability at the best possible level could be required on a case-by-case basis depending on local organisation types.

Stakeholders impacted	ANSPs, Airport Operators, Airspace Users[35], Network Manager
Geographical scope	SWIM services must be deployed in the EATMN (European Air Traffic Management Route Network).
ATM Master Plan reference	Essential Operational Change (EOC): • ATM Interconnected network MP Level 3 objectives: • INF10.13, INF10.14, INF10.15, INF10.16, INF10.17
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate

[35] Military authorities included

them, which includes the implementation of Family 5.2.1 (digital certificates).. These risk assessments and the resulting mitigations need to be documented.

Family Deployment Approach

The figure below provides a non-exhaustive description of the service providers and service consumers, either civil or military. It is considered that all information exchanges are completed before providing and/or consuming any SWIM Service.

Service	Service Provider	Service Consumer
ATFCM Tactical Updates Service (Airport Capacity and Enroute)	NM	ANSP[36]
Flight Management Service (Slots and NOP/AOP integration)	NM	AO[37], AU, ANSP
Measures Service (Traffic Regulation)	NM	ANSP, AU
Short term ATFCM measures services (MCDM, eHelpdesk, STAM measures)	NM	ANSP, AU
Counts Service (ATFCM Congestion Points)	NM	ANSP

[36] Subject to local agreement between Airport Operator and ANS Provider
[37] Subject to local agreement between Airport Operator and ANSProvider

ATFCM Tactical Updates Service (Airport Capacity and Enroute)		
ANSP[38]	**DM1** Provide ATFCM Tactical and pre-tactical updates to NM	Provide ATFCM tactical and pre-tactical updates for the aerodrome capacity values, sector configuration plans, Enroute capacity values, monitoring values (OTMV), traffic volume activations and runway configuration activation to NM. This milestone supports Family 4.2.1 ANSP-DM1 – Use of NM technical platform and NM B2B service. This DM needs to be synchronised between civil and military ANSPs, AOs and NM. ***Milestone achievement conditions:*** The ANSP system provides the ATFCM tactical and pre-tactical updates to NM via the NM B2B Services
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
NM	**DM1** Upgrade NM systems for SWIM compliance	The NM system is upgraded in order to make the NM B2B Services SWIM compliant. This milestone supports Family 4.2.1 NM-DM2 – Develop Network Manager B2B services ***Milestone achievement conditions:*** The NM B2B Services are SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service
Flight Management Service		
ANSP	**DM1** Consume NM flight update information	The ANSP system is upgraded to consume the flight updates relative to the flights in their AOR/AOI (including the ATFM slot), which are published by NM via the NM B2B Services. There is a link to Family 4.2.1 interactive NOP ***Milestone achievement conditions:*** The ANSP consumes flight update information
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations

[38] Subject to local agreement between Airport Operator and ANS Provider

AO[39]	**DM1**  Provide the Predicted Departure Planning Information to NM	Systems in the airport are upgraded to send both the Predicted and normal Departure Planning Information (P-DPI and DPI) to NM via the NM B2B Services. This milestone supports Family 4.2.2 AO-DM2: Implement Network Manager B2B services This DM needs to be synchronised between civil and military ANSPs, AOs and NM. ***Milestone achievement conditions:*** The P-DPI and DPI is sent to NM via the NM B2B Services.
	DM2  Provide the Arrival Planning Information to NM	Systems in the airport are upgraded to send Arrival Planning Information (API) to NM via the NM B2B Services. This milestone supports Family 4.2.2 AO-DM2: Implement Network Manager B2B services. This DM needs to be synchronised between civil and military ANSPs, AOs and NM. ***Milestone achievement conditions:*** The API is sent to NM via the NM B2B Services
	DM3 Consume NM flight update information	Systems in the airport are upgraded to consume the flight update information made available via the NM B2B Services. This milestone supports Family 4.2.2 AO-DM2: Implement Network Manager B2B services. ***Milestone achievement conditions:*** Systems in the airport consume the NM flight update information published via the NM B2B Services.
	DM4 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
AU	**DM1** Consume NM flight update information	The Airspace User flight planning system is upgraded to consume the flight updates relative to their flights (including the ATFM slot), which are published by NM via the NM B2B Services. There is a link to Family 4.2.1 interactive NOP ***Milestone achievement conditions:*** The Airspace User system consumes the updates of their flights
NM	**DM1** Upgrade NM systems for SWIM compliance	The NM system is upgraded in order to make the NM B2B Services SWIM compliant. This milestone supports Family 4.2.2 NM-DM3: Develop Network Manager B2B services and Family 4.3.1 NM-DM2: Provide flight update information ***Milestone achievement conditions:***

[39] Subject to local agreement between Airport Operator and ANS Provider

		The NM B2B Services are SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Measures Service		
ANSP	**DM1** Provide traffic regulation proposals to NM	The ANSP system is upgraded to use the NM B2B Services in order to provide NM with traffic regulation proposals. This milestone supports Family 4.1.1 ANSP-DM2a: Upgrade local systems. This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The ANSP system provides the regulation proposals to NM via the NM B2B Services
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges is used for daily operations
AU	**DM1** Consume NM measures updates	The Airspace User flight planning system is upgraded to consume the measures updates, published by NM via the NM B2B Services, which may affect their flights. There is a link to Family 3.2.1 ***Milestone achievement conditions:*** The Airspace User system consumes the measures updates
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
NM	**DM1** Upgrade NM systems for SWIM compliance	The NM system is upgraded in order to make the NM B2B Services SWIM compliant. This milestone supports Family 4.1.1 NM-DM2: Provide interface between NM and local tool ***Milestone achievement conditions:*** The NM B2B Services are SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Short term ATFCM measures services (MCDM, eHelpdesk, STAM measures)		
ANSP	**DM1** Collaborate on the definition and application of STAM	The ANSP system is upgraded to use the NM B2B Services (as a consumer) in order to collaborate with NM on the definition and application of STAM measures. This milestone supports Family 4.1.1 ANSP-DM2a – Upgrade the local systems This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The ANSP system provides the STAM measures to NM via the NM B2B Services
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges used for daily operations
AU[40]	**DM1** Collaborate on the application of STAM	The AU system is upgraded to use the NM B2B Services in order to collaborate with NM on the application of STAM measures. There is a link with STAM in the Family 4.1.1. This DM needs to be synchronised between AUs and NM. ***Milestone achievement conditions:*** The AU system consumes the NM B2B Services to participate in the CDM for STAM measures on its flights
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges are used for daily operations
NM	**DM1** Upgrade NM systems for SWIM compliance	The NM system is upgraded in order to make the NM B2B Services SWIM compliant. This milestone supports Family 4.1.1 NM-DM2 – Provide interface between NM and local tool ***Milestone achievement conditions:*** The NM B2B Services are SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

[40] Airspace users can decide whether to use NM HMI or exchange and consume STAM measures via NM B2B service as stipulated in AF4

Counts service (ATFCM congestion points)		
ANSP	DM1 Consume Counts service	ANSP system is upgraded to compute the ATFCM congestion points based on the information received via the NM B2B Counts service. ***Milestone achievement conditions:*** The ANSP system consumes the counts service to detect the ATFCM congestion points via the NM B2B Services
ANSP	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, the capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** Information Exchanges used for daily operations
NM	DM1 Upgrade NM systems for SWIM compliance	The NM system is upgraded in order to make the NM B2B Services SWIM compliant. This milestone supports Family 4.2.1 NM-DM2 – Develop Network Manager B2B Services ***Milestone achievement conditions:*** The NM B2B Services are SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Performance impact – Family 5.5.1:

Benefit areas	Capacity	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub–AF 5.6 Flight Information Exchange (Yellow Profile)

Family 5.6.1 – Flight Information Exchange

Target Date	31/12/2025

Description

Actual achievement of the objectives set forth in AF1 to AF4 requires the capability to effectively share information on individual flights and perform collaborative decision-making processes among all actors concerned with the operation of a flight.

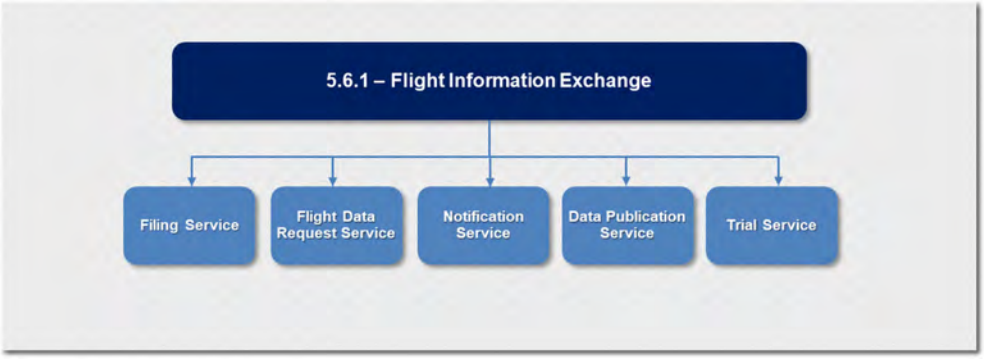

Figure 27 - Flight Information Exchange services

Such a CDM environment requires novel and improved technology that enables flawless exchange of large volumes of flight-related information all along the flight lifecycle while safeguarding data consistency and stakeholders' access (i.e., information is available at the right time, in the right way to the appropriate CDM participant).

FF-ICE (Flight and Flow Information for a Collaborative Environment) constitutes the necessary framework for moving in the envisaged direction.

FF-ICE Release 1 (FF-ICE/R1) – together with its technological foundation (FIXM, Flight Information Exchange Model) and with relevant SWIM information services – addresses the exchange of enriched pre-departure flight information. Stakeholders' compliance with FF-ICE/R1 provisions provides additional support for the achievement of the objectives stated in AF1 to AF4.

Further FF-ICE releases will address the post-departure flight data exchanges and the aircraft feedback aspects respectively, in a natural evolution towards Trajectory Based Operations.

This Family addresses the implementation of the FF-ICE/R1 services over SWIM that are required to exchange pre-departure flight information. Service implementations must be compliant with the applicable version of the FIXM standard.

This Family also addresses the deployment of SWIM services to support A-CDM, with specific regard to the exchange of departure information between the Network Manager (NM) and the airports (Departure Planning Information) and the publication of flight update information.

Stakeholders shall put systems into operation that make relevant use of such services in their daily business. It is important to highlight that there will be a transition period (expected to be quite long) with mixed modes of operations. Given the global reach of the concerned stakeholder groups (mainly in relation to AUs) and the lack of implementation mandates on some of them (stakeholders for which

the transition is voluntary, business-case dependant), there will be a combination of FF-ICE capable and FF-ICE-non-capable stakeholders.

During the transition period, stakeholders implementing FF-ICE/R1 may need to continue to support the current ICAO FPL 2012 format via the traditional communication means.

Service outlines[41]:

- **Filing Service**

This service implements:

  - FF-ICE flight plan (eFPL, including updates and cancellations) submission to the Network Manager that includes information such as 4D trajectory information, flight specific performance data and the Global Unique Flight Identifier (GUFI).
  - Feedback provision (validation and filing status) to eFPL originators.
  - The operational stakeholders shall use NM B2B Services supporting the information Exchange of FF-ICE.

- **Flight Data Request Service**

This service allows FF-ICE-enabled stakeholders to retrieve data about a flight such as the whole eFPL, search and rescue data or the filing status. The operational stakeholders shall use NM B2B Services supporting the information Exchange of FF-ICE.

- **Notification Service**

This service implements the capability to notify FF-ICE-enabled stakeholders about flight departure and arrival events (replacement of DEP and ARR). The operational stakeholders shall use NM B2B Services supporting the information Exchange of FF-ICE.

- **Data Publication Service**

This service allows the Network Manager to publish and distribute eFPLs to the concerned FF-ICE-enabled stakeholders. The operational stakeholders shall use NM B2B Services supporting the information Exchange of FF-ICE.

- **Trial Service**

This service allows FF-ICE-enabled AUs (eAUs) to request feedback from the Network Manager on a trial in a “what-if” operational evaluation context. The service enables eAUs to explore the impacts of any intended change to a filed eFPL and determine the feasibility/validity of a flight plan before committing to it.

Airspace users are not mandated to implement this but are recommended to upgrade the Airspace Users system to be able to use the NM FF-ICE/R1 Trial Service.

The operational stakeholders shall use NM B2B Services supporting the information Exchange of FF-ICE.

- **Departure Planning Information Service**

See Family 5.5.1

- **Flight Update Publication Service**

See Family 5.5.1

[41] The FF-ICE/R1 Planning Service is out of the scope of CP1 (Figure 27 displays the match between Common Project 1 requirements and FF-ICE/R1 services).

- **Extended AMAN SWIM Service**

The service allows the AMAN System to provide sequence information in the context of extended horizon to upstream ATSUs and/or to a Satellite Airport. This information is used to coordinate the actions to be taken by the cooperative ATSUs to make the correct time adjustment to flights under their control in order to get the best and most efficient arriving flight sequence at the relevant airports based on the AMAN arriving planning tool.

The table below provides an overview of the match between the text of Common Project 1 and the services mentioned above.

CP1	Service
Flight plan and routes generation and validation	Filling Service, Trial Service (FF-ICE/R1)
Flight plans, 4D trajectory	Filling Service, Data Publication Service (FF-ICE/R1)
Flight performance data	Filling Service (FF-ICE/R1)
Flight status	Notification service (departure and arrival events) (FF-ICE/R1)
Flights lists	Data Publication Service (FF-ICE/R1)
Detailed flight data	Flight Data Request Service (FF-ICE/R1)
Flight update departure information[42]	Departure Planning Information Service (A-CDM)
Flight update messages (FUM)[43]	Flight Update Publication Service (A-CDM)

System requirements

FF-ICE/R1 Services

Network Manager:

- Support the Filing Service, Flight Data Request Service, Notification Service, Data Publication Service, Trial Service, through the NM B2B services in support of information Exchange of FF-ICE;
- Support eFPL translation service and distribution to relevant FF-ICE-non-capable ATS units.

ANSPs:

- Consume the eFPL via the Data Publication Service using the NM B2B services in support of information Exchange of FF-ICE;
- Consume the Flight Data Request Service, using the NM B2B services in support of information Exchange of FF-ICE;
- Consume the Notification Service using the NM B2B services in support of information Exchange of FF-ICE.

Airspace Users:

[42] See Family 5.5.1- Network Information Exchange
[43] See Family 5.5.1- Network Information Exchange

- Consume the Filing Service using the NM B2B services in support of information Exchange of FF-ICE.

A-CDM Services

- See Family 5.5.1

Extended AMAN SWIM Service

ANSPs:

- Provide SWIM service with AMAN data to associated En-Route sectors
- Consume the extended AMAN data from the AMAN system

Dependencies

Adoption of FF-ICE/R1 organisational provisions by concerned stakeholders is a pre-requisite for actual deployment and use of FF-ICE/R1 services over SWIM.

FF-ICE/R1 services over SWIM support the other ATM functionalities referred to in AF1, AF2, AF3 and AF4, by making available:

- AF1 Family 1.1.1 Extended AMAN.
- AF3 Families 3.2.1 and 3.2.2: AUs' detailed 4D trajectory (including free route segments) and flight-specific performance data.
- AF4 Family 4.3.1: AUs' detailed 4D trajectory and flight-specific performance data.

Civil / Military Coordination

Civil/military coordination could be required on a case-by-case basis depending on local organisation.

Stakeholders impacted	ANSPs, Airspace Users[44], Network Manager
Geographical scope	FF-ICE service must be deployed in the EATMN (European Air Traffic Management Route Network). A-CDM service must be deployed for those airports listed in Family 2.2.2. Extended AMAN service must be deployed in those Airports and associated En-Route sectors listed in Family 1.1.1.
ATM Master Plan reference	Essential Operational Changes (EOC): • ATM Interconnected network MP Level 3 objectives: • INF10.18, INF10.19, INF10.20, INF10.21, INF10.22, INF10.23
Cyber security Requirements	To mitigate the cyber security risks, it is necessary to conduct a cyber security assessment prior to any system update/implementation. Stakeholders must assess the risks and apply appropriate security checks and controls to mitigate them, which includes the implementation of Family 5.2.1 (digital certificates).. These risk assessments and the resulting mitigations need to be documented.

[44] Military authorities included

Family Deployment Approach

Service implementation is the set of activities by which the information service is implemented in a target environment and technology context. Service implementation involves testing and validation.

Flight information exchanges are performed in conformance with the EUROCONTROL SWIM specifications.

The below table gives a non-exhaustive description of the service providers and service consumers. It is considered that all information exchanges are completed before providing and/or consuming any SWIM Service.

Service	Service Provider	Service Consumer
Filing Service	NM	AUs
Flight Data Request Service	NM	ANSPs
Notification Service	NM	ANSPs
Data Publication Service	NM	ANSPs
Trial Service	NM	AUs Recommended
Extended AMAN SWIM Service	ANSP	ANSP

Filing Service

AU	**DM1** Consume the NM FF-ICE/R1 Filing Service	The AU system is upgraded to be able to use the NM FF-ICE/R1 Filing Service for the submission of eFPLs and any updates to NM. ***Milestone achievement conditions:*** The AU system consumes the NM FF-ICE/R1 Filing Service
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** The AU system uses the NM FF-ICE/R1 Filing Service
NM	**DM1** Develop FF-ICE/R1 Filing Service	The NM system is upgraded to support the FF-ICE/R1 Filing Service; this service is part of the NM B2B Services ***Milestone achievement conditions:*** The FF-ICE/R1 Filing Service is developed
	DM2 Provide the FF-ICE/R1 Filing Service	• Validations and live trials of the FF-ICE/R1 Filing Service • SWIM compliance activities • Deployment in operations • This milestone supports Family 4.3.1 NM-DM4 – Upgrade NM System related to FF-ICE Release 1

		This DM needs to be synchronised between AISPs, AUs and NM. ***Milestone achievement conditions:*** The FF-ICE/R1 Filing Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service
Flight Data Request Service		
ANSP	**DM1** Consume the NM FF-ICE/R1 Flight Data Request Service	The ANSP systems are upgraded to be able to consume the NM FF-ICE/R1 Flight Data Service when requiring access to the information of a particular eFPL. ***Milestone achievement conditions:*** The ANSP systems consume the NM FF-ICE/R1 Flight Data Request Service.
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** The ANSP systems use the NM FF-ICE/R1 Flight Data Request Service in daily operation
NM	**DM1** Develop FF-ICE/R1 Flight Data Request Service	The NM system is upgraded to support the FF-ICE/R1 Flight Data Request Service; this service is part of the NM B2B Services ***Milestone achievement conditions:*** The FF-ICE/R1 Flight Data Request Service is technically available
	DM2 Provide the FF-ICE/R1 Flight Data Request Service	• Validations and live trials • SWIM compliance activities • Deployment in operations This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The FF-ICE/R1 Flight Data Request Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Notification Service		
ANSP	**DM1** Consume the NM FF-ICE/R1 Notification Service	The ANSP systems are upgraded to be able to send the departure and arrival information about eFPLs through the NM FF-ICE/R1 Notification Service. ***Milestone achievement conditions:*** The ANSP systems consume the NM FF-ICE/R1 Notification Service.
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** The ANSP systems use the NM FF-ICE/R1 Notification Service in daily operation
NM	**DM1** Develop the FF-ICE/R1 Notification Service	The NM system is upgraded to support the FF-ICE/R1 Notification Service in order to be able to receive information about departure and arrival of flights; this service is part of the NM B2B Services ***Milestone achievement conditions:*** The FF-ICE/R1 Notification Service is technically available
	DM2 Provide the FF-ICE/R1 Notification Service	• Validations and live trials • SWIM compliance activities • Deployment in operations • This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The FF-ICE/R1 Notification Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Data Publication Service		
ANSP	**DM1** Consume the NM FF-ICE/R1 Data Publication Service	The ANSP systems are upgraded to be capable of receiving and processing eFPLs distributed by the NM FF-ICE/R1 Data Publication Service, in addition to ICAO 2012 FPLs. This milestone supports Family 4.3.1 ANSP DM3. ***Milestone achievement conditions:*** The ANSP systems are able to consume and process the eFPL information provided by NM FF-ICE/R1 Data Publication Service
	DM2 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures

		are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** The ANSP systems are able to use the eFPL information provided by NM FF-ICE/R1 Data Publication Service in daily operations
NM	**DM1** Develop FF-ICE/R1 Data Publication Service	The NM system is upgraded to support the FF-ICE/R1 Data Publication Service for the distribution and publication of eFPLs to the concerned stakeholders; this service is part of the NM B2B Publish/Subscribe Services ***Milestone achievement conditions:*** The FF-ICE/R1 Data Publication Service is technically available
	DM2 Provide the FF-ICE/R1 Data Publication Service	• Validations and live trials • SWIM compliance activities • Deployment in operations This DM needs to be synchronised between civil and military ANSPs and NM. ***Milestone achievement conditions:*** The FF-ICE/R1 Data Publication Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service
Trial Service		
NM	**DM1** Develop FF-ICE/R1 Trial Service	The NM system is upgraded to support the FF-ICE/R1 Trial Service; this service is part of the NM B2B Services ***Milestone achievement conditions:*** The FF-ICE/R1 Trial Service is technically available
	DM2 Provide the FF-ICE/R1 Trial Service	• Validations and live trials • SWIM compliance activities • Deployment in operations This milestone supports Family 4.3.1 NM-DM4 - Upgrade the NM systems related to FF-ICE/R1. This DM needs to be synchronised between AUs and NM. ***Milestone achievement conditions:*** The FF-ICE/R1 Trial Service is SWIM compliant and available in the SWIM Registry as an operational SWIM compliant service

Extended AMAN SWIM Service		
ANSP	**DM1** Provide the extended AMAN data	Upgrade of AMAN system to provide extended AMAN data exchanges via a SWIM service to associated En-Route sectors to coordinate the actions to be taken by the cooperative ATSUs to get the best and most efficient arriving flight sequence. This milestone supports Family 1.1.1 ANSP-DM1: Upgrade ATC systems to support extended AMAN This DM needs to be synchronised between civil and military ANSPs. ***Milestone achievement conditions:*** The AMAN system provides the extended AMAN data exchanges via a SWIM service.
	DM2 Consume the extended AMAN data	Upgrade of ATC system to consume the extended AMAN data exchanges from the AMAN system. This milestone supports Family 1.1.1 ANSP-DM1: Upgrade ATC systems to support extended AMAN. ***Milestone achievement conditions:*** The ATC system consumes the extended AMAN data exchanges via a SWIM service.
	DM3 Operational use	The system is used to support daily operations once the systems have been implemented, the procedures are in place, capability assessment has been delivered, and the training has been completed. ***Milestone achievement conditions:*** The ATC system uses the extended AMAN data exchanged via a SWIM service in daily operations.

Performance impact – Family 5.6.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

3.6. AF6 - Initial Trajectory Information Sharing

3.6.1. Work Breakdown Structure and SESAR Solutions

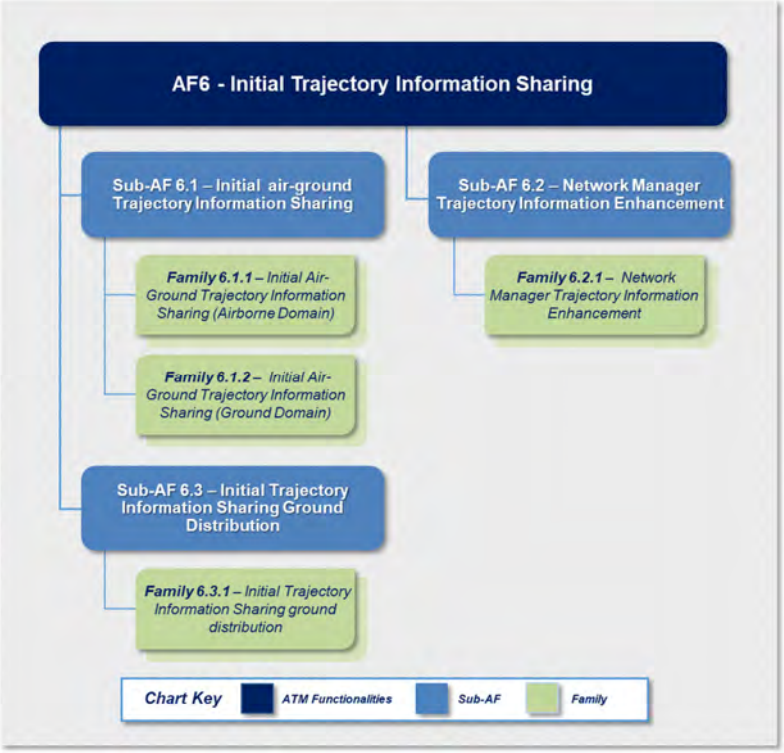

Figure 28 - AF6 Work Breakdown Structure

Initial trajectory information sharing is expected to allow the aircraft downlink of trajectory information, its distribution on the ground and its improved use by the ground air traffic control ('ATC') systems for conformance monitoring and by the Network Management systems for enhanced trajectory information.

This ATM Functionality is composed of three Sub-ATM Functionalities and each Sub-ATM Functionality is addressed by one Family, except Sub-AF 6.1 which is addressed by two Families. The links between the Families and the SESAR Solutions can be found in the table below:

Family	SESAR Solutions	EOC
Family 6.1.1 – Initial air-ground Trajectory Information Sharing (Airborne Domain)	Solution #115 "Extended projected profile (EPP) availability on ground"	Trajectory-based operations
Family 6.1.2 – Initial Air-Ground Trajectory Information Sharing (ground domain)	Solution #115 "Extended projected profile (EPP) availability on ground" #18-06b1 "NM trajectory Performance Improvement	Trajectory-based operations
Family 6.2.1 – Network Manager Trajectory Information Enhancement	#18-06b1 "NM trajectory Performance Improvement"	Trajectory-based operations
Family 6.3.1 – Initial Trajectory Information Sharing Ground Distribution	Solution #115 "Extended projected profile (EPP) availability on ground"	ATM interconnected network

3.6.2. Deployment Approach and Synchronisation Needs

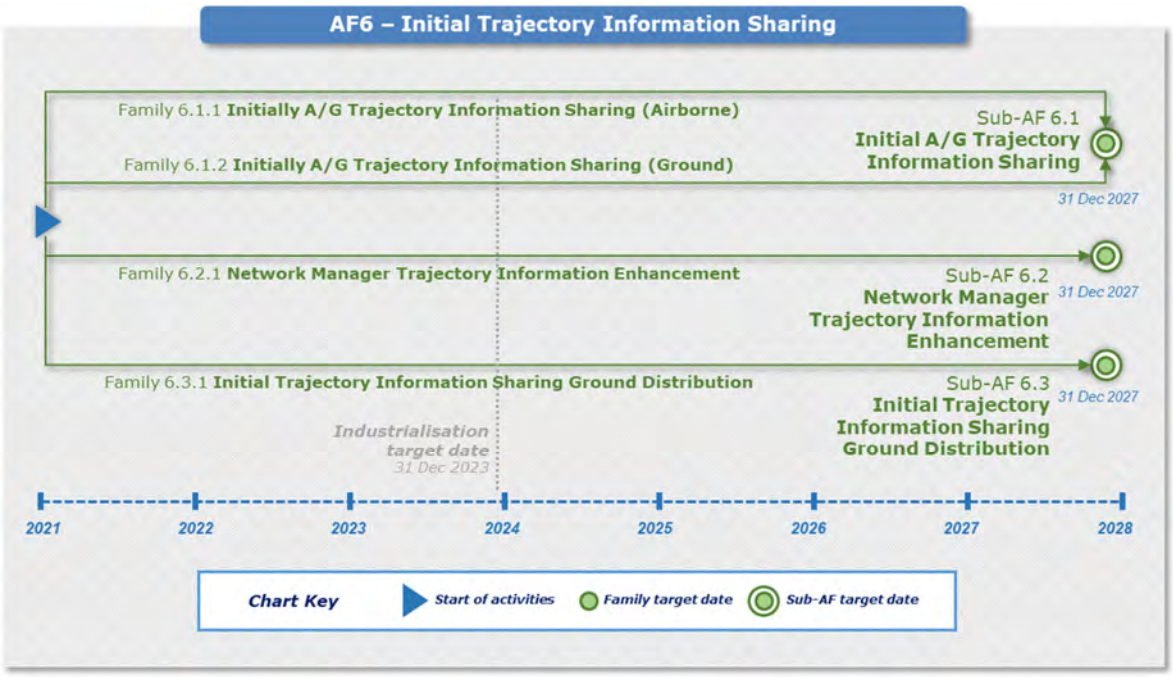

Figure 29 - AF6 Deployment Approach

From an operational point of view, making the FMS trajectory available for ground stakeholders will improve the efficiency of flight handling. In order to improve the ATM/ATC functionalities already in place, this is required to ensure interoperability between various stakeholders, e.g., aircraft operators, ANSPs and NM. This can be achieved by aligning technical and operational enhancements described in the six ATM Functionalities. The synchronisation among the activities related to these technical and operational enhancements is one of the key points that must be ensured in order to guarantee the maximum exploitation of network benefits.

From a technical perspective, the deployment of initial trajectory information sharing functionality must be synchronised among the ground and airborne systems to ensure operational benefits. In order to satisfy this synchronisation requirement, airborne and ground should provide interoperable interfaces, otherwise the European ATM network would face a lack of seamless operations due to fragmentation and the expected benefits would be jeopardised.

Synchronisation must involve all ANSPs, the Network Manager and Airspace Users, where system upgrades are required.

From a global perspective, the cooperative arrangements in the Memorandum of Cooperation NAT-I-9406A between the United States of America and the European Union on air traffic management modernisation, civil aviation research and development and global interoperability, should be considered to ensure US/EU harmonised implementation of trajectory-based operations.

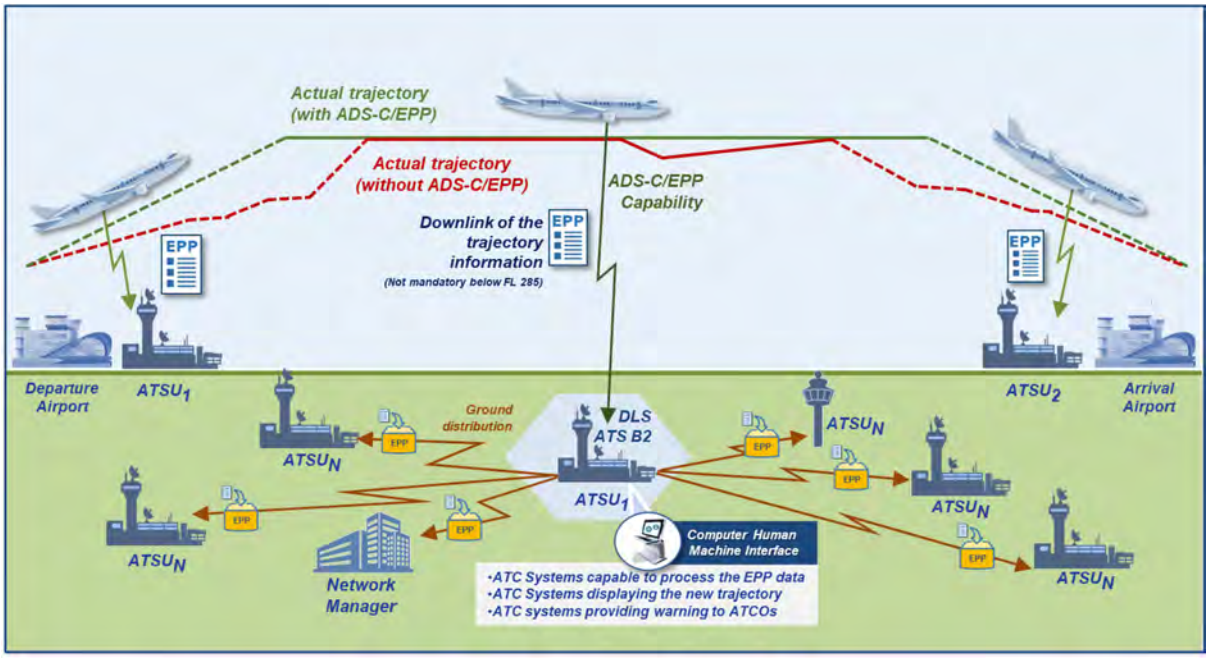

Figure 30 - AF6 synchronisation needs

Synchronisation needs of AF6:

Between Member States	Between air and ground stakeholders	Between civil and military stakeholders
✓	✓	

AF6 – Industrialisation Target Date

"Industrialisation target date means a date by when the standards and the specifications are to be available for the ATM Functionality or sub-Functionality to enable its implementation" (Ref. Amendments to Implementing Regulation (EC) No 409/2013).

The CP1 Regulation includes, in its article 4, an Industrialisation Target Date for AF6:

3. By way of derogation from paragraph 1, common projects may also include AT M functionalities or sub-functionalities that are not ready for implementation but that constitute an essential component *of the common project concerned and provided their industrialisation is deemed to be finalised within three years from the adoption of the concerned common project. For that purpose, an industrialisation target date for those ATM functionalities or sub-functionalities shall also be defined in the common project.*

4. Upon expiry of the industrialisation target date, the Commission, with support from the European Union Aviation Safety Agency, shall verify that the ATM functionalities or sub-functionalities referred to in paragraph 3 have been standardised and that they are ready for implementation. Where they are found not to be ready for implementation*, they shall be withdrawn from the common project regulation.*

The Industrialisation Target Date for AF6 is set for the 31st of December 2023. The Families under AF6 therefore have to be ready for implementation by then, meaning that all required standards are available.

The current standardisation status of each of the AF6 Families is summarised below:

Family 6.1.1: Standards for ADS-C/EPP as part of ATS B2 are available:

- ED-228A/RTCA DO-350A/Baseline 2 SPR standard
- ED229A - RTCA DO-351A/Baseline 2 Interoperability standard
- ED 230A/RTCA DO 352A Interoperability Requirements Standard for Baseline 2 ATS Data

- Communications and FANS 1/A accommodation (FANS 1/A – Baseline 2 Interop Standard)

Family 6.1.2: Standards, technical specifications and/or best practices for ATC ground systems are required. They will be available by the 31st of December 2023, based on the outcomes of PJ31 and PJ38. OEP workstream 12.2 will elaborate the technical specifications.

Family 6.2.1: Standards are not necessary (systems upgrade only applicable to NM). Validation of the system requirements for NM to enhance the trajectory prediction with EPP are required.

Family 6.3.1: ADS-C Common Service is under validation by SJU (PJ38). The technical specifications will be defined by the 31st of December 2023, based on the outcomes of PJ31 and PJ38 and the technological components should achieve V4 by then. Relevant SESAR solutions is #115 from SESAR 1. The Network manager Operational Excellence Programme (OEP) workstream 12.2 will elaborate the technical specifications.

Further details on how to successfully meet the Industrialisation Target Date are provided for each Family in the related sections.

3.6.3. CNS enablers for AF6

With regard to AF6, the evolution of the Data Comm systems which support it have to be considered.

The CNS communication aspects are paramount for the harmonised deployment of all AF6 Families to successfully achieve the overall implementation of AF6 from a technological perspective (systems, procedures and human resources). Some technologies are considered as essential enablers to continue and progress with the deployment of the AF6 Families (e.g., SatCOM and LDACS).

For the *AF6 – Initial Trajectory Information Sharing* deployment, SESAR Deployment Manager has already elaborated a specific document named *D5.2.1.5.1 – "Assumptions for a synchronised deployment towards Initial Trajectory Information Sharing"* (December 2020) in which all the technical, operational, and regulatory elements required for the AF6 deployment have been taken into account. In this document, SESAR Deployment Manager elaborated an integrated roadmap for the timely implementation of AF6, including the required ADS-C/EPP capability as part of ATS B2.

Sub-AF 6.1 – Initial Air-Ground Trajectory Information Sharing

Family 6.1.1 – Initial Air-Ground Trajectory Information Sharing (Airborne Domain)

Target Date	31/12/2027
Industrialisation target date[45]	31/12/2023

Description

Trajectory information will be enhanced by using air-ground trajectory exchange. The preliminary steps for the deployment of Initial Trajectory Information Sharing consists of the downlink of Extended Projected Profile (EPP) data from the aircraft and processing of this data by the ATC systems and NM systems.

Aircraft operators intending to operate aircraft above FL285 (with an individual certificate of airworthiness first issued on or after the 31st of December 2027) shall equip aircraft with ADS-C/EPP compliant avionics capable of down-linking trajectory information using ADS-C Extended Projected Profile (EPP) as part of the ATS B2 services. The trajectory data will be automatically downlinked from the airborne system in accordance with the contract terms and will be used by the ground system.

System requirements

- Aircraft operators shall ensure that aircraft with an individual certificate of airworthiness first issued on or after the 31st of December 2027 operating GAT flights above FL 285 in the ICAO EUR region are equipped with ADS-C/EPP as part of ATS B2 capability in accordance with the applicable standards in order to downlink aircraft trajectory.
- Aircraft equipped with ADS-C/EPP compliant avionics shall down-link trajectory information using ADS-C Extended Projected Profile (EPP) as part of the ATS B2 services. The trajectory data will be automatically downlinked from the airborne system in accordance with the contract terms.

Dependencies

- Family 6.1.2: Family 6.1.1 can only be implemented in conjunction with Family 6.1.2, which is providing the corresponding system functionalities on the ground.
- Family 3.1.1 and 3.1.2: There is an interdependency with Flexible Airspace Management.

Civil / Military Coordination

This Family will also support the interoperability needs of military/state transport-type aircraft operating as GAT deemed to be ADS-C/EPP capable.

Stakeholders impacted	Airspace Users[46]
Geographical scope	Initial Trajectory Information Sharing shall be deployed in all ATS units providing air traffic services within the airspace for which the Member States are responsible in the ICAO EUR region.

[45] A date by which the ATM functionality or sub-functionality is to complete the standardisation and certification processes to enable its procurement, installation, and implementation

[46] Military authorities included when acting as aircraft operators flying as GAT above FL285

ATM Master Plan reference	Essential Operational Change (EOC): Trajectory Based Operations https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: ATC22 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber security Requirements	Cyber security is a risk and therefore conducting a proper risk-based security assessment prior to any system update is necessary. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

AU	**DM1** New aircraft configuration definition	In the scope of the aircraft configuration management process, aircraft operators must ensure the procurement of the ADS-C/EPP functionality and compliance according to ATS B2 services for aircraft intending to operate as GAT above FL285. ***Milestone achievement conditions:*** Aircraft operators have taken the order of the ADS-C/EPP functionality (part of ATS B2 services) into account during the aircraft configuration process.
	DM2 Prepare Training Procedures	Ensure the preparation of training material with regard to the new system and procedures. ***Milestone achievement conditions:*** Aircraft operator has ensured appropriate procedures and training material are available in due time.
	DM3 Training	Perform flight crew training for the operational use of the new system. ***Milestone achievement conditions:*** Aircraft operator has ensured flight crew training is completed in order to operate equipped aircraft.
	DM4 Perform A/C Acceptance Process & Obtain Operational Approval	Ensure aircraft operators check the availability of the new functionality during the aircraft acceptance/delivery process as well as the availability of the corresponding operational approval from its supervisory authority if an operational approval is required. ***Milestone achievement conditions:*** Aircraft operator has checked the availability of ADS-C/EPP installation and the operational approval (if required) during the aircraft acceptance/delivery process.
	DM5 Operational use	The operational use of the ADS-C/EPP functionality (as part of ATS B2 capability) can start on equipped aircraft. ***Milestone achievement conditions:***

	Mandated aircraft are equipped with ADS-C/EPP compliant avionics and are down-linking trajectory information using ADS-C Extended Projected Profile (EPP).

How to fulfil the Industrialisation Target Dates

For the airborne domain, standards have been published. In order to pass the industrialisation target date, the certification specifications (CS-ACNS) must be amended accordingly.

Afterwards, aircraft manufacturers must complete the certification processes of ADS-C/EPP on all applicable aircraft types, and it is recommendable to offer the solution to aircraft operators at least 1 or 2 years before the 31st of December 2027.

This is a prerequisite to start the timely implementation process by aircraft operators regarding the changed aircraft configuration definition, the preparation of training material, and for flight crew training.

The mandate requires aircraft operators to ensure aircraft operating flights in ICAO EUR region with an individual certificate of airworthiness first issued on or after the 31st of December 2027 are equipped with ADS-C/EPP as part of ATS B2 capability in accordance with the applicable standards in order to downlink aircraft trajectory.

Performance impact – Family 6.1.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 6.1 – Initial Air-Ground Trajectory Information Sharing

Family 6.1.2– Initial Air-Ground Trajectory Information Sharing (Ground Domain)

Target Date	31/12/2027
Industrialisation target date[47]	31/12/2023

Description

Trajectory information will be enhanced by using air-ground trajectory exchange. The preliminary steps for the deployment of Initial Trajectory Information Sharing consists of the downlink of Extended Projected Profile (EPP) data from the aircraft and processing of this data by the ATC systems.

The ground systems will enable controllers to display the downlinked route on the Controller Working Position. The consistency of the downlinked route will be automatically cross-checked against the expected trajectory on the ground. In case of an inconsistency, controllers will receive a warning.

System requirements

- Ground systems shall support the ADS-C/ EPP application as part of ATS B2 services while retaining compatibility with Controller Pilot Data Link Communications (CPDLC) services as required by Commission Regulation (EC) No. 29/2009 (amended by IR 310/2015) including provision of service to flights equipped only with ATN-B1.
- All ATS providers defined in section 6.3.1 of this document and related ATC systems shall be able to receive and process EPP trajectory information.
- The ATC systems shall enable controllers to display the route of the downlinked trajectory.
- The ATC systems shall provide a warning to controllers in case of a discrepancy between the downlinked trajectory and the expected route.

Dependencies

- Family 6.1.1: Family 6.1.2 can only be implemented in conjunction with Family 6.1.1, which is providing the corresponding aircraft functionalities.
- Families 3.1.2, 3.1.2, 3.21 and 3.2.2: There is a dependency with Flexible Airspace Management and Free Route Airspace. Air-ground trajectory exchange improves trajectory information, which enhances the display of activated airspace reservations at the CWP together with ATCOs' situational awareness.

Civil / Military Coordination

In certain cases, military organisations provide ATS services to GAT traffic. Therefore, these organisations may be subject to CP1 AF6 requirements applicable to ATS providers. In such cases, military ATM systems should be also adapted (considering their specificity).

Stakeholders impacted	ANSPs[48]

[47] A date by which the ATM functionality or sub-functionality is to complete the standardisation and certification processes to enable its procurement, installation, and implementation

[48] Military authorities included

Geographical scope	Trajectory information data shall be distributed to and processed at all ATS units providing air traffic services above FL 285 within the airspace for which the Member States are responsible in the ICAO EUR region.
ATM Master Plan reference	Essential Operational Change (EOC): Trajectory Based Operations https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: ATC23 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring
Cyber Security requirements	Modern ATM system design requires enhanced connectivity and is using more and more common and open components, services and standards. Cyber security is a risk and therefore conducting a proper risk-based security assessment prior to any system update is necessary. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

ANSP	**DM1** Description of common requirements for ADS-C/EPP Data integration into ANSP Systems	Ensure the ANSP Systems requirements for receiving, processing and displaying ADS-C/EPP data to provide warnings to the ATCO in case of discrepancies between the downlinked trajectory and the ground system trajectory are defined. ***Milestone achievement conditions:*** Description of common requirements in terms of ADS-C/EPP data integration, ADS-C contract management, as well as defining functional HMI requirements within the ANSP systems.
	DM2 Complete ANSP System deployment	Ensure integration of ANSP Systems with ADS-C/EPP data processing and displaying. ***Milestone achievement conditions:*** Common integration process confirming the integrity of the corresponding equipment has been completed
	DM3 Safety Assessment	Ensure the safety assessment is completed and approved by the appropriate authority. ***Milestone achievement conditions:*** Submission of a safety case to the competent authority before putting into service.
	DM4 Training	Ensure familiarisation with the new system functionalities and training of operational personnel (includes obtaining NSA approval) is completed well in advance of the deployment date. ***Milestone achievement conditions:*** Controllers have received appropriate training and any necessary approval (training and safety case) from the NSA is obtained.

	DM5 Operational use	Start of operational use no later than the 31st of December 2027. ***Milestone achievement conditions:*** Ground systems supporting ADS-C/ EPP application including the data display and warnings to controllers as described in the requirements are put into operation.

How to fulfil the Industrialisation Target Dates

By the industrialisation target date (December 2023), the specifications to allow the ground systems having the capability to receive and process EPP data downlinked from the aircraft must be available.

- Reception of the EPP data must be harmonised: definition of ATM conformance monitoring parameters to ensure the reception of standardised EPP data on the ground (PJ38). This is a prerequisite to reach industrialisation level before the implementation target date set on the 31st of December 2027.
- Ensure the establishment of a high-level CONOPS that sets the baseline for further operational specifications. In line herewith, the definition of harmonised operational guidelines should be developed and synchronised with the technical deployment steps describing the overall operational concept, prerequisites and, at a high level, the way this concept is to be applied. This CONOPS could be used as operational concepts and procedures at local level. This CONOPS is currently being developed under the OEP, workstream 12.2.

Performance impact – Family 6.1.2:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 6.2 – Network Manager Trajectory Information Enhancement

Family 6.2.1 – Network Manager Trajectory Information Enhancement

Target Date	31/12/2027
Industrialisation target date[49]	31/12/2023

Description

The NM Trajectory information could be enhanced by using Extended Projected Profile (EPP) data. Pending further validations, NM system could be capable of receiving and processing EPP data. For increasing the accuracy of NM systems trajectory prediction, some EPP elements might be used for the tactical trajectory update in the flight post departure phase. The display of EPP and EPP warnings are not required for NM as they are pure ATC functions.

Although there is no confirmed planning for the NM EPP validation activities, it should be noted that the NM's EPP implementation is not linked with the EPP display and warnings by ANSPs and therefore it will not impact their plans.

System requirements

The Network Manager should, subject to successful industrialisation target date, use some elements of the downlinked trajectories to enhance the calculation /predictions of NM systems trajectories.

Dependencies

AF4 Family 4.2.1: the downlinked trajectory information set out in AF6, where available, should be processed by Network Manager systems related to NOP to support target time over ('TTO') or TTA, or both, to enhance the trajectory.

Civil / Military Coordination

Possible coordination with military authorities if required.

Stakeholders impacted	Network Manager
Geographical scope	Network Manager
ATM Master Plan reference	Essential Operational Change (EOC): Trajectory Based Operations https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: ATC24 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring

[49] A date by which the ATM functionality or sub-functionality is to complete the standardisation and certification processes to enable its procurement, installation, and implementation

Cyber security Requirements	Modern ATM systems design is requiring enhanced connectivity and is increasingly using common and open components, services and standards. This trend exposes systems to increased cybersecurity risks. Cyber security is a risk and therefore conducting a proper risk-based security assessment prior to any system update is necessary. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach

NM	**DM1** Systems to be upgraded	NM systems to be upgraded in line with the validation results (if the validation is successfully performed). This DM needs to be synchronised between NM and ANSPs.

How to fulfil the Industrialisation Target Dates

It should be noted that NM system requirements for EPP management cannot be identified with the required level of granularity as SESAR exercises were mostly oriented to EPP data display and warnings, as well as the EPP impact within a single sector.

Application of EPP elements to the trajectories covering the compete flight across multiple ATS units and sectors is required to be validated via a dedicated validation exercise. It should be noted that EPP can by no means act as a replacement of NM system trajectories because EPP does not contain many of the elements provided to NM during the post departure period. The SESAR validation exercise should identify which portion of EPP could be considered sufficiently accurate to be used by NM systems.

SWIM TI Yellow profile might be used by NM for ground-ground exchange of down-linked trajectory data, but this functionality is not yet validated.

Application of EPP on NM system's trajectories should be fully validated (V3 maturity) by December 2023.

Performance impact – Family 6.2.1:

Benefit areas	**Capacity**	
	Flight efficiency	
	CO_2 emissions	
	Cost efficiency	
	Safety	
	Predictability	
	Noise	
	Digitalisation	
	Automation	

Sub-AF 6.3 – Initial Trajectory Information Sharing ground distribution

Family 6.3.1 – Initial Trajectory Information Sharing ground distribution

Target Date	31/12/2027
Industrialisation target date[50]	31/12/2023

Description

Trajectory information data coming from airborne systems is distributed on the ground to ATS units and NM to minimise the air-ground data transmissions. The trajectory data shall be processed and displayed to the controllers in a harmonised way as set out in section 6.1.2.

System requirements

- ADS-C/EPP trajectory shall be made available to ATS units and the Network Manager systems. The ground communication infrastructure must be reliable, fast, secure and efficient to support initial trajectory information sharing.
- Ground systems shall ensure trajectory data downlinked from the aircraft is distributed to ATS units and Network Manager systems.

Dependencies

- Family 6.1.1: Family 6.3.1 can only be implemented in conjunction with Family 6.1.1, which provides the corresponding airborne and ground functionalities.
- Families 3.1.1 and 3.1.2: There is an interdependency with Flexible Airspace Management.

Civil / Military Coordination

Coordination with military authorities as required, e.g., for military access to the Trajectory data if providing ATS services to GAT above FL285.

Stakeholders impacted	ANSPs[51], Network Manager
Geographical scope	Trajectory information data shall be distributed to and processed at all ATS units providing air traffic services above FL 285 within the airspace for which the Member States are responsible in the ICAO EUR region.
ATM Master Plan reference	Essential Operational Change (EOC): ATM interconnected network https://www.atmmasterplan.eu/exec/essential-operational-changes MP Level 3 objectives: ATC25 https://www.atmmasterplan.eu/depl/essip_objectives/monitoring

[50] A date by which the ATM functionality or sub-functionality is to complete the standardisation and certification processes to enable its procurement, installation, and implementation

[51] Military authorities included

Cyber security Requirements	Cyber security is a risk and therefore conducting a proper risk-based security assessment prior to any system update is necessary. Stakeholders must assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.

Family Deployment Approach		
ANSP	**DM1** Ground distribution Architecture definition	Ground distribution architecture is defined to meet the required performance levels as defined in the applicable standards ***Milestone achievement conditions:*** Applicable standards, definitions and technologies are ready, and the ground distribution architecture has been defined
	DM2 Ground Infrastructure deployment	The ground infrastructure, following the architecture defined in DM1, has to be deployed throughout Europe, tested and prepared for connecting ANSPs. ***Milestone achievement conditions:*** The ground infrastructure has been deployed.
	DM3 ATS Units systems connected to Ground distribution Infrastructure	The ATS systems have to be connected to the ground distribution infrastructure in order to receive and process ADS-C/EPP information, ensuring a harmonised ground data distribution. This DM needs to be synchronised between NM and ANSPs. ***Milestone achievement conditions:*** ATS systems are tested and connected to the ground infrastructure
	DM4 Safety Assessment	The safety assessment of the changes must be developed and delivered to the competent authority. ***Milestone achievement conditions:*** The safety assessment has been developed and delivered to the competent authority
	DM5 Training	All relevant staff (technical and operational) must be duly trained. ***Milestone achievement conditions:*** Training has been completed.
	DM6 Operational Use	Initial Trajectory Information Sharing ground distribution is ready for operational use once the procedures are in place, the systems have been upgraded, the safety assessment has been delivered and approved, and the training has been completed. ***Milestone achievement conditions:*** ATS systems distributing operational data are put into service

NM	**DM1** Ground distribution Architecture definition	Ground distribution architecture is defined to meet the required performance levels as defined in the applicable standards ***Milestone achievement conditions:*** Applicable standards, definitions and technologies are ready, and the ground distribution architecture has been defined
	DM2 Ground Infrastructure deployment	The ground infrastructure, following the architecture defined in DM1, has to be deployed throughout Europe, tested, and prepared for connection to the NM systems. ***Milestone achievement conditions:*** The ground infrastructure has been deployed.
	DM3 NM systems receiving the EPP data	Upgrade NM system for reception of EPP data. The received EPP data might be used for the update of a portion of NM's end to end trajectory. This DM needs to be synchronised between NM and ANSPs. ***Milestone achievement conditions:*** The NM interface for EPP data reception is available.

How to fulfil the Industrialisation Target Dates

Applicable standards/technical specifications for the ground distribution of EPP must be available. Technologies used in the architecture should reach V4 maturity level no later than the 31st of December 2023.

Recommended implementation: development of a Common European ADS-C Service

This service is not part of CP1 and therefore not mandatory; however, it is deemed as beneficial as it supports fast and efficient ADS-C contract management. The intention is to implement this solution in order to alleviate the Air-Ground communication infrastructure, improve the deployment of Initial Trajectory Information Sharing ground distribution and minimising deployment fragmentation SJU PJ.38 is validating this service and OEP workstream 12.2 will elaborate technical specifications that can be adopted to fulfil the needs of the current Implementing Rule.

Description:

One identified option for reliable, fast and efficient initial trajectory information sharing is to develop an ADS-C Common Service using SWIM TI Yellow Profile, as will be validated by PJ.38.

The ground ADS-C common service must be established based on a common service definition addressing ADS-C contract management, service interfaces, communication protocols and key performance indicators:

- The ground ADS-C common service must distribute the ADS-C/EPP data to the relevant ATS Units and NM Systems;
- ATS units must be capable of establishing ADS-C contracts for aircraft within their area of interest, or even beyond if operationally required.

Tentative Timeline for development of the ADS-C Common Service:

The validation of the ADS-C Common Service (PJ.38) will be performed before the end of 2023. The ADS-C Common Service technical specifications will be defined in parallel before the end of 2023, considering as an input the outcomes of the PJ.38 validation activities.

The definition of the ADS-C Common Service will cover the functions and requirements for initial Trajectory Information Sharing ground distribution.

Any selected service provider must roll out the service in a such way that the integration of the ground infrastructure and training is covered.

Family	Standards available	Readiness for implementation
6.1.1	Yes	Plans from manufacturers and operators
6.1.2	Under elaboration by OEP WS 12.2	Plans from ANSPs
6.2.1	No, not required	Availability of SESAR validation results
6.3.1	Under elaboration by OEP WS 12.2	Availability of PJ38 validation report and technical specification developed by OEP WS 12.2

4. Acronyms

Acronym	Description
#	
4D	*Four Dimensional: x, y, z and time*
A	
A6	*A6 Alliance*
ACC	*Area Control Centre*
A-CDM	*Airport Collaborate Decision Making*
ACH	*ATC Change Message (ICAO format, NMOC special)*
ADEXP	*ATS Data Exchange Presentation*
ADS	*Automatic Dependent Surveillance*
AFUA	*Advanced Flexible Use of Airspace*
AF	*ATM Functionality*
AFI	*Arrival Free Intervals*
AFP	*ATC Flight Plan proposal Message (ICAO)*
AFTN	*Aeronautical Fixed Telecommunications Network*
AIM	*Aeronautical Information Manual*
AIP	*Aeronautical Information Publication*
AIRAC	*Aeronautical Information Regulation and Control*
AIRM	*Aeronautical Information Reference Model*
AIS	*Aeronautical Information Service*
AISP	*Aeronautical Information Service Provider*
AIXM	*Aeronautical Information Exchange Model*
AMA	*Arrival Manager Constraint message (OLDI)*
AMAN	*Arrival Manager*
AMC	*Airspace Management Cell*
AMXM	*Aerodrome Mapping Exchange Model*
ANSP	*Air Navigation Service Provider*
AO	*Airline Operator /Airport Operator*
AOC	*Airline Operating Centre /Airline Operating Communication*
AOM	*Aircraft Operations Manual*
AOP	*Airport Operations Plan*
API	*Application Interface /Arrival Planning Information*
APL	*ATC Flight Plan Message (ICAO)*
APOC	*Airport Operations Centre*
APP	*Approach Control Unit /Approach Control Position*
APW	*Area Proximity Warning*
ARES	*Airspace Reservation*
ARR	*ICAO ATS Arrival Message*
ASM	*Airspace Management*
A-SMGCS	*Advanced Surface Movement Guidance and Control System*
ATC	*Air Traffic Control*
ATCO	*Air Traffic Controller*
ATFCM	*Air Traffic Flow and Capacity Management*
ATFM	*Air Traffic Flow Management*
ATM	*Air Traffic Management*
ATN	*Aeronautical Telecommunications Network*
ATOT	*Actual Take Off Time*
ATS	*Air Traffic Service*
ATSU	*Air Traffic Service Unit*
AU	*Airspace User*

Acronym	Description
AUP	*Airspace Use Plan*
AVSEC	*Aviation Security*
B	
B1	*Baseline 1*
B2	*Baseline 2*
B2B	*Business to Business*
BFD	*Basic Flight Data (DFS version of an IFPL)*
C	
CA	*Conflict Alert /Contractual Management*
CACD	*Central Airspace and Capacity Database*
CATC	*Conflicting ATC Clearances*
CBA	*Cross Border Area*
CDM	*Collaborative Decision Making*
CDO	*Continuous Descent Operations*
CFD	*Change to Flight Data*
CFPS	*Computer Flight Plan Software Provider*
CFSP	*Computer Flight Planning Service Providers*
CFT	*Call for Tender*
CHMI	*Collaborative Human Machine Interface*
CIAM	*Collaborative Interface for Airspace Management*
CMAC	*Civil-Military ATM Coordination*
CNS	*Communications, Navigation and Surveillance*
CONOPS	*Concept of Operations*
COP	*Coordination Point*
CORA	*Conflict Resolution Advisory*
COTS	*Commercial Off-The-Shelf*
COVID	*Corona Virus Disease*
CP1	*Common Project 1*
CPDLC	*Controller Pilot Data Link Communications*
CSP	*Communication Service Provider*
CTOT	*Calculated Take Off Time*
CWP	*Controller Working Position*
D	
DCT	*Direct Routing*
DEP	*ICAO ATS Departure Message*
DLS	*Data Link Service*
DM	*Deployment Milestone*
DMAN	*Departure Manager*
DPI	*Departure Planning Information*
DSP	*Data Link Service Provider*
E	
EACP	*European Aviation Common PKI*
EAD	*European AIS Database*
EAP	*EU ATC Harmonisation and Integration Programme Alignment Process*
EASA	*European Aviation Safety Agency*
EATMN	*European Air Traffic Management Network*
EAUP	*European Airspace Use Plan*
EC	*European Commission*
ECI	*Electronic Clearance Input*
ED	*EUROCAE Document*
EFD	*EFTMS Flight Data*

Acronym	Description
EFS	*Electronic Flight Strip*
EN	*European Norm*
EOC	*Essential Operational Changes*
EPP	*Extended Projected Profile*
ERNIP	*European Route Network Improvement Plan*
ESA	*European Space Agency*
ESCP	*European Strategic Coordination Platform*
ESSP	*European Satellite Service Provider*
ETFMS	*Enhanced Tactical Flow Management System*
ETSI	*European telecommunication Standardisation Institute*
EU	*European Union*
EUR	*European Region*
EUROCONTROL	*European Organisation for the Safety of Air Navigation*
EUUP	*European Update Airspace Use Plan*
F	
FAA	*Federal Aviation Administration*
FAB	*Functional Airspace Block*
FDP	*Flight Data Processing*
FDPS	*Flight Data Processing System*
FF-ICE	*Flight and Flow Information for a Collaborative Environment*
FIXM	*Flight Information Exchange Model*
FL	*Flight Level*
FMP	*Flow Management Position*
FMS	*Flight Management System*
FPL	*Flight Plan Message (ICAO)*
FRA	*Free Route Airspace or Fraport*
FUA	*Flexible use of Airspace*
FUM	*Flight Update Message*
G	
GANP	*Global Air Navigation Plan (ICAO)*
GAT	*General Aviation Traffic*
GIS	*Geographical Information System*
GML	*Geography Mark-up Language*
GUFI	*Global Unique Flight Identifier*
H	
HMI	*Human Machine Interface*
HVAC	*Heating, Ventilating and Air Conditioning*
I	
iAOP	*Initial Airport Operations Plan*
IATA	*International Air Transport Association*
IATF	*International Aviation Trust Framework*
ICAO	*International Civil Aviation Organisation*
ICD	*Interface Control Document*
ICS	*Industrial Control System*
IFPS	*Integrated Initial Flight Plan Processing System*
INAP	*Integrated Network Management and Extended ATC Planning*
IP	*Internet Protocol*
IR	*Implementing Rule /Integrated Receiver*
IT	*Information Technology*
IWXXM	*ICAO Meteorological Information Exchange Model*
K	

Acronym	Description
KPA	*Key Performance Area*
KPI	*Key Performance Indicator*
L	
LARA	*Local and Regional ASM Application*
LDACS	*L-Band Digital Aeronautical Communication System*
LVP	*Low Visibility Procedure*
M	
MASPS	*Minimum Aircraft System Performance Specification*
MCDM	*Measure Collaboration Decision Making*
MET	*Meteorological*
METAR	*Meteorological Aviation Routine Report*
MOC	*Memorandum of Cooperation*
MONA	*Monitoring Aids*
MOU	*Memorandum of Understanding*
MP	*Measurement Plan*
MSP	*Multi-sector Planner*
MTCD	*Medium Term Conflict Detection*
MWO	*Meteorological Watch Office*
N	
NES	*n-CONNECT*
NIA	*Network Impact Assessment*
NM	*Nautical Mile /Network Manager*
NMOC	*Network Manager Operation Centre*
NOP	*Network Operations Plan*
NOTAM	*Notice to Airmen*
NPZ	*No Planning Zone*
NSA	*National Supervisory Authority*
O	
OLDI	*On-Line Data Interchange*
OPS	*Operational*
OSI	*Open Systems Interconnection*
OT	*Operational Technology*
OTMV	*Occupancy Traffic Monitoring Values*
P	
PCP	*Pilot Common Project*
PDPI	*Pre-Departure Information*
PDS	*Pre-Departure Sequencing System*
PENS	*Pan-European Network Service*
PJ	*SESAR JU Project*
PKI	*Public Key Infrastructure*
PSR	*Primary Surveillance Radar*
R	
RAD	*Route Availability Data*
RMCA	*Runway Monitoring and Conflict Alerting*
RPA	*Remotely Piloted Aircraft*
RRP	*Re-routing Proposal Message*
RWY	*Runway*
S	
SAM	*Slot Allocation Message (ETFMS)*
SARP	*Standard and Recommended Practice (ICAO)*
SCADA	*Supervisory Control and Data Acquisition*

Acronym	Description
SDM	*SESAR Deployment Manager*
SDP	*SESAR Deployment Programme*
SES	*Single European Sky*
SESAR	*Single European Sky ATM Research*
SHAPE	*Solutions for Human-Automation Partnerships in European ATM*
SIGMET	*Significant Meteorological Advisory*
SJU	*SESAR Joint Undertaking*
SMS	*Safety Management System*
SPEC	*Specification*
SPECI	*Special Aerodrome Weather Report*
SRM	*Slot Revision Message (ETFMS)*
SSR	*Secondary Surveillance Radar*
STAM	*Short Term ATFM Measures*
SUP	*Supervisor/Supplement*
SWA	*Software Assurance*
SWIM	*System Wide Information Management*
SYSCO	*System Supported Coordination*
T	
TAC	*Tactical Air Navigation*
TAF	*Terminal Aerodrome Forecast*
TBO	*Trajectory Based Operations*
TCA	*Terminal Conflict Alert*
TCT	*Tactical Controller Tool*
TFSG	*Trust Framework Study Group*
TI	*Technical Infrastructure*
TMA	*Terminal Manoeuvring Area*
TOBT	*Target Off Block Time*
TRA	*Temporary Reserved Airspace/Temporary Restricted Area*
TS	*Time Server*
TSA	*Temporary Segregated Area*
TSAT	*Target Start-Up Approval Time*
TT	*Technical Topic (Technical Topics Database)*
TTA	*Target Time of Arrival*
TTO	*Target Time Over*
TTOT	*Target Take Off Time*
TWY	*Taxiway*
U	
UAC	*Upper Area Control Centre*
UUP	*Updated Airspace Use Plan*
V	
VA	*Validation Authority*
VAA	*Volcanic Ash Advisory*
VAAC	*Volcanic Ash Advisory Centre*
VACP	*Volcanic Ash Contingency Plan*
VDL	*Very-High Frequency Digital Link*
VDL2	*VDL Mode 2*
VME	*VDL Management Entity*
VPA	*Variable Profile Areas*
W	
WAFC	*World Area Forecast Centre*
Y	

Acronym	Description
YP	*Yellow Profile*