SESAR
DEPLOYMENT MANAGER

PLANNING

GUIDANCE MATERIAL FOR SESAR DEPLOYMENT PROGRAMME IMPLEMENTATION

PLANNING VIEW

20 December 2017

LET'S DELIVER TOGETHER

Guidance Material for SESAR Deployment Programme Implementation

Planning View 2017

FPA MOVE/E2/2014-717/SESAR FPA
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Introduction

The adoption by European Commission of the Reg. (EU) n. 716/2014 (Pilot Common Project), the establishment of the SESAR deployment Manager as per Reg. (EU) n. 409/2013, as well as the subsequent elaboration of the SESAR Deployment Programme, mark all together the real start of the Deployment Phase of the SESAR Project. It is within such phase that the modernization of the European ATM system becomes an operational reality and brings expected benefits, after its careful planning and its progress towards an adequate level of technological maturity.

This modernization initiative entails a coordinated effort from all operational stakeholders impacted by the Regulation, which are required to get organized to ensure a synchronized, timely and performance-driven deployment of the ATM Functionalities included in the PCP.

In this framework, whereas the Pilot Common Project sets out, at very high level, what has to be implemented, where it should be implemented, which stakeholders are called to invest to implement, and when this implementation shall be completed, the SESAR Deployment Programme represents the necessary planning tool and common reference work plan to steer the implementation and detail how the deployment activities should be carried out.

Fig. 1 - The SESAR Deployment Programme and the guidance material for its implementation

As the Single European Sky environment is under constant evolution and the European ATM infrastructure is expected to experience further developments and transformation, the tailored structure of the SESAR Deployment Programme has been designed to integrate the main workplan for CP deployment activities with the necessary guidance material to support its timely and synchronized implementation.

In this perspective, the Planning View 2017 thus represents the further breakdown of the "*Project View*" of the Pilot Common Project, as laid down within the SESAR Deployment Programme.

The Planning View will then be yearly updated to make sure that all operational stakeholders can adapt their investments and their implementation activities on the basis of the latest strategic developments.

In a nutshell, the Planning View provides a more detailed planning tool to Operational Stakeholders involved in the deployment of Common Projects, clearly defining the scope of the implementation activities, as well as the suggested approach to be followed.

In addition, this document represents the technical and most up-to-date reference for the submission of projects under upcoming CEF Calls, within the Category Common Projects.

Considering its role as blueprint for ATM Stakeholders' investment plans, the Planning View is therefore organized into the following three sections:

- Section 1, which provides for an overview of all major strategic elements that need to be addressed to ensure a timely and synchronized deployment of the PCP. The section presents an outlook on some of the key deployment activity streams, such as the Implementation of Data Link capabilities, the establishment of the SWIM Governance framework and a specific section on the cyber security aspects;
- Section 2, which outlines, as a refinement of the "*deployment Approach*" described at paragraph 3.2 of the SESAR Deployment Programme, the approach to be followed in the short-to-medium term, highlighting those activities that are most urgently needed. The analysis – performed at Family level – will be based on the optimization and / or sequencing aspects of the implementation activities, as well as on performance and CBA-related considerations.

- Section 3 lays down and further specifies the scope, features and main attributes of the 48 families identified in the SESAR Deployment Programme. The Family-based tables comprise all relevant information associated to the technological and operational elements to be deployed, complemented by specific recommendations to Stakeholders involved in their implementation. Finally, this section entails the list of key activities to be performed to deploy each Family, as well as the set of intermediate milestones to be achieved (i.e. the so-called *deployment approach* at family level)[1].

The Planning View 2017 also encompasses three separated Annexes:

- Annex A: Project View – Project Details, which features additional details and information on the 2014, 2015 and 2016 CEF-awarded projects. Due to its large size, this Annex will be available only on electronic version on the SESAR Deployment Manager website;

- Annex B: Standardization and Regulation Roadmaps, constantly updated with the ultimate goal of becoming the bridge between the SESAR Development and Deployment Phase through the industrialization phase. For each of the 48 Families include in the SESAR Deployment Programme, the Annex connects them with the relevant SESAR solutions, Very Large-Scale Demonstrations, ATM Master Plan OIs, as well as encompassing the reference to relevant Guidance Material, Specifications, Standards, MoCs and Regulations.

- Annex C: Performance Assessment and CBA Methodology, an essential tool in monitoring PCP implementation, assessing and monitoring cost and benefits of implementation projects submitted or not by operational stakeholders but also assessing the impact of "missing implementation projects", i.e. implementation projects not submitted timely and identifying solutions to recover such situations and get the whole PCP implemented. On the basis of principles laid down in the SESAR Deployment Programme, the performance assessment and CBA methodology describes the different steps taken to set the baseline against which performance will then be monitored during DP execution.

[1] This section will be also matched by a dedicated Appendix – "*List of services covering Reg. (EU) No. 716/2014*" – which contains a list of services partially covering the ATM information exchanges required by the PCP in the framework of the AF5 implementation.

KEY DEPLOYMENT ACTIVITIES

SESAR
DEPLOYMENT MANAGER

1. Key deployment activities

1.1 Data Link Services: Implementation Status and Next Steps

In December 2015, the SESAR Deployment Manager was requested by DG Move to prepare a "*DLS implementation strategy that will encompass all implementation activities still required to get DLS and then AF6 implemented*".

Accordingly, SDM developed and successfully consulted with the stakeholders the strategy which has been delivered to DG MOVE as an addendum to the Strategic View of the SESAR Deployment Programme 2016 on 28 September 2016.

Immediately after delivery, EC requested SDM to derive from this strategy a "DLS Recovery Plan" to urgently implement the necessary technological upgrades to ensure a stable and reliable ATN/VDL Mode 2 service", also using 2016 CEF Transport Calls as an opportunity to further facilitate recovery of DLS situation by end 2016. The DLS Recovery Plan develops a roadmap from today's DLS implementation status in Europe up to Initial Trajectory Information Sharing (AF6) implementation by the deadlines set in the Pilot Common Project (1st January 2025 for ground and 1st January 2026 for the airborne segment).

The DLS Recovery Plan was approved by EC and referred to as priority in the 2016 CEF Transport Calls for proposals on 13th October 2016 and has been published on the DG MOVE website: http://ec.europa.eu/transport/modes/air/sesar/deployment_en.

The DLS Recovery plan aims at focusing on the concrete and relevant activities required to be undertaken in the ground and airborne domains in order to achieve, in the right sequence, a synchronized DLS deployment in Europe. Taking into consideration the high-level principles concerning the DLS implementation outlined in the Addendum to the Strategic View of the DP 2016, as well as the outcomes of the ELSA study, the plan has been structured in the following paths:

- Path I – Implementation of the DLS transitional solution: identifying the deployment activities needed to meet EU (IR) 2015/310 and ELSA's recommendations, focusing in particular on the envisaged transitional solutions (Model B or Model C with Multi-frequency for the ground segment; and "best in class" avionics for the airborne segment).
- Path II – Preparatory activities towards the target solution: identifying the steps towards the target solution (Model D), through the implementation of ELSA's recommendations in order to grant the required performance needed to achieve full AF6 implementation.

On 18th October 2016, the EC also mandated the SESAR Deployment Manager to act as Data Link Services (DLS) Implementation Project Manager, "*responsible for organizing, implementing and monitoring the activities identified in the recovery plan as necessary for the implementation of the DLS transitional solution and the preparatory actions for the full achievement of the European target solution, Model D, in order to achieve the implementation of AF6 in accordance with the deadlines defined in the PCP Regulation. This role shall include managing the overall set-up, steering and coordination of the technical approach through*:

- *Identification of homogeneous service area starting from thorough analysis of the current situation in EU Member States;*
- *Definition of the target ground architecture per service area in cooperation with the local stakeholders;*
- *Interconnection of sub-networks within each service area to achieve a European distributed network and a European common approach;*
- *Updated CBA and expected contribution to SES performance objectives."*

These "architect" tasks shall be performed in consultation with all relevant stakeholders, in particular the SESAR Joint Undertaking, the Network Manager, the European Aviation Safety Agency and the European Defense Agency."[2]

Following the mandate, SDM facilitated a proactive and direct involvement of all the relevant stakeholders to ensure a coordinated submission of required DLS implementation projects to the CEF Transport Calls for proposals, also stimulating the establishment of a single European DLS governance. In this context, the DLS Recovery plan was also referred to in the 2016 CEF Transport Calls for proposals, serving as reference

[2] Extract from the European Commission mandate to SDM by 18 October 2017

for applications addressing DLS implementation, which has been identified as a priority topic under the SESAR common projects category of the call.

Covering its role of coordinator, SDM designed a dedicated DLS Cluster for the 2016 CEF Transport Calls, including implementation projects directly contributing to the two paths identified within the DLS Recovery Plan. The following picture illustrates the DLS Cluster designed for the 2016 CEF Transport Calls:

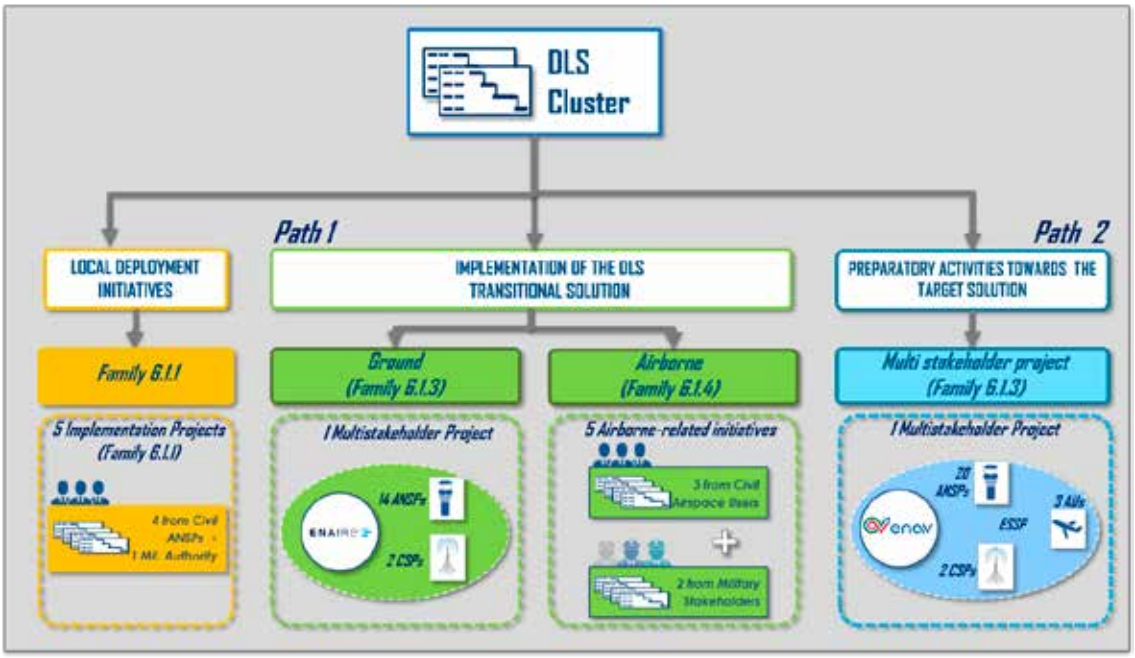


Fig. 2 - DLS Cluster for the 2016 CEF Transport Calls

With regard to Path I - ground domain, the multi-stakeholders project - 2016_161_AF6 – "General Call - DLS Implementation Project - Path 1 "Ground" stakeholders", is participated by:

- 14 ANSPs;
- 2 Communication Service Providers.

For what concerns the Path I - airborne domain, 5 projects were submitted and fully awarded.

With regard to Path II, the implementation project, 2016_159_AF6 – "DLS Implementation Project - Path 2", is participated by:

- 20 ANSPs;
- 2 Communication Service Providers;
- European Satellite Services Provider (ESSP);
- 3 Airspace Users.

Path I

In accordance to DLS Recovery Plan, Path I IPs are covering both the Ground and Airborne side of the implementation of the DLS Transitional solution in the short-term, in order to meet the requirements from Regulation (EU) no. 2015/310.

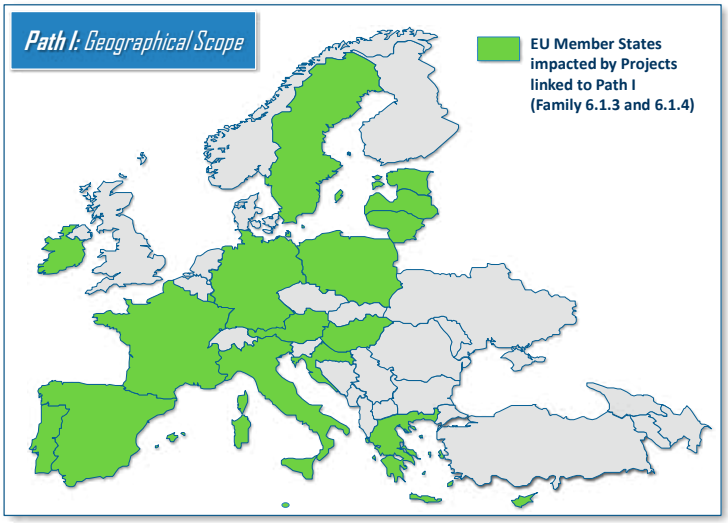


Fig. 3 - Path I Geographical Scope

Path II

Path II aims at identifying the main preparatory activities to be undertaken towards the implementation of the target solution (Model D), in support to SDM activities.

Considering its role by EC mandate, SDM is expected to perform specific activities towards the implementation of the target solution, through the implementation of ELSA recommendations in order to achieve the required VDL 2 network performance and capacity needed to achieve full AF6 implementation. These activities will be fed by the main findings stemming from specific tasks and related deliverables elaborated by the above-mentioned Path II project.

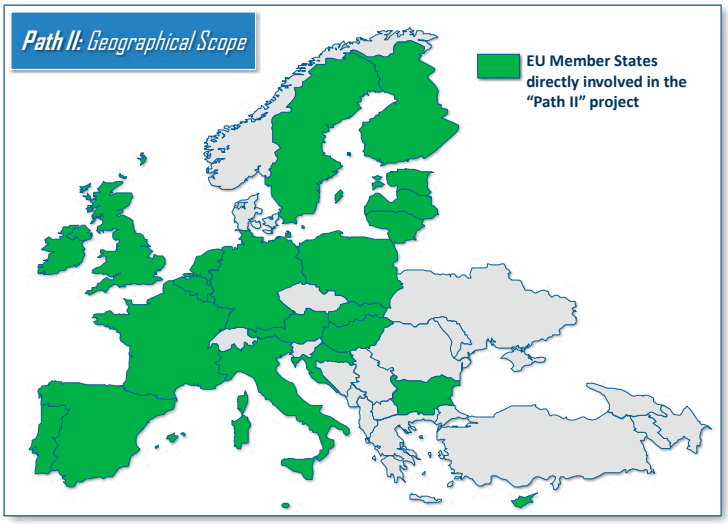


Fig. 4 - Path II Project Geographical Scope

Specifically, SDM tasks for the Path II are outlined in the following picture and describe in detail below:

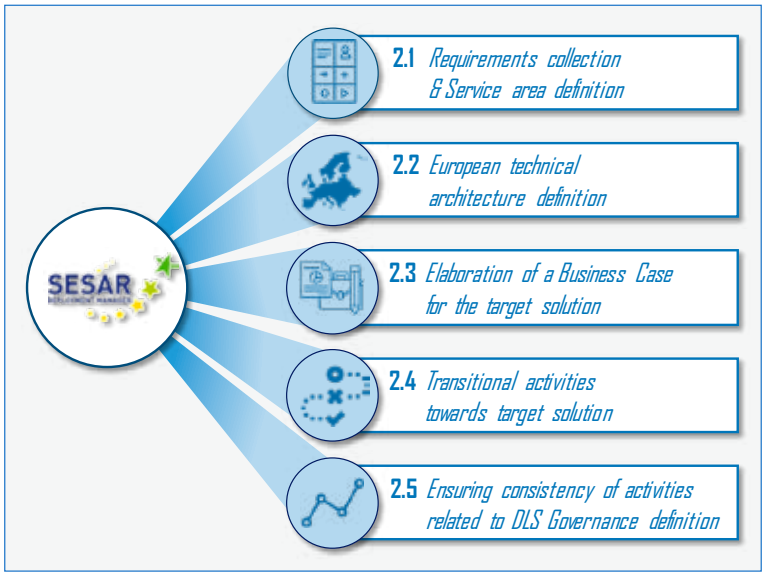


Fig. 5 - Path II: SDM tasks

1. **"Requirements collection and Service Areas definition"***:* SDM, acting as the DLS implementation project manager and architect, has worked on the definition of Service Areas (i.e. groups of neighboring Countries/regions which are in a similar operational environment and with a similar state of play), that represent the first step towards the final picture needed to develop the target solution. For this purpose, SDM has developed a specific document "*Service Area proposal (Initial draft)"* with the aim to provide a first proposal for the Service Areas definition. As stated before, the document has been elaborated on the basis of the work initiated within Path II project, taking into account the main findings stemming from its related deliverable "D2.1 - Requirements Identification Report" whose purpose is to identify the best way for the deployment of ELSA study[3] findings also in line with the indications reported in the SDM DLS Recovery Plan. SDM has then performed a dedicated analysis of the elements and proposed Service Areas scenarios collected in the D2.1 and has elaborated its first proposal for the Service Areas definition.

   It is worth noting that the Service Area proposal will be further detailed and complemented to take into account essential main outcomes stemming from the following tasks that SDM is expected to perform in close cooperation with the Path II project.

2. **"European technical architecture definition"***:* SDM will detect all the relevant elements needed for the definition of the technical architecture at Service Area and European level, starting from the identified Service Areas. This task will be performed in collaboration with Multi-stakeholder project "2016_159_AF6", through the findings stemming from a further elaborated version of the deliverable "D2.1 - Requirements Identification Report". SDM has worked on the elaboration of a document "Overall architecture proposal (Initial draft)" with the aim to provide a proposal for the overall architecture. The contents of Service Area proposal and European Technical Architecture definition will be included in a specific SDM deliverable "*D12.2 – Service Areas and overall architecture proposal*" that will be submitted to the European Commission by September 2017.

3. **"Elaboration of a Business Case for the target solution":** starting from the Service Areas definition and the preliminary activities related to the overall architecture definition, SDM will elaborate a dedicated Business case to evaluate the feasibility of the new European target solution. With regard to this, SDM will benefit of the support given by WP3 "Elaboration of a Business Case for the Target Solution" of the Multi-stakeholder project "2016_159_AF6".

4. **"Transitional activities towards target solution":** once the Service Areas and the overall architecture will be identified, SDM will identify the future steps and activities that are expected to be put in place to ensure the transition from the models deployed at Country/Region level towards the target solution throughout Europe. To perform this task, SDM will take into account the main outcomes stemming from the WP4 "Coordination with DLS IP Path 1" of the Multi-stakeholder project "2016_159_AF6".

5. **"Ensuring consistency of activities related to DLS Governance definition":** SDM is expected to ensure the consistency between the DLS strategy detailed in DP 2016 and the work for the establishment of a European Common DLS Governance, in terms of roles, responsibilities and processes needed for a common approach for DLS deployment. The development activity is in the responsibility of WP5 "Definition of a European Common DLS Governance" of the Multi-stakeholder project "2016_159_AF6".

[3] VDL Mode 2 Measurement, Analysis and Simulation Campaign by the ELSA Consortium and Programme Partnership – 2016

Other complementary activities

Following the outcomes of the DLS-COM workshop of 24 November 2016, the European Commission (EC) has, based on the ELSA recommendations and DLS Recovery Plan, identified a number of gaps – functions still to be filled or actions still to be completed – and the possible owners.

Building on these considerations, the EC formally mandated EASA, EUROCAE, Network Manager and SJU to address specific actions as detailed below:

EASA has been requested to launch, as soon as possible, two distinct actions:

- A short-term review of Regulation (EC) No 29/2009 to assess, clarify and adapt the conditions for exemptions in current Regulation (EC) No 29/2009, and to clarify the provisions regarding non-AOC traffic operators…
- The launch of the new rulemaking task for the revision of the DLS Regulation, to address all regulatory needs for the implementation of multi-frequency DLS on the basis of Model D.

Network Manager (NM) has been requested to:

- continue supporting the DLS implementation and reinforcing the RFF function;
- perform the "pan-European ATN/VDL2 performance monitoring and spectrum coordination function infrastructure performances impact and monitoring function";
- to support the implementation of the DLS Recovery plan and duly report all findings stemming from previously mentioned actions to the Commission, EASA and SDM.

EUROCAE has been requested to:

- closely work with EASA and the SDM in identifying and developing as needed, the required standards for "end-to-end certification" of DLS solutions;
- continue adapting ED-92D, as needed, targeting the ELSA model D implementation, and complement it by the necessary clarifications and guidance material, to ensure coherence and consistency among all standards and certification material;

SJU has been requested to:

- further support the implementation of the DLS recovery plan in terms of research or large-scale validation tasks, relying on the active coordination between SDM, EASA, the Network Manager and EUROCAE.

On the basis of the requests and tasks detailed above, a wide process of analysis and revision has started in each organization to clarify and address the technical aspects related to all the mentioned topic. SDM and all the other mandated organization are working together through a close cooperation in order to face all the next steps.

1.2 SWIM Governance Action Plan implementation

Since the publication of the Deployment Programme 2016, the execution of the SDM SWIM Governance Action Plan detailed in DP 2016 has started. In particular, Phase 1, a set of 4 targeted actions by a group of stakeholders supported by SDM, has been completed, while Phase 2, the execution of the SWIM Governance Deployment Implementation Project, has started.

However, some of the pre-conditions of the SWIM Governance Deployment Action Plan have changed, leading to some updates of the plan, in particular the timeline of some of the tasks.

1.2.1 Action Plan Update

Background

The SDM SWIM Action Plan built on 2 Phases on the basis of the following assumptions:

1. The readiness of a subgroup of stakeholders to undertake, under the coordination of SDM, preparatory activities for the SWIM Governance Deployment Implementation Project if a minimum financial support could have been provided – (Phase 1);

2. The submission of a new Implementation Project for the deployment of SWIM Governance in response to the 2016 CEF Transport Calls by a wide group of stakeholders and the start of the execution of the project following the INEA awarding decision expected for early summer 2017 – (Phase 2).

Both the assumptions were fulfilled and the work for the implementation of the SDM SWIM Action Plan started in due time. However, during the preparation of the SWIM Governance Deployment Implementation Project (IP) for the 2016 CEF Transport Calls, the involved stakeholders stressed the very close relationship between Phase 1 and Phase 2, with some of the tasks in Phase 1 being continued as tasks in Phase 2. Consequently, few changes to the tasks content and planning were agreed with SDM.

Resulting updates to the SWIM Action Plan

As a result of the adjustments to the planning, the SWIM Action Plan was updated as follows:

- Phase 1 has been reduced to 4 essential tasks, mainly due to the earlier start of the CEF Call 2016 IP and has been shortened to last from October 2016 to June 2017;
- The remaining tasks previously belonging to Phase 1 have been moved to Phase 2 in order to have a wider buy-in by operational stakeholders. Furthermore, some Phase 2 tasks have been re-scoped and some other tasks added (Common security requirements and International Coordination).

More details on the updates are provided in the following paragraphs.

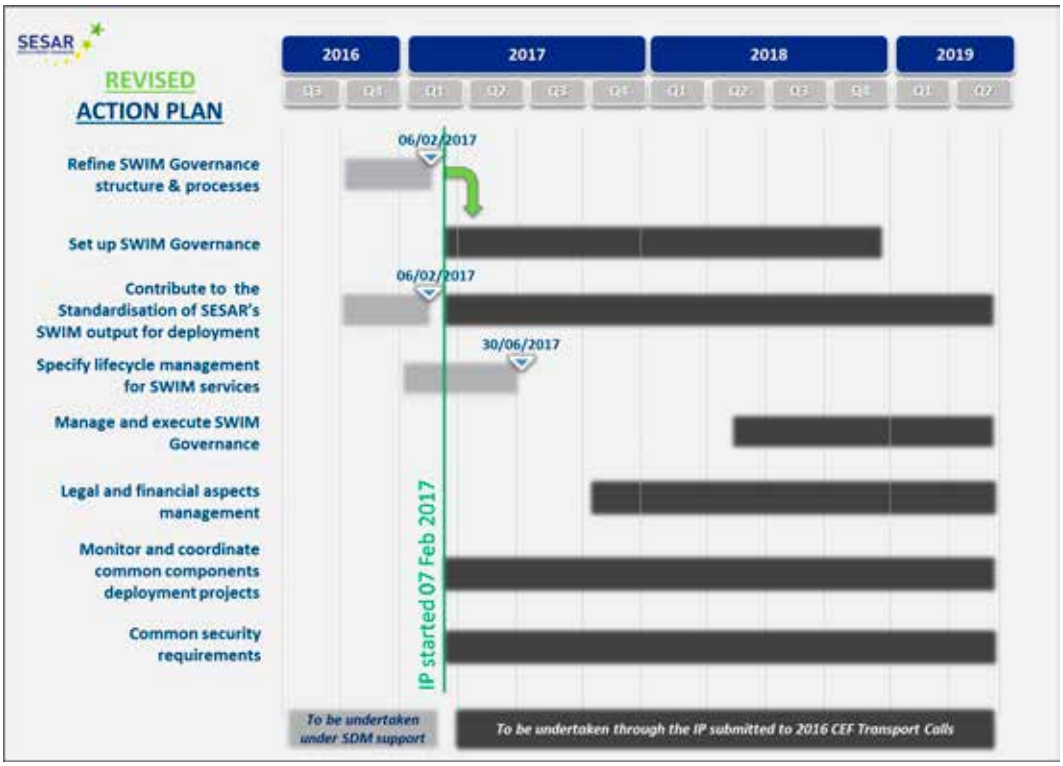


Fig. 6 - Updated SWIM Governance Deployment Action Plan

1.2.2 Updated Phase 1 – Prepare SWIM Governance Deployment

Since finalization of SWIM Governance Action Plan SDM has worked with stakeholders to support their preparation of a new IP under CEF Call 2016. At the same time, SDM has supported the implementation of Phase 1 of SWIM Governance by funding an effort of 300 man days and by providing logistics. Reflecting the changed time schedule of the 2016 CEF Transport Calls IP, all the following tasks were carried out as part of Phase 1 under SDM coordination and support:

- **Task 1 - Project Management**: the project management encompassed all activities related to the organization and management of the work in Phase 1 as well as the management of the impact on the Implementation Project planned for Phase 2. The task included planning, coordination and control of the work progress whilst ensuring the quality of the deliverables within the planned timeframe. The work was shared between the Project Manager and the partners which are task leaders in the 2016 CEF Transport Calls Implementation Project.
- **Task 2 – Refine SWIM governance structure and processes**: the activity was focused on gathering the supporting material on SWIM Governance developed in the scope of SESAR1 and the INEA 2015 project. The result is report summarizing the state of SWIM Governance preparing the foundation for the work to be carried out in Task 2 - Setup SWIM Governance - of the 2016 CEF Transport Calls IP.
- **Task 3 - Contribute to the standardization of SESAR's SWIM output for deployment**: the activity is ensuring that the various initiatives on SWIM standardization (Eurocontrol standardization groups, EUROCAE WG104) are aligned.
- **Task 4 - Specify the lifecycle management for SWIM services**: as there is no equivalent task in Phase 2, this task stayed mainly in line with the original Action Plan and carried out the work overlapping with the Implementation Project until June 2017 so that the outcome can be considered in the management and execution of SWIM Governance. This task produced a policy for the lifecycle management of services as well as a number of requirements on other policies related to it.

All 4 tasks in Phase 1 have delivered as intended. The reports are currently under SDM review and will be consolidated into SDM reports to the EC while at the same time serving as inputs to the new Implementation Project.

1.2.3 Updated Phase 2 – Deploy SWIM Governance (2016 CEF Transport Calls IP)

As foreseen by the Action Plan, an enlarged group of 22 stakeholders (12 ANSP, Eurocontrol Network Manager, 4 airlines, 3 airports, 1 military stakeholder and EUMETNET) has submitted a new IP proposal on SWIM Governance Deployment in response to the 2016 CEF Transport Calls and has been granted full co-funding support following the publication of the Call Awarding results by INEA.

Its scope encompasses all Phase 2 tasks according to the SWIM Governance Action Plan plus:

- Some tasks foreseen for Phase 1;
- Common security requirements;
- International coordination.

The new IP has started on February 7th, 2017, continuing the Phase 1 tasks. The official kick-off meeting took place on March 10th, 2017. The task refining and setting up the SWIM Governance is the first priority of the project and has already commenced its work. The current focus lies on defining the Terms of Reference for the Governance bodies as well as the essential policies guiding the SWIM Governance execution.

The end of the project is scheduled for July 2019.

The project scope encompasses all Phase 2 tasks according to the SDM SWIM Governance Deployment Action Plan. It also adds some tasks foreseen for Phase 1, which have been included into the project based on its earlier start. Namely these are

- Develop SWIM Compliance Guidance Material;
- Monitor and coordinate common components deployment projects.

In close coordination with SDM, two relevant activities were added to the projects scope:

- Common security requirements;
- International coordination.

Common security requirements aim at kick-starting the implementation of Family 5.1.4 of the Deployment Programme, which is also a common SWIM component. In the description of family 5.1.4 it is stated that: "*It is recommended that stakeholders launch a common Implementing Project, in coordination with the SWIM Governance, dealing with the topics of security and cyber security of SWIM*". In principle, a similar setup of the project and a similar group of stakeholders as for the SWIM Governance Deployment IP is foreseen. As stakeholders clearly indicated that no project would be presented in 2016 CEF Transport Calls, SDM proposed that a first step should be taken by the SWIM Governance Deployment project due to the overlap in topics as well as in participants.

The need to deal with international coordination was identified during the cooperation activity with FAA, in which SWIM Governance is one focus area. Hence the results of the SWIM Governance Deployment project are considered to be an input to international coordination and standardization activities, for example in ICAO. It is important to note that this task comprises the preparation of material for coordination activities, not the participation in any meeting or group itself.

SDM continues its commitment in coordinating the deployment of SWIM Governance by supporting the project execution, also hosting a shared document repository.

1.3 Cyber security

This section is an early guidance for ATM investors, who are the final responsible of addressing cybersecurity aspects while deploying the technological elements included within the Deployment Programme.

The objective is to:

- Clarify the relevance of cyber security in the context of SESAR;
- Illustrate potential adverse outcomes if cyber security is not addressed adequately by all stakeholders;
- Support stakeholders in providing useful reference and guidance material.

However, European Commission, EASA, SESAR Joint Undertaking and other EU Organizations and Bodies are still working to setup a comprehensive framework to secure operations and prevent cyber-attacks. Therefore, this section should not be understood as the final picture and will be updated in future releases of the Planning View, as part of the guidance material to implement the SESAR Deployment Programme.

1.3.1 Cybersecurity in the Aviation environment

Transportation and in particular Aviation have been identified in the EU Directive on Security of Network and Information Systems (NIS Directive 2016/1148) due to their importance for society. Aviation represents an attractive target for a wide range of attackers.

Legacy ATM systems are usually highly customised systems using heterogeneous and often proprietary point to point communication methods. Modern and future ATM systems design, on the contrary, rely on enhanced interconnectivity and will increasingly make use of Commercial Off The Shelf (COTS) components. Due to their open architecture and wide availability they support the reduction of costs for stakeholders. The vast distribution of COTS components as well as the usage of open standards introduce increased cyber security risks to aviation systems. It is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SESAR Deployment Manager (SDM) believes that all Deployment Programme (DP) Families 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 shall assess these risks and apply appropriate security controls to mitigate them.

1.3.2 Threats and consequences

Physical assets range from HVAC (Heating, Ventilation & Air Conditioning) system to controller working position and aircraft, virtual assets range from airline customer database to airspace modelling data. For virtual assets, the data may be stolen, destroyed or tampered with hence becoming unreliable. Be it physical or virtual, the consequences of a cyber-attack may lead to:

- significant and widespread loss of reputation across the industry
- damage to assets
- unavailability of services

- delay and traffic disruptions
- profit loss
- safety breach
- accidents
- etc.

There is also the virtual – physical dimension, also known as the cyber – physical dimension, where changes in virtual assets through cyberspace have an immediate effect on physical outcomes. This includes for example SCADA systems (Supervisory Control and Data Acquisition) which monitor and control operations at an airport or remote facilities (e. g. a radar station).

1.3.3 Available Regulation and guidance material

In order to minimise disruption of operations, resilience has always been essential to the performance of the air transport system. Resilience at the elementary system level is a first step but resilience at business level also needs to be ensured, holistic business continuity plans should therefore be elaborated by operational stakeholders.

Investments in cyber security have become necessary to ensure safe and timely operations. In regard to existing resource constraints and economic pressure, we must however be proportionated and ensure we are following a responsible, documented and risk-based approach. All stakeholders should anticipate that their NSA's will require them to provide evidence on security risk assessment.

Notwithstanding what NSA's may request from their operational stakeholders, here is a list of regulations, standards and guidance documents which are sometimes targeting a specific audience but may inspire good practises across the whole community.

For States and "operators of essential services"

- The Network and Information Security (NIS) Directive (2016/1148) requests Member States to identify "operator of essential services" by 9 November 2018 and lists for air transport the following organisations: air carriers, airport managing bodies and traffic management control operators. The NIS directive also requests the States to ensure that "operators of essential services" take:
    1. "*Appropriate and proportionate technical and organisational measures to manage the risks posed to the security of network and information systems which they use in their operations. Having regard to the state of the art, those measures shall ensure a level of security of network and information systems appropriate to the risk posed*".
    2. "*Appropriate measures to prevent and minimise the impact of incidents affecting the security of the network and information systems used for the provision of such essential services, with a view to ensuring the continuity of those services*".

For ANSPs and NM:

- Commission Implementing Regulation 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, in its requirement ATM/ANS.OR.D.010 Security Management states that:
    - (a) *Air navigation services and air traffic flow management providers and the Network Manager shall, as an integral part of their management system as required in point ATM/ANS.OR.B.005, establish a security management system* […]
    - (d) *Air navigation services and air traffic flow management providers and the Network Manager shall take the necessary measures to protect their systems, constituents in use and data and prevent compromising the network against information and cyber security threats which may have an unlawful interference with the provision of their service.*
- CANSO Cyber Security and Risk Assessment Guide

For all stakeholders:

- General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679) on the protection of natural persons with regard to the processing of personal data and on the free movement of such data
- ITU X.1205 "Overview of Cybersecurity"

- CEN EN 16495 "Information security for organisations supporting civil aviation" builds on the structure of the ISO/IEC 27000 family - Information security management systems
- ISO 27000 family of standards are focused on information security matters:
  - ISO 27001 - Information technology — Security techniques — Information security management systems — Requirements
  - ISO 27002 - Information technology — Security techniques — Code of practice for information security management
  - ISO 27003 - Information Technology — Security techniques — Information security management system implementation guidance
  - ISO 27004 - Information technology — Security techniques — Information security management — Measurement
  - ISO 27005 - Information technology — Security techniques — Information security risk management
  - ISO 27006 - Information technology — Security techniques — Requirements for bodies providing audit and certification of information security management systems
- NIST Cybersecurity Framework

Furthermore, here below some recommendations:

1. **Ensure Competency**: ensure that you have a Chief Information Security Officer (CISO) who is competent for the task and who has the backing of his high-level management.
2. **Maintain a Cyber Risk Assessment**: Investments have to be proportionate to the threat. In order to do this, risk assessments need to be performed. It is important that any cyber risk assessment is updated at least every 6 months. Favour low cost, simple and repeatable risk assessment techniques, know your key assets and get independent experts to validate them;
3. **Control your Supply Chain**: Once you introduce defences identified in a risk assessment, suppliers can still undermine your cyber security. Ensure they follow a documented cyber security policy by enforcing appropriate contractual agreements;
4. **Exercise Cyber Resilience**: nobody can guarantee that they are totally secure against all cyber threats. Cyber risk assessments help identify potential attack scenarios. These scenarios can be used to exercise your ability to recover from a potential incident;
5. **Act now.**

1.4 Global Interoperability

The analysis of the necessary harmonisation of the main technological developments and evolution, as well as the necessary synchronisation needs, is at the cornerstone of the SDM effort to contribute to global interoperability. Special reference was given to the risk of lack of global interoperability, which has been representing a key concern for airspace users in the SDM stakeholder consultation process.

The United States FAA's NextGen and European Union's SESAR project are the two largest ATM modernisation programs currently under way. The cooperation between US FAA and EU SJU and SDM is instrumental to achieve global interoperability of ATM systems and to support harmonisation of standards, technologies and procedures on deployment matters. The SDM has committed to work on a complete life cycle view (definition, development, deployment) of both NextGen and SESAR, confirming the importance of promoting SESAR as one project. With respect to cooperation with the FAA and global harmonisation the SDM works therefore closely with the SJU, ensuring a single SESAR view to the international stakeholders' community.

Framework and guidance from Policy Level

The international activities of SDM take place under the oversight of the policy level led by the European Commission, which has delivered a specific mandate to SDM to set the scope of the cooperation with the FAA.

Regarding European cooperation with US/FAA, for R&D purposes the cooperation between SESAR JU and NextGen is taking place under the umbrella of the MoC between the EU and US[4] with specific reference to Annex 1. With respect to deployment, the SDM cooperation with the US/FAA is currently taking place under the umbrella of the Letter of Intent (LoI), signed by FAA and EC in June 2015.

Whilst cooperating with the FAA through two different frameworks in the period 2016-2017, SDM and SJU are working closely together to ensure that SESAR is perceived as a single project. In case of any future development towards a revised US EU MoC, covering the full life cycle, the cooperation of SESAR and FAA will evolve the updated framework according to the same principles.

State of Harmonisation between SESAR and NextGen

In December 2016, the second edition of the State of Harmonisation Document on the state of US/EU Air traffic modernisation and its programs SESAR and NextGen was published simultaneously by SJU/SDM and FAA[5]. The purpose of this regular publication is to provide a high-level summary of the current state of progress towards achieving the necessary level of harmonisation and global interoperability between NextGen and SESAR. More broadly, the publication reflects the current and planned collaboration efforts by the United States and the European Union to harmonize and secure the modernisation of air traffic management bilateral as well as globally in support of the ICAO Global Air Navigation Plan (GANP) and its Aviation System Block Upgrade (ASBU) programme.

Both NextGen and SESAR recognize the need to integrate the air and ground parts of their respective ATM systems by addressing efficiency needs of flight trajectories planning and execution and the seamless and timely sharing of accurate information. The US–EU harmonisation work aims to ensure that modernisation and advances in aviation and in the air navigation systems worldwide can be made in a way that supports a high-performing aviation system over time and global cooperation leading to seamless operations and safe and efficient practices for the airspace users and the travelling public.

NextGen and SESAR have together made significant progress in several critical areas since the publication of the first edition of the State of Harmonisation in 2014 and the state of harmonisation document includes for the first time the full life cycle of the programmes – including deployment. The European deployment stakeholders are invited to contribute their views and expectations for the future progress via the SDM Stakeholder Consultation Platform and via the consultation activities of the Cooperative Arrangements to the different key technical issues (i.e. in particular but not limited to Datalink, SWIM and AMAN).

Outlook to upcoming DP editions

As outlined above, it is foreseen to incorporate outcomes from the SDM-FAA cooperation work into the functional views of the SESAR Deployment Programme in order to complement it with a wider global perspective. With respect to ICAO SARPs and guidance material related to deployment, SDM will work in close cooperation with SJU, feeding and supporting the relevant working groups at European level on deployment matters, under the guidance of EC. SDM will further seek co-operation of the manufacturing industry in this context (especially airborne manufacturers but not limited to); this activity takes place under the framework of the Cooperative Arrangements with the manufacturing industry according to Regulation (EU) no. 409/2013.

Eventually, the international exchange on experiences on deployment execution, lessons learnt and best practices in implementation are expected to contribute to SDMs capability to fulfill the tasks of synchronisation and coordination for Common Projects implementation in accordance to Regulation (EU) no. 409/2013. The key implementation initiatives with respect to DataComm implementation and on SWIM governance will be in the focus and will benefit from the SDM FAA cooperation.

[4] Memorandum of Cooperation between the United States of America and the European Union, 3rd March 2011, published in the Official Journal on the European Union 5th April 2011 (MoC including Annex 1)
[5] NextGen – SESAR State of Harmonization (Second Edition) – 2016, prepared by the Coordination Committee (CCOM) for the US-EU MoC Annex 1 High-Level Committee

SHORT-TERM DEPLOYMENT APPROACH

SESAR
DEPLOYMENT MANAGER

2. Short-term Deployment Approach

In the SESAR Deployment Programme, a deployment approach for each ATM Functionality has been defined. The interdependencies among the families are also identified, providing the different linkages (enhancement or prerequisite) and stressing the need of synchronising certain families.

The deployment approach for each AF and Sub-AF represents the sequencing of the deployment activities (e.g. of specific families) associated to an ATM Functionality, and corresponds to the preferred approach to be followed by operational stakeholders impacted by the PCP Regulation and therefore requested to invest in the implementation of new technologies and/or operational improvements.

By construction, the recommended deployment approaches per ATM Functionalities are stable in time, and could only be changed at the occasion of an evolution of the Common Project regulations.

In the Planning View, the deployment approach also identifies the short-term elements needed to achieve the overall AFs deployment in accordance to the deadline set by the PCP regulation. Indeed, following this approach, the intention is to propose the required Short-Term Implementation Needs as the basis for the Commission to identify priorities for awarding EU financial incentives.

These short-term elements, identified through the DP families, may evolve in future editions of the Planning View, as the implementation progresses. This is a living section whose aim is to reflect only the short-term needs.

The short-term deployment approach is supported by three fundamental pillars: technical considerations, status of implementation in Europe, and performance contribution.

The technical aspects rely on the need to deploy a given family in order to successfully achieve the overall AF or Sub-AF from a technology perspective (systems and procedures). This implicitly means that the families identified in the short-term deployment approach are paramount pre-requisites to continue and progress with the deployment of the functionality. In some cases, it also happens that the families within an AF are prerequisites for families belonging to a different AF. In these cases, it is key to provide a transversal view by highlighting the interdependencies and identifying which are the prerequisites.

The status of implementation, based on the Monitoring View, gives the actual picture of the current deployment of a given family in the requested places. The PCP Regulation defines the sites that must deploy each ATM Functionality and sub-Functionality. The Deployment Programme is the tool to achieve the successful deployment on time of all the sub-Functionalities, and therefore it is needed to identify where there are gaps in terms of implementation and also to monitor how the deployment is progressing across Europe. Depending on the implementation gaps identified with the Monitoring View, and also depending on the technical need to deploy a given family described in the DP, it will be paramount to focus and push for its deployment. This would derive on including those families in the short-term deployment approach.

It is important to note that being part of the short-term deployment approach does not necessarily imply that a family is the most important within the Sub-AF, either from a performance or technical perspective. This means that the family is only considered important for short-term deployment if there is a global lack of implementation. For example, a Family can be currently part of the short-term deployment approach due to the lack of implementation projects, but could be removed from the short-term deployment approach in the upcoming edition should implementation have progressed (i.e. implementation projects are in the pipeline). This could also be extended to the inclusion of another Family in the short-term deployment approach in the future, as a continuation of the implementation of the Sub-AF.

Finally, the performance aspects must be taken into account in order to secure the positive CBA of the PCP. Those families that are mostly contributing to the 4 main KPAs require special attention and care from the deployment and monitoring perspective. Including those families with great performance impact will protect the overall realisation of benefits for each sub-Functionality. Therefore, the short-term deployment approach will be complemented with a description of the performance contribution from each AF and Sub-AF, and when possible, these benefits will be monetised extrapolating them until 2030.

It has to be noted that the monetisation of benefits, and the estimation of fuel, CO_2 and delay savings are based on the existing implementing projects (real data) but also on an extrapolation of those other projects still to be implemented in order to achieve the full deployment of each family.

All these three key pillars combined will support the identification of the short-term deployment approach, and will allow SDM to focus its efforts on monitoring and supporting the implementation of the identified families by the required operational stakeholders.

AF1 – Extended AMAN and Performance Based Navigation in the High Density TMAs

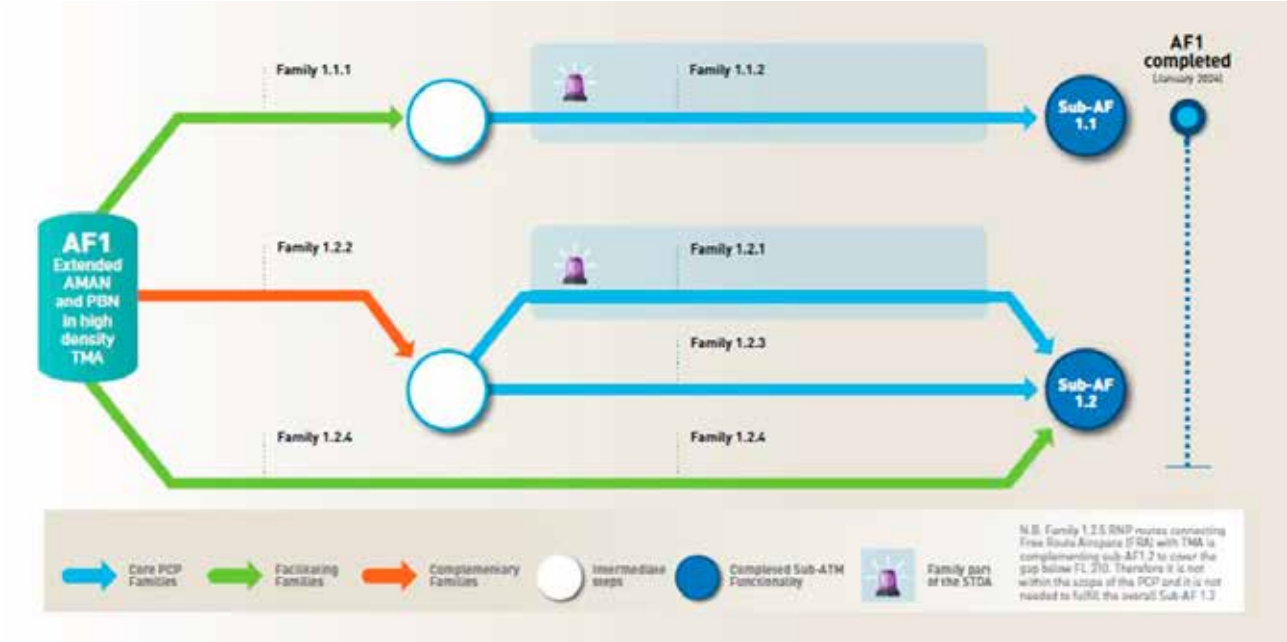


Fig. 7 - AF1: Short Term Deployment Approach

AF1 is divided into two Sub-AFs: Extended AMAN and PBN in high density TMAs.

Sub-AF 1.1: Extended AMAN, the short-term deployment approach shall focus on family 1.1.2 AMAN upgrade to include Extended Horizon function. This family is the core of the Sub-AF, and with its implementation, Sub-AF 1.1 of the PCP will be achieved. The required technology has been validated in SESAR and is considered mature for deployment, although additional local validations may be needed in particularly challenging environments such as where multiple PCP airports lie within close proximity of one another and affect each other's arrival planning horizons. Whilst Basic AMAN is already available at a good number of the PCP airports (13 out of 25) and activities are in progress in additional 10 airports, the Extended AMAN has been fully deployed only at London-Heathrow and the implementation activities have reached only partial results in 13 airports. In addition, for 5 airports, no specific plan has been declared by stakeholders. The Regulation states that the Extended AMAN must be ready by January 1st, 2024, therefore, by the end of 2017 there will be 6 years left to complete the implementation in the remaining airports.

This Sub-AF has an impact on the fuel emissions and also on the predictability. In 2017, there are 11 implementation projects in execution phase, which affect a total traffic of 68,8 million of flights, representing some 49,6% of the total traffic at PCP airports. Extended AMAN is expected to contribute in terms of savings in minutes and fuel and CO_2 savings as reported in the table.

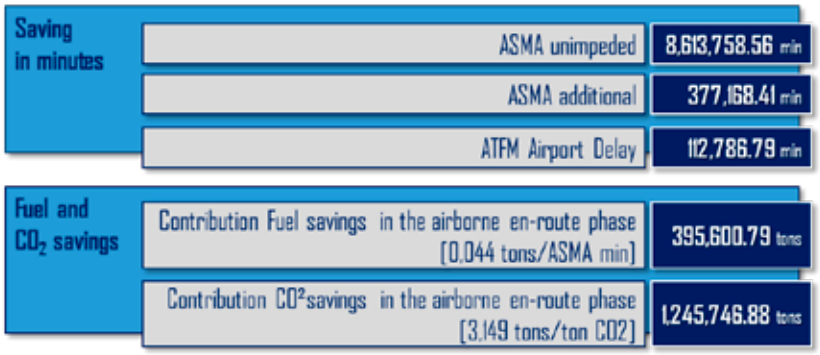


Fig. 8 – Sub-AF 1.1: Performance Contribution

These estimated benefits would be translated into a monetisation of 450,44 million euros.

Sub-AF 1.2: PBN in high density TMAs, the short-term deployment approach should focus on Family 1.2.1 RNP APCH with vertical guidance. This family includes vertically guided RNP approach procedures to two lines of minima (LNAV/VNAV and LPV), which are the core of Sub-AF 1.2 together with RNP 1 SIDs and

STARs (family 1.2.3). The short-term focus is on 1.2.1 since presently there are some technical issues with the implementation of RNP 1 operations in high density TMAs (included but not limited to, the lack of RNP reversion, the lack of means to indicate RF capability in ICAO flight plan and concerns over the critical mass required to materialize benefits). Work on these issues is progressing in multiple fora and SDM does not foresee the need to revise the FOC of family 1.2.3.

RNP Approach family has been fully implemented in Nice, Oslo, Paris Orly, Vienna and Zurich airports, while the deployment has achieved partial results within eleven additional airports. There are however on-going initiatives and/or plans to deploy such Family within all PCP airports, although in some cases not all the Family scope is included within these plans. The FOC date for the implementation of this Family is January 2021, therefore, by the end of 2017 there will be only 3 years left to complete the implementation within the PCP scope.

This Sub-AF has an impact on the fuel emissions, cost-effectiveness and also on the predictability. In 2017 there are 9 implementation projects in execution phase, which affect a total traffic of 24 million of flights, representing some 35,1% of the total traffic at PCP airports. RNP APCH is expected to contribute in terms of savings in minutes and fuel and CO_2 savings as reported in the table.

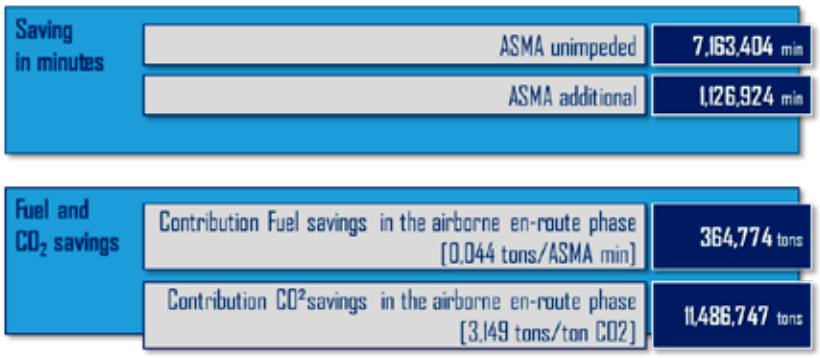


Fig. 9 – Family 1.2.1 - Performance Contribution

These estimated benefits would be translated into a monetisation of 407,75 million euros.

AF2 – Airport Integration and Throughput

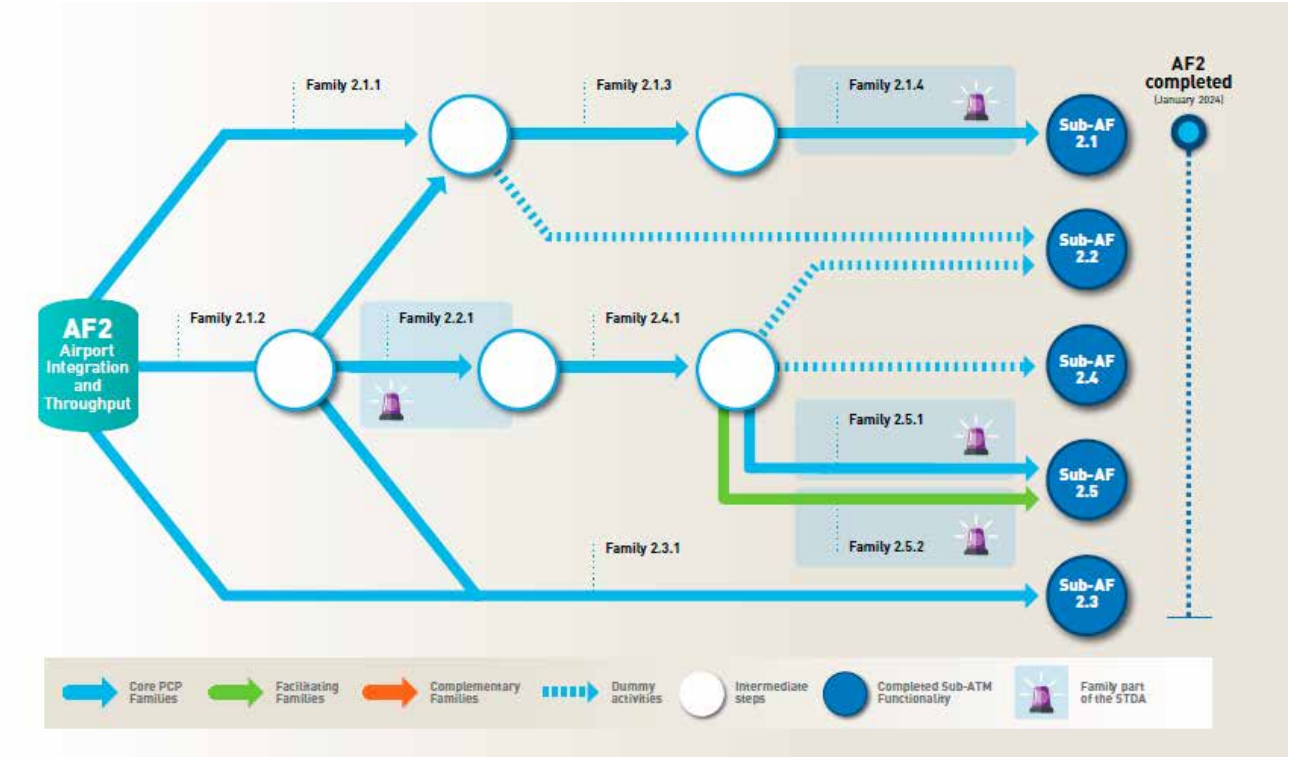


Fig. 10 - AF2: Short Term Deployment Approach

AF2 is divided into five Sub-AFs: Departure Management Synchronised with Pre-departure sequencing, Departure Management integrating Surface Management Constraints, Time-Based Separation for Final

Approach, Automated Assistance to Controller for Surface Movement Planning and Routing and Airport Safety Nets.

The short-term deployment approach for AF 2 should focus on family 2.1.4 Initial AOP, 2.2.1 A-SMGCS level 2, 2.5.1 Airport Safety Nets associated with A-SMGCS (Level 2) and 2.5.2 Vehicle and aircraft systems contributing to Airports Safety Nets.

Sub-AF 2.1: As described in family 2.1.4, the Airport Operations Plan (AOP) is the element that reflects the operational status of the Airport and therefore facilitates Demand and Capacity balancing. It 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 optimization can be made. The ATM stakeholders' planning processes and working methods are included in the AOP. This means that it is the tool to enable an optimized pre-departure sequencing with information management systems for airspace users and airport.

Initial DMAN and A-CDM are essential pre-requisites and essential requirements to the implementation of Initial AOP.

Family 2.1.4 is linked with Family 4.2.4 AOP/NOP information sharing, being the AOP a prerequisite to achieve the full implementation of 4.2.4. Therefore 2.1.4 is paramount to complete Sub-AF 4.2 implementation.

The current implementation of Initial AOP in Europe has achieved the full deployment of the Family only in Zurich, out of the 25 airports listed in the PCP. Implementation activities on-going and/or plans to deploy the Family have been declared within 19 airports, but concrete results have been achieved only in three additional airports. Moreover, no plans have been defined in 4 airports. With the FOC date of this Family set on January 2021, an acceleration in the deployment is highly needed.

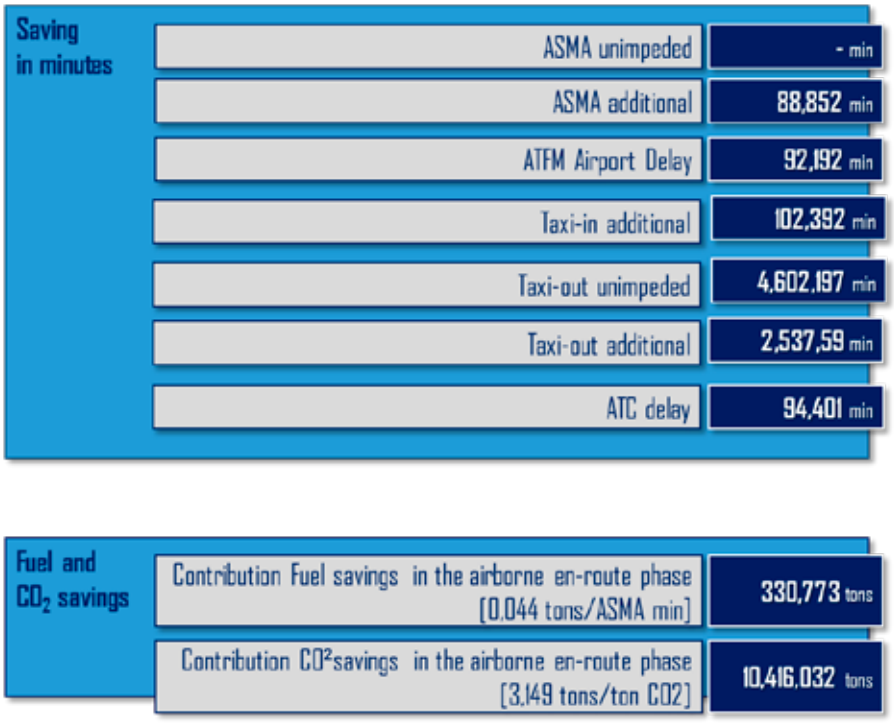


Fig. 11 - Family 2.1.4 - Performance Contribution

The Initial AOP implementation will have an impact on environment, cost-effectiveness and capacity. In 2017 there are 13 implementation projects in execution phase, which affect a total traffic of 27,4 million of flights, representing some 40,1% of the total traffic at PCP airports. Initial AOP is expected to contribute in terms of savings in minutes and fuel, as well as CO_2 savings as reported in the chart. These estimated benefits would be translated into a monetisation of 355,4 million euros.

Sub-AF 2.2: A-SMGCS level 2 is a level 1 system complemented by the A-SMGCS function to detect potential conflicts on runways, taxiways and intrusions into restricted areas and provide the controllers with appropriate alerts. It is the first step to achieve Sub-AF 2.2 benefits. Main benefit is related to safety. However, some other benefits such as "cost-effectiveness", "capacity" and "environment" should not be neglected nor forgotten.

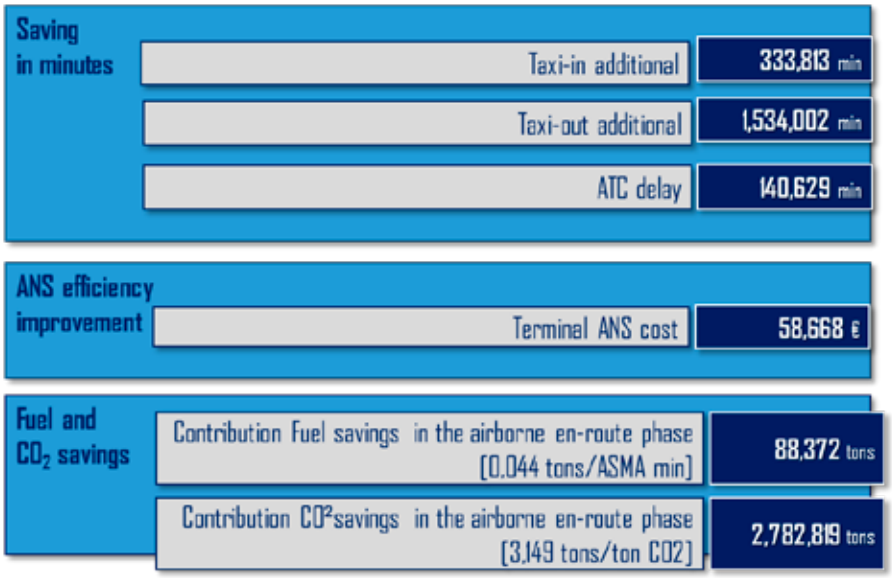


Fig. 12 - Family 2.2.1: Performance Contribution

A-SMGCS level 2, as reported in detail in the DP Monitoring View, is still far from being fully deployed within the whole PCP geographical scope. 9 airports have declared to have it fully deployed, whilst additional 7 have declared certain level of implementation (not higher than 70% of the total).

Family 2.2.1 is a prerequisite to implement Sub-AFs 2.2, 2.4 and 2.5. It will therefore have an impact on safety, cost-effectiveness, capacity and environment. In 2017 there are 10 implementation projects in execution phase, which affect a total traffic of 23,37 million of flights, representing some 34,2% of the total traffic at PCP airports. A-SMGCS is expected to contribute in terms of savings in minutes and fuel and CO_2 savings in the chart below.

These estimated benefits would be translated into a monetisation of 86,18 million euros.

Sub-AF 2.5: Airport Safety Nets associated with A-SMGCS Level 2 and Vehicle and Aircraft systems contributing to Airport Safety Nets implementation is critical for safety, and the FOC date is 01/01/2021, therefore there is a clear need to push for its implementation.

Currently, the status of implementation of Family 2.5.1 and 2.5.2 is far from its full completion, as only 1 airport declared the full implementation of Family 2.5.1 and 3 airports declared to have deployed Family 2.5.2. Plans to implement the Families by January 2021, deployment target date set in the PCP, have been declared by the vast majority of involved stakeholders, although tangible results have already been achieved only in Munich and Nice for Family 2.5.2.

AF3 – Flexible ASM and Free Route Airspace

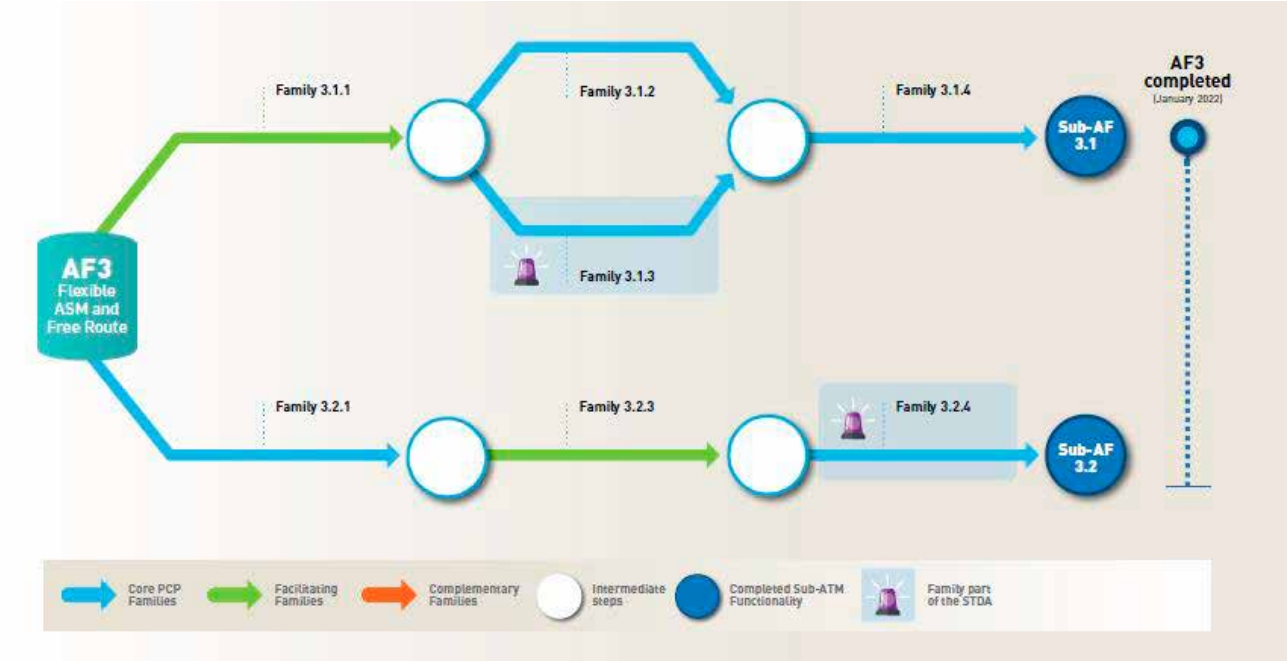


Fig. 13 - AF3: Short Term Deployment Approach

AF3 is divided into two Sub-AFs: Flexible Airspace Management and Free Route.

The short-term deployment approach for AF 3 should focus on family 3.1.3 Full rolling ASM/ATFCM process and ASM information sharing, and 3.2.4 Implement Free Route Airspace.

Sub-AF 3.1: Full rolling ASM/ATFCM process and ASM information sharing (fam. 3.1.3) together with the automated (enabling) ASM tools described in family 3.1.1, enhances the distribution of information and therefore the management and awareness, on airspace status and availability. It provides support for AFUA and FRA operations.

The implementation of Family 3.1.3 is currently in progress within 13 States (both with or without the support of CEF funding), and another 12 have declared intention and/or plans to deploy it, whilst there are no specific plans at the moment in another 4 countries. Furthermore, the Network Manager is currently implementing the Family according to its remit, also benefitting of initiatives undertaken within the SDM coordination activities.

Family 3.2.4 Implement Free Route Airspace is the core family of PCP Sub-AF 3.2. The implementation of FRA requires the availability of certain systems described in Family 3.2.1.

Specific focus should be put mainly on AU system upgrades (e.g. flight plan filing systems (CFSP) to support long DCT segments and handling of LAT/LONG, if required) and ANSPs (e.g. FDPS and Controller Support tools). NM systems may require further adaptation to support growing and extended FRA across Europe.

Although some States have already implemented FRA supported by their ATS systems, further benefits introducing cross-border/ large-scale implementation of FRA might require additional system upgrades, new functions, procedures and controller tools. Currently 14 countries have declared a full FRA implementation, whilst the implementation is either in progress or at least planned within all other applicable countries.

For families 3.1.3 and 3.2.4 in total 8 implementation projects are currently executed. The performance contribution of these projects is expected to be around 15% of the total nautical mile savings expected from AF 3 and 4, which represents some 89.3 million nautical miles and 155.9 million CO_2 tons. Moreover, these families will deliver 2.9% of all ATFM en-route delay reductions resulting from AF 3 and 4 projects, which represents some 10.95 million minutes.

The performance of future projects that will close the currently remaining gap for families 3.1.3 and 3.2.4 is still under evaluation with the support of the Network Manager.

AF4 – Network Collaborative Management

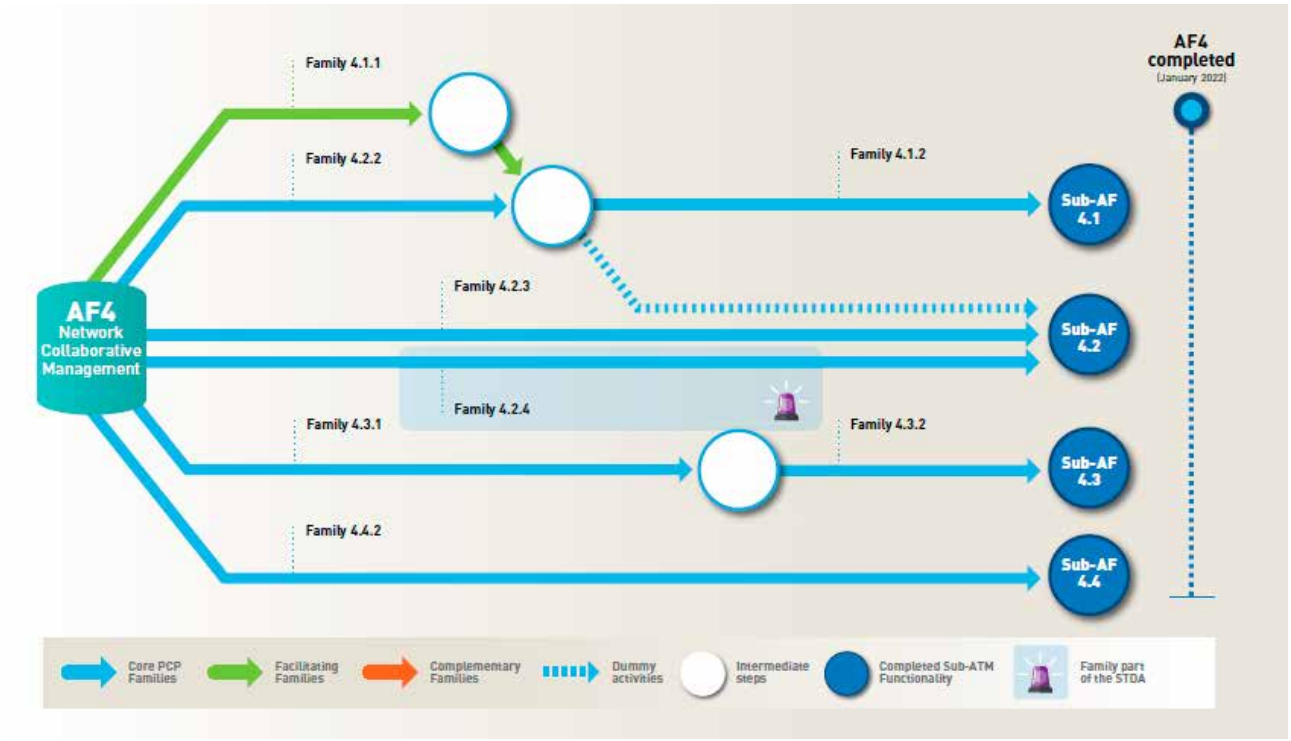


Fig. 14 - AF4: Short Term Deployment Approach

AF4 is divided into four sub-AFs: Enhanced Short Term ATFCM Measures, Collaborative NOP, Calculated Take-off Time to Target Times for ATFCM purposes, and Automated Support for Traffic Complexity Assessment. The short-term deployment approach for AF 4 should focus on Family 4.2.4 AOP/NOP information sharing.

Sub-AF 4.1: although being the most beneficial Sub-AF, it is not considered as part of the short-term deployment approach in the very short term (2017-2018). This is due to the high level of implementation of family 4.1.1 and the on-going Network Manager implementation project in family 4.1.2. The other operational stakeholders have very few plans to implement the phase 2, waiting for stable concept and tool.

Sub-AF 4.2: the Airport element that reflects the operational status of the Airport and therefore facilitates Demand and Capacity Balancing is the Airport Operations Plan (AOP), described in Family 2.1.4.

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 (Network Operation Plan). The AOP/NOP information sharing is the technical data layer on the collaborative NOP.

The current implementation of Family 4.2.4 is still lagging behind, as no progress has been declared within any of the PCP listed airports; on the other hand, the deployment activities are currently in progress within 13 airports, mainly through CEF-funded initiatives, also involving the Network Manager. In order to achieve full performance of Family 4.2.4, it is recommended to implement Family 2.1.4 since it is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level.

One Implementation Project associated to Family 4.2.4 is in execution phase. This project is expected to contribute 0.88% of all nautical miles that are expected to be saved by a full AF 3 and AF 4 implementation, which represents some 5,28 million nautical miles and 8,31 million CO_2 tons.

The performance of future projects that will close the currently remaining gap for family 4.2.4 is still under evaluation with the support of the Network Manager.

AF5 – Initial SWIM

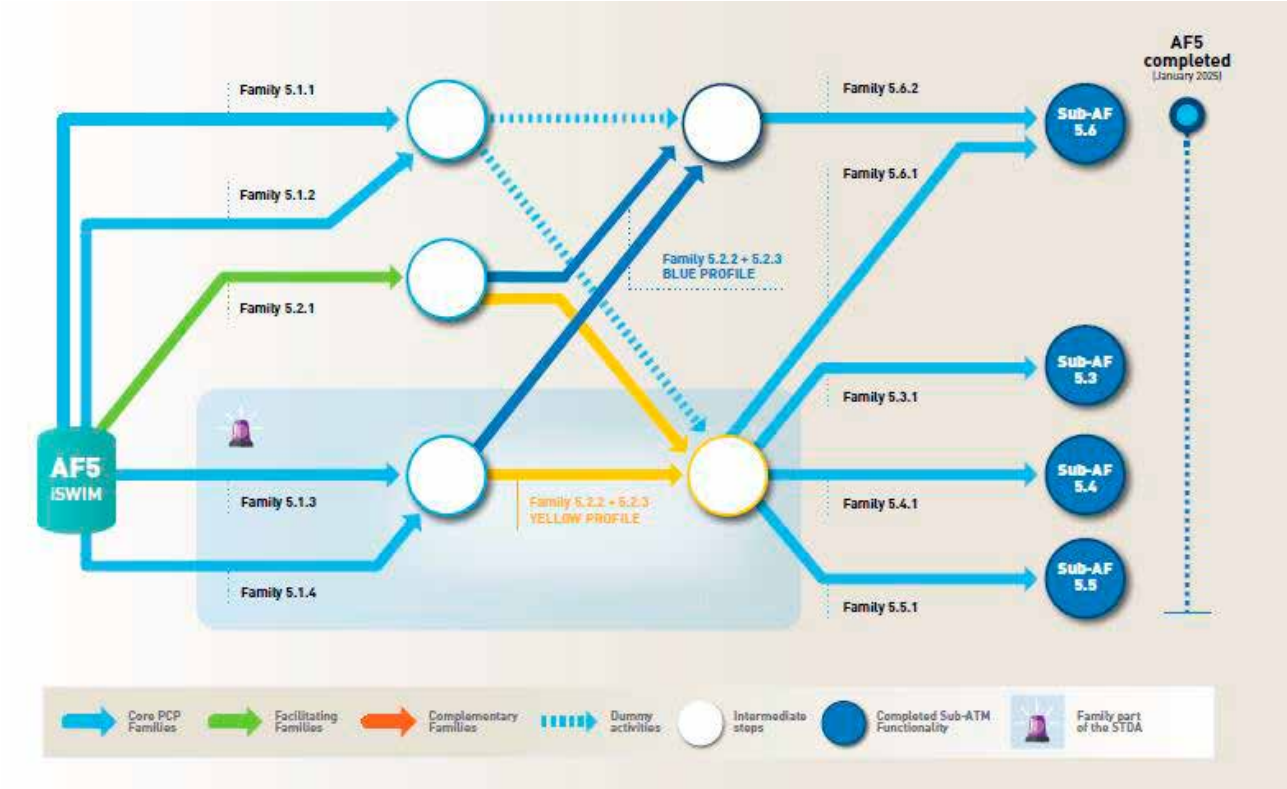


Fig. 15 - AF5: Short Term Deployment Approach

AF5 is divided into six Sub-AFs: Common infrastructure components, SWIM Technical Infrastructure and Profiles, Aeronautical information exchange, Meteorological information exchange, Cooperative network information exchange and Flight information exchange.

The short-term deployment approach for AF 5 should focus on family's 5.1.3 Common SWIM Infrastructure components, 5.1.4 Common SWIM PKI and cyber security, 5.2.2 Stakeholders SWIM Infrastructures Components and 5.2.3 Stakeholders' SWIM PKI and cyber security. The common SWIM Infrastructure components required by the PCP regulation comprise the registry and the Public Key Infrastructure (PKI), which are included in families 5.1.3 and 5.1.4 respectively. Family 5.1.3 also comprises the SWIM Governance, which is paramount for a proper and harmonised SWIM implementation.

The Stakeholders SWIM Infrastructure components are comprised in family 5.2.2 and 5.2.3. Together with 5.1.3 and 5.1.4 this enables the Yellow and Blue Profiles, which are the backbone of AF5 and prerequisite for the implementation of the "information" Sub-AFs (the blue bubbles at the end in the illustration above).

It is also essential that the ANSPs requested to deploy Flight Object (Family 5.6.2), implement as soon as possible NewPENS (Family 5.1.2) by joining the first group of ANSPs having initiated NewPENS implementation. As the AF5 supports other AFs, this particular AF should be also considered when implementing the families that are linked. The "information" Sub-AFs shall be deployed in synchronisation with the other AF Families as defined in the interdependencies shown in section 3.2 of the SESAR Deployment Programme.

The current implementation of families 5.1.3, 5.1.4, 5.2.2 and 5.2.3 didn't allow for the closure of any existing implementation gaps across Europe, as the implementation is highly depending from the establishment of a common SWIM Governance Framework, which is addressed by the multi-stakeholder initiative started on February 2017. The deployment of Family 5.2.2 has been initiated within 16 countries and associated plans have been declared for additional 10 countries, whilst for Family 5.2.3 the implementation has started in 12 countries.

At his stage, it is difficult to forecast the future benefits of AF5 projects in general. According to PCP CBA, an upgraded infrastructure will have an impact on ANS productivity gains, therefore these investments are necessary steps to upgrade the existing infrastructure in order to reach an enhanced information sharing between all relevant stakeholders, which will contribute to AF3, AF4 and AF6 ambitions too.

Regarding Family 5.1.3 currently only two funded projects exist, which created a multi-project thread and are covering the "Deployment toolkits" in order to enable a harmonised implementation of the SWIM data exchange models (AIXM/(I)WXXM/FIXM) and the "SWIM Registry" which will provide a platform for the service providers and users to find information about SWIM (SWIM Reference Management). An improvement of visibility will have a direct effect on service adoption, reusability and interoperability. The registry will provide a trusted reference in the registry information and ultimately in the SWIM service network.

Family 5.1.4 was created as a split from family 5.1.3 in DP 2016 but no project has been awarded so far.

Family 5.2.2 is represented by 7 CEF-funded projects, which are mainly initial steps towards a future SWIM Capability in Spain, Germany, United Kingdom, Italy, Poland, France and within Network Manager, aiming at implementing in each civil or military stakeholder SWIM components i.e. Yellow Profile, any other components necessary for stakeholder SWIM implementation (Supervision, Security, …) At this stage one project is expecting benefits in the form of reduced system maintenance costs.

Family 5.2.3 was created as a split from family 5.2.2 in DP 2016 but, so far, no project has been awarded.

AF6 – Initial Information Trajectory Sharing

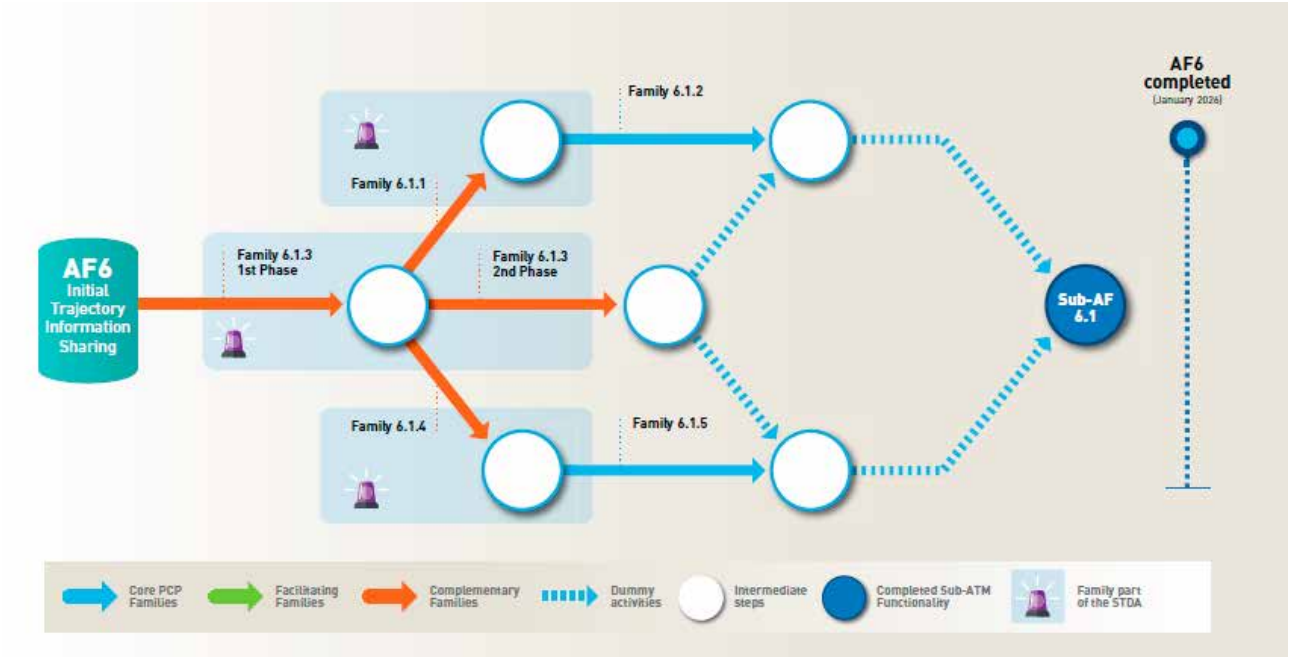


Fig. 16 - AF6: Short Term Deployment Approach

AF6 has only one Sub-AF, which is the Initial Trajectory Information Sharing.

The short-term deployment approach for AF 6 should focus on families 6.1.1 ATN B1 Based Services in ATSP domain, 6.1.3 A/G and G/G Multi Frequency DL Network in defined European Service Areas, and 6.1.4 ATN B1 capability in Multi Frequency environment in aircraft domain.

Family 6.1.1 implements ATN B1 capabilities in the ATSP domain in order to secure compliance with the original DLS mandate EC 29/2009 as amended by 2015/310. Family 6.1.1 can only be implemented in conjunction with family 6.1.3, which is providing the corresponding communication infrastructure for air/ground data link. The ATN COM domain included in family 6.1.3 will support both the ATN B1 services required to fulfill the DLS mandate and the trajectory downlinks with EPP (which are part of the ATN B2 services mandated by the PCP).

Deployment of Family 6.1.3 is divided into two phases: Transition from Model A or C to Model B or C with MF in the first phase, and the transition from model B or Model C with MF to Model D in a second phase. The short-term focus is:

- on projects improving the existing VDL Mode 2 network's performance by adding additional channels through the introduction of Multi Frequency, as well as
- on projects preparing the transition to Model D.

In parallel to Families 6.1.1 and 6.1.3, Family 6.1.4 targets the implementation of avionic systems supporting ATN B1 applications.

These three families are essential pre-requisites to move later on to families 6.1.2 and 6.1.5, which will adapt ground ATM (ANSP/NM) and avionics systems to utilize EPP. In addition, the second phase of family 6.1.3 will improve the A/G DL network capacity to support the increased data volumes anticipated with the utilization of EPP. This approach will facilitate the objective listed in the PCP Regulation that "*at least 20 % of the aircraft operating within the airspace of European Civil Aviation Conference (ECAC) countries in the ICAO EUR region corresponding to at least 45 % of flights operating in those countries, are equipped with the capability to downlink aircraft trajectory using ADS-C EPP as from 1 January 2026*".

Most ANSPs affected by the DLS IR have already deployed Family 6.1.1 and have the required connectivity provided by an initial deployment of family 6.1.3 functionality. In the past, these have been local deployment activities lead by the ANSPs of the respective countries. Starting with CEF Transport Call 2016, a significant number of ANSPs and CSPs have joined a multi-stakeholder project in a consolidated effort to improve the performance of the European VDL Mode 2 network (first phase of family 6.1.3). In addition, even more stakeholders, including Airspace Users, have joined a second multi-stakeholder project to address the long-term objective to further optimize the European A/G Datalink network for performance and capacity according to ELSA recommendations (second phase of family 6.1.3).

On European Airspace User side, the amount of aircraft supporting CPDLC according to the DLS IR continues to increase with a number of airlines submitting projects under family 6.1.4, both retrofitting existing aircraft and forward-fitting aircraft that are being ordered.

Currently there are no funded projects in CEF Call 2014 and Call 2015, which will show some possible operational improvements. Therefore, it is difficult to forecast an impact on performance at this stage. Nevertheless, an enriched qualitative content of future messages due to better infrastructure (data channels) will allow making even better decisions by all involved stakeholders. The possibility of continuously updating relevant information will reduce decision times and will directly impact i.e. flight times, fuel burn and CO_2 reduction, savings which were already foreseen in PCP too.

Due to the fact that more and faster information to and from the aircraft is available, the corresponding ground systems (E.g. FDP, RDP etc.) can provide better prediction of the available flight profile for Airspace Users. This leads to more efficient aircraft trajectories leading to the above-mentioned savings.

Additionally, where today CPDLC is in operation a significant relief of standard routine voice communication is evident. E.g. "*logon" and "forward*" messaging is much more efficient and less time-consuming with the use of DLS CPDLC: this leads to increased situational awareness on ATCOs and pilots' side.

Finally, it is expected that today's capacity constrains could be impacted as well. Beside these quantitative expectations, an impact is expected on safety, because of a much more accurate information sharing via i-4D technologies. These will make possible for the first time to identify movements of aircrafts not only by position and height but by time as well. This information of an additional dimension should have an influence on ATCO productivity, which is difficult to forecast at this stage.

FAMILY DESCRIPTIONS

SESAR
DEPLOYMENT MANAGER

3. Family Descriptions

The SESAR Deployment Programme encompasses the so-called "*Project view*" of the Pilot Common Project, which shall be considered as the core "*operational*" part of the whole document, as it illustrates the 48 Families which regroup the technological and operational elements to be deployed in accordance to Regulation (EU) n. 716/2014. Figure 17 provides the full WBS of all DP Families, as associated to their respective AF and Sub-AF, also specifying their level of readiness for implementation.

Fig. 17 – Overall WBS of the 48 DP Families

In order to fully complement the information provided within the SESAR Deployment Programme, the following paragraphs provide a detailed and comprehensive description of each of the Programme Families. The main objective is therefore to support Operational Stakeholders in their implementation activities, including the detailed overview of all information required to implement timely the PCP.

To this end, the following tables describe the main features and characteristics of each Family, organized within the following sub-sections:

General Information, providing a snapshot on the Family and illustrating its full technical description, as well as providing some key information to locate it in the framework of the Deployment Programme:

- **Family Number and Title**;
- **Main Sub-AF**;
- the **Readiness for Implementation**, which indicates both the readiness for deployment of the Family and the time-wise urgency for the launch of the related implementation initiatives. The Families have been clustered as follows:
  - ***High Readiness Families***: these Families are mature for implementation and time wise the most urgent to be deployed in order to continue timely PCP implementation and early benefits delivery;
  - **Medium Readiness Families**: these Families are ready for implementation, although time wise they are less urgent to be deployed for PCP timely implementation;
  - **Low Readiness Families**: these Families are not yet ready for implementation but, when developing the future versions of the DP, will be re-considered as their readiness for implementation is expected to improve in time.
- **Initial Operational Capability**, to clearly identify the start of the deployment[6];
- **Full Operational Capability**, to clearly identify the expected end of deployment[7];
- **Description and Scope**, illustrating the full scope of the technological and operational elements to be deployed to comply with the Deployment Programme;
- **Interdependencies**, outlining other Families (or Sub-AFs) whose implementation is strictly connected and related to the Family's deployment;
- **Synchronization Needs**, highlighting the need for a coordinated deployment and for synchronizing the implementation activities in order to fully achieve the performance benefits; such efforts might involve several stakeholders, combining different stakeholder categories;
- **Civil/Military Coordination**, focusing on the alignment potentially to be established between civil and military stakeholders involved in the Family's implementation;

Stakeholders' Categories involved in the Deployment, which outlines the stakeholders impacted by the Pilot Common Project and defines their involvement in the implementation activities:

- **Stakeholders considered as gaps,** which identifies those stakeholder categories that are requested by the PCP regulatory framework to invest in order to fill in the gaps and therefore are potentially eligible for co-funding under upcoming CEF Transport Calls**;**
- **Other stakeholders involved in the Family deployment**, which identifies stakeholder categories which have to be considered as contributors for the full operational deployment of the Family itself, without being necessarily requested by the PCP framework to invest;

[6] Start deployment date for a Family is driven by the start of the first implementation of at least one of the operational improvements/one of the enablers associated with this Family at least in one place with PCP geographical scope. As a consequence, it could happen that a Family has already started to be implemented (Start date = before 2014) whilst not all associated operational improvements/enablers are ready for implementation yet.

[7] End deployment date for a Family occurs when all the operational improvements/enablers associated to this Family have been implemented and put into operational use everywhere within the Pilot Common Project's geographical scope. End deployment date of a Family is expected to occur at the latest by the deadline set by the Regulation (EU) 716/2014 for the associated Sub-AF.

References and Guidance Material, which provides the direct reference to the ICAO Global Navigation Plan and to the ATM Master Plan associated to the Family:

- **Links to ICAO Global Navigation Plan ASBUs,** which outlines the links to Aviation System Block Upgrades (ASBU) included in the latest edition of the Global Air Navigation Plan;
- **ATM Master Plan References**, which identifies the link to the latest edition of the ATM Master Plan, referring both to Level 2 and to Level 3;
- **Cyber security Requirements**, which – for relevant Families – reports on the identified requirements to be considered in the deployment of the Family, having specific regard to the potential cyber-threats linked to the increased connectivity associated to the full PCP deployment.

This view is further enhanced and detailed within the dedicated **Annex B** of the Planning View "**Standardization and Regulation Roadmaps**", which also includes the following items:

- **SESAR Solutions and Very Large-Scale Demonstrations**, listing all related operational and technological improvements developed by SESAR members and the associated validation activities, as performed in real operational environments;
- **Guidance Material / Specifications / Standards**[8];
- **Means of Compliance and / or Certifications**;
- **Regulations**;

Recommendations to Stakeholders, which combines targeted recommendations on how to address the Family in the framework of the upcoming CEF Calls with a high-level definition of the key steps that should be followed in the deployment of the required operational and technological elements. The sub-section is therefore composed of:

- **Recommendation for IPs proposals**, which lists the main recommendations to operational stakeholders which aim at launching implementation initiatives linked to the Family;
- **Deployment Approach,** illustrating to potential candidate implementing Partners the suggested approach to be followed in order to deploy the Family. This field will also present and describe the key milestones towards the Family implementation, identifying the activities shall be performed by each of the involved Stakeholder categories. Such milestones are also used during the SDM Monitoring exercise, aiming at identifying the current status of implementation of the PCP throughout Europe.

[8] Guidance material/Specification/Standards can be considered as appropriate and recommended for support to implementation. They can also be referenced in Means of compliance or Regulation. Means of compliance listed in tables are non-binding standards adopted by EASA or ESOs to illustrate means to establish compliance with regulations and implementing rules. However, alternative means for compliance can be applied if accepted by the relevant National Supervisory Authority (NSA). Regulations listed in the tables are binding instruments considered as relevant for the family implementation.

3.1 AF #1– Extended AMAN and PBN in high density TMA

Family 1.1.1 – Basic AMAN

1.1.1 – Basic AMAN			
Main Sub-AF	S-AF 1.1 Arrival Management Extended to en-route Airspace		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2020

Description and Scope

Implement Basic AMAN to support traffic synchronization in high density TMAs.

Basic AMAN shall:

- improve sequencing and metering of arrival aircraft in selected TMAs and airports;
- continuously calculate arrival sequences and times for flights, taking into account the locally defined landing rate, the required spacing for flights arriving to the runway and other criteria;
- provide automated decision support for sequencing and metering of traffic arriving to an airport;
- provide to ATCO as a minimum, simple Time To Lose / Time To Gain - TTL/TTG – information.

Interdependencies

Family 1.1.2: Basic AMAN (1.1.1) can serve as an intermediate step towards Extended AMAN (1.1.2).

Family 2.1.2: Integration of AMAN information in the Electronic Flight Strip (EFS).

Family 2.3.1: Integration of Time Based Separation (TBS) with AMAN.

Synchronization Needs

Ex-ante synchronization requirements, to be further assessed at the level of Local Implementation Projects.

Integration with local ATM systems is necessary to process the flight plan and radar data, which requires defined interfaces to respective ATM system components (FDP, CWP, SDP)

Civil / Military Coordination

Coordination with military authorities (AU, ANSP, AD regulator) as required.

Stakeholders considered as gaps	ANSPs	
Other stakeholders involved in the Family deployment	Airport Operators	
Links to ICAO GANP ASBUs	B0-RSEQ (Improved Traffic Flow through Sequencing (AMAN/DMAN)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	TS-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	ATC07.1

Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented
Recommendation for IPs proposal	Where deemed necessary for operational or organizational reasons, Basic AMAN may be implemented as an intermediate step towards Extended AMAN. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or the installation of an AMAN planning tool supporting applicable sequencing procedures. Such installation would require a final acceptance of the tool and the integration with other existing systems **(MM1 – Installation and Integration)**. The applicable concept of operations shall also be broken down into documented and approved work procedures **(MM2 – Procedures available)**. The elaboration of such operational procedures could also require that the airspace structure and adjacent airports are taken into duly consideration. Before the start of the operational use of the AMAN planning tool, a safety assessment shall be performed successfully **(MM3 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

Family 1.1.2 – AMAN upgrade to include Extended Horizon function

1.1.2 – AMAN Upgrade to include Extended Horizon function			
Main Sub-AF	S-AF 1.1 Arrival Management Extended to en-route Airspace		
Readiness for implementation	High		
Initial Operational Capability	01/01/2015	**Full Operational Capability**	01/01/2024

Description and Scope

Implementation of arrival management extended to en-route airspaces at high density TMAs and its associated adjacent ATSUs.

Arrival Management extended to en-route Airspace extends the AMAN horizon from the 100-120 nautical miles to 180-200 nautical miles from the arrival airport. Traffic sequencing/metering may be conducted in the en-route before top-of-decent, to propagate the potential TMA delays to the en-route sectors, thus allowing the flight crew to optimize the flight profile and reducing the need for low level holding at TMA entry and/or excessive radar vectoring inside the TMA.

Extending the AMAN horizon may affect the airspace design, and it is therefore essential that all stakeholders, including military authorities are consulted.

Air Traffic Control (ATC) services in the TMAs implementing 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 covered by the Extended AMAN horizon. Input data to Extended AMAN need to be provided by the most accurate trajectory prediction information available (including EFD, CPR, etc.).

- In order to facilitate a timely implementation of the arrival sequence, a sector receiving arrival messages must display information for the controller.
- An ATSU operating an "Extended AMAN" should be able to generate arrival messages to adjacent sectors providing advisories to be implemented on aircraft outside its own sectors.
- ATM systems must be upgraded in order to be able to generate, communicate, receive, acknowledge and display arrival management information (e.g. AMA, B2B).
- Bilateral agreements must be established between involved sectors that could be under the responsibility of different ATC units as well as located in different countries.
- Network Manager will be part of the Extended AMAN data exchanges, as required, for the overall network impact assessment and relevant network optimisations.
- Extended AMAN processes addressing multiple airports needs to be coordinated. Overall network performance must be considered.
- Integration of departing traffic from airports within the extended planning horizon destined to arrive at the Extended AMAN airport.

If Basic AMAN (Family 1.1.1) is already implemented, it might be necessary to upgrade the functionality or consider replacement to meet the requirements and/or to prepare for the automatic coordination with adjacent ACCs as required for AMAN with extended horizon.

Interdependencies

Family 1.1.1: Basic AMAN is a facilitator.

Family 1.2.5: RNP routes connecting Free Route Airspace (FRA) with TMA facilitate stable and efficient sequencing through the whole arrival phase.

Family 2.1.2: Integration of Extended AMAN information in the Electronic Flight Strips.

Family 2.3.1: Integration of Time Based Separation (TBS) with Extended AMAN.

Family 3.2.1: Upgrade of ATM systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Routing Airspace (FRA).

Family 4.3.2: Reconciled Target Times for ATFCM and arrival sequencing.

AF 5: Where iSWIM functionality is available, data exchange concerning Extended AMAN shall be implemented using SWIM services.

AF 6: Downlinked trajectory information, where available, shall be used by the Extended AMAN.

Synchronization Needs

When extending the AMAN horizon, synchronization must be made with all affected sectors and Network Manager. Synchronization is also needed to adjust/upgrade the ATM-systems of the adjacent ACC/UACs to process the arrival message provided by Extended AMAN (SW-change, test, integration, and implementation).

Family 1.1.2 may be implemented either as a horizon extension of a pre-existing Basic AMAN (1.1.1) or through a fresh implementation from the scratch.

Civil / Military Coordination

Airspace design and procedural changes must be coordinated with military authorities when affected

Stakeholders considered as gaps	ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Airport Operators, Military Authorities	
Links to ICAO GANP ASBUs	B0-RSEQ Improved Traffic Flow through Sequencing (AMAN/DMAN) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	TS-0305 Available TS-0305-A Available (SESAR Release 4)
	ATM Master Plan Level 3 (Edition 2016)	ATC15.1, ATC15.2
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended that Extended AMAN is implemented directly, although Basic AMAN can be deployed as an intermediate step. It is also possible to structure the deployment IP so that the horizon is first extended from the Basic AMAN into the en-Route sectors within the same ATSU. The subsequent second stage would then cover the extension to all the other affected en-Route ATSUs upstream. Upstream ATS units are obliged to support the Extended AMAN functionality for the airports within the PCP geographical scope. It is strongly recommended that these upstream ATS units participate in the relevant deployment projects to ensure an effective operation. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or installation of an Extended AMAN planning tool, supporting applicable sequencing procedures. Such installation would require a final acceptance of the tool and the integration with other existing systems.	

	If applicable, data exchange with the Network Manager is envisaged and local coordination with the Military Authority should be performed, whether necessary **(MM1 – Installation and integration completed including information exchange)**. The applicable concept of operations shall also be broken down into documented and approved work procedures, also considering the proper coordination with Network Manager **(MM2 – Procedures Available)**. The elaboration of such operational procedures could also require that the airspace structure and adjacent airports are taken into duly consideration. Adjacent ATSUs within the Extended horizon shall implement appropriate functionality in their systems, deploy training and develop procedures to fully support extended arrival management in their sectors **(MM3 – Upstream ATSU Implementation completed).** Before the start of the operational use of the Extended AMAN planning tool, a safety assessment shall be performed successfully **(MM4 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

Family 1.2.1 – RNP APCH with vertical guidance

1.2.1 – RNP APCH with vertical guidance			
Main Sub-AF	S-AF 1.2 Enhanced Terminal Airspace using RNP-Based Operations		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

Implementation of vertically guided RNP approach procedures (LNAV/VNAV and LPV) in high-density TMAs. RNP APCH utilize the capabilities of the on-board navigation system to provide 3D guidance.

RNP APCH comes in two variations:

- LNAV/VNAV, where vertical guidance is typically provided by the aircraft pressure altimeter. This capability is common in legacy medium and large transport aircraft categories. The procedure features linear lateral guidance to the runway and its vertical component is dependent on local QNH. Limitations of pressure altimetry also result in a minimum temperature limitation below which the approach may not be flown. In the approach chart the minima line is denoted as LNAV/VNAV and is rarely below 350 ft. Note that it is also possible to fly the procedure using SBAS if available from the on-board database.
- LPV, where lateral and vertical guidance is provided by a suitably augmented GNSS sensor feeding the on-board navigation system. EGNOS is the European GNSS augmentation system certified for this purpose. SBAS approach capability is common in Business Aviation and all recent air transport designs. It is also gaining acceptance in the general aviation segment. The procedure features angular guidance to the runway and thus is designed as ILS lookalike in that the sensitivity of the Course Deviation Indicator (CDI) increases the closer to the runway. Depending on the EGNOS SOL service used, DH can be as low as 250 ft (APV-I) or 200 ft (LPV). The minima line is denoted as LPV in the approach chart.

Points to be noted:

- Airspace users aiming to equip to RNP APCH capability should reference this family in the proposal.
- State aircraft operation might require alternative means of compliance which are currently under development.
- Mixed mode operation will remain a reality for the foreseeable future; airport operators should exercise due regard for non-equipped traffic.
- RNP APCH was not intended as a replacement of the conventional precision approach, although the LPV-200 variant can be used to substitute a CAT I ILS. All airports in the PCP scope are generally expected or required to remain open in severely adverse weather conditions and thus are dependent on their installed ILS CAT II/III capabilities.

RNP APCH provides superior performance to conventional non-precision instrument approach; airport operators are encouraged to employ RNP APCH as the primary contingency for ILS, withdraw conventional non-precision procedures and decommission the related nav-aid infrastructure, subject to local traffic equipage rates and capability.

Interdependencies

Family 1.2.2: Geographical database

Synchronization Needs

There is the need to coordinate/synchronize efforts (operational procedures, ground infrastructure and aircraft capabilities) between ANSPs and Airspace users to ensure the return of investment and/or the start of operational benefits. Coordination of deployment of PBN procedures is a local issue and must include all affected parties (ANSPs, airports, AUs and military authorities).

Civil / Military Coordination		
Coordination with military authorities (AU, ANSP, AD regulator) as required.		
Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Military Authorities (AU)	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-APTA Optimization of Approach Procedures including Vertical Guidance	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0602 Available AOM-0604 Available AOM-0605 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	NAV10
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	RNP Approach shall be implemented to all standard landing runways* at airports within the PCP geographical scope. The IP proposal should include a study/plan aimed at withdrawing existing non-precision approach procedures and the corresponding decommissioning of related nav-aids. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View. *Standard landing runway = a runway that is used for arrivals in nominal operations	
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or installation of the Database tool, which would also need the data exchange functions to be available. Such installation would require a final acceptance of the tool itself and the integration with other existing systems **(MM1 – Database tool created including data exchange functions)**, also taking into consideration that duly coordination with the Military Authority should be performed, as required. The Geographic Database shall be populated with the available geographical data, duly considering all the parameters to assure the quality of the data to be transferred **(MM2 – Database populated with quality assured data)**. Before the start of the operational use of the database, a safety assessment report shall be elaborated, delivered and approved **(MM3 – Safety Assessment)**, work procedures established and all the relevant staff shall be duly trained **(MM4 – Operational procedures established including training of staff)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 1.2.2 – Geographic Database for Procedure design

1.2.2 – Geographic Database for Procedure design			
Main Sub-AF	S-AF 1.2 Enhanced Terminal Airspace using RNP-Based Operations		
Readiness for implementation	High		
Initial Operational Capability	01/01/2014	**Full Operational Capability**	01/01/2019

Description and Scope
Procurement/provision of geographic database to support procedure design including obstacle data as part of AIM. The availability of an up-to-date and quality assured geographic database (including the obstacle items) of each TMA is a prerequisite to design new procedures such as RNP approaches. Geographical databases could be used by AUs to validate procedures with regards to performance for different aircraft types. PBN is in most cases based upon procedures involving geographical positions expressed in latitude and longitude rather than radio beacons placed on ground (with the exception of DME), thus a geographical point will have a direct impact on safety and quality of navigation. A geographical point expressed in latitude and longitude can consist of up to 19 characters and hence carries a large amount of risk of input errors when handled manually. Procedures and functions must be in place to ensure that the full chain from the originator of the information (land surveyor) to the database in the procedure design tools, the AIM databases and the on-board navigation databases is such that no errors are introduced. Implementation of support procedures and functions to detect errors is one component in order to ensure the integrity of the data, and also a secure means for communicating the geographical data is fundamental. Manual handling of latitude/longitude and other navigation data is not acceptable as the risk of introduction of errors is too high.
Interdependencies
Exchange of geographical data is included in AIM that is supposed to be a service within SWIM (AF5).
Synchronization Needs
Prerequisite for 1.2.1, 1.2.3 and 1.2.4.
Civil / Military Coordination
Coordination with military as required.

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-APTA Optimization of Approach Procedures including Vertical Guidance	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0602 Available AOM-0604 Available
	ATM Master Plan Level 3 (Edition 2016)	NAV10

Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or installation of the Database tool, which would also need the data exchange functions to be available. Such installation would require a final acceptance of the tool itself and the integration with other existing systems **(MM1 – Database tool created including data exchange functions)**, also taking into consideration that duly coordination with the Military Authority should be performed, as required. The Geographic Database shall be populated with the available geographical data, duly considering all the parameters to assure the quality of the data to be transferred **(MM2 – Database populated with quality assured data)**. Before the start of the operational use of the database, a safety assessment report shall be elaborated, delivered and approved **(MM3 – Safety Assessment)**, work procedures established and all the relevant staff shall be duly trained **(MM4 – Operational procedures established including training of staff)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

Family 1.2.3 – RNP1 Operations in high density TMAs (ground capabilities)

1.2.3 – RNP 1 Operations in high density TMAs (ground capabilities)			
Main Sub-AF	S-AF 1.2 Enhanced Terminal Airspace using RNP-Based Operations		
Readiness for implementation	High		
Initial Operational Capability	01/01/2015	**Full Operational Capability**	01/01/2024

Description and Scope

Implementation of RNP 1 departure and arrival routes (SIDs and STARs) including the use of the Radius to Fix (RF) path terminator where benefits are enabled for noise exposure, emissions and/or flight efficiency (reducing environmental impact). The STARs shall terminate at the final approach fix.

Required Navigation Performance (RNP) is a type of Performance Based Navigation (PBN) that allows an aircraft to fly a specific path between two defined points in space independently of terrestrial navaids placed along the route. RNP also requires monitoring and alerting capability on-board to safeguard the integrity of the position sensor.

As per definition, RNP 1 requires the Total System Error to remain within 1 NM either side of the intended flight path 95% of the time. This level of navigational accuracy together with the inherent integrity monitoring function offers a large potential for efficiency and capacity improvements by optimizing TMA airspace design accordingly. Current studies focus on TMA concepts with route spacing reduced to 7 NM.

Implementing stakeholders, primarily ANSPs and Airport Operators, are encouraged to implement airspace concepts taking advantage of the performance benefits offered through RNP; this may require the optimization or upgrades of existing support tools (MTCD, CDT, CORA) and safety nets (APW, STCA), or addition of new ones (related to primarily conformance monitoring). Stakeholders should consider the use of RF for accurate and repeatable turn execution. Where continuity of conventional navigation means is required alongside RNP1, issues related to mixed mode of operation (could include military/state aircraft, non-equipped aircraft) must be taken into account.

As TMA operations become increasingly independent of conventional terrestrial navaids, such infrastructure, primarily VOR and NDB, should be considered for decommissioning. ANSPs shall ensure that their standing network of conventional navaids is sufficient to support an adequate contingency against GNSS outages, including a constellation level failure event. It is encouraged to seek cross-border agreements for better utilization of the remaining terrestrial infrastructure, optimally within a European regional harmonized activity.

Interdependencies

Capability of ground systems and services should be synchronized with capability of aircraft and airspace users including military. PBN operations require availability of quality assured and accurate geographical data. See AF1 Family 1.2.2. The implementation of PBN/RNP in High-Density TMAs should be coordinated as needed with implementation of PBN/RNP in adjacent airspace covered by Extended AMAN supporting stable and efficient sequencing. See Families 1.1.2 and 1.2.5.

Synchronization Needs

The deployment of PBN in high density TMAs shall be synchronized due to the potential network performance impact of delayed implementation in the airports within the geographical scope of PCP. Synchronization of deployment is a local issue and must include all affected parties (ANSPs, airports, AUs and military). From a technical perspective, the adjustment/upgrade of ATM systems and procedural changes shall be synchronized with civil and military aircraft capabilities in order to ensure that the performance objectives are met. The synchronization of investments shall involve multiple airport operators ANSP and airspace users. 1.2.3, 1.2.4 and 1.2.5 should be coordinated and synchronized.

Civil / Military Coordination

Coordination with military authorities as required.

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories B1-FRTO Improved Operations through Optimized ATS Routing B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0603 SESAR Release 2 AOM-0605 SESAR Release 5 AOM-0602 Available AOM-0601 Available
	ATM Master Plan Level 3 (Edition 2016)	NAV03
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended that implementation projects involve all major stakeholders concerning design, validation and public consultation of RNP1 procedures to achieve the full benefits. The IP proposal should include a study/plan for the rationalization of legacy nav-aid infrastructure. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View. Note that aircraft related projects concerning RNP outside the approach phase belong to Family 1.2.4.	
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATM systems and/or their installation. Such systems – Safety Nets being MTCD, STCA, CDT, CORA, etc – would also require the provision of their final acceptance and the integration with other existing systems considering that some of these components are included in Family 3.2.1 **(MM1 – ATM systems upgrade)**. Moreover, RNP1 routes to and from all landing and departure runways shall be designed, duly validated and their safety appropriately assessed **(MM2 – RNP Procedure Design and validation and safety assessment)**. While performing such activities, it should be taken into consideration that the proper coordination with the Military Authority shall be performed, as required. RNP1 Procedures shall then be published for all runways **(MM3 – RNP AIS Implementation (publication))**, and, once public consultation has been finalized in accordance to the local regulation **(MM4 – Public consultation)** and the procedures are approved by the NSA, all operational and technical staff shall be appropriately trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.	

Family 1.2.4 – RNP1 operations (aircraft capabilities)

1.2.4 – RNP 1 Operations (aircraft capabilities)			
Main Sub-AF	S-AF 1.2 Enhanced Terminal Airspace using RNP-Based Operations		
Readiness for implementation	High		
Initial Operational Capability	01/01/2015	**Full Operational Capability**	01/01/2024

Description and Scope

Implementation of aircraft PBN/RNP navigation capability with RF legs. This family enables efficient and environmentally friendly operations (noise and GHG emissions) in departure (SID), arrival (STAR), approach and connection to En-Route airspace.

Required Navigation Performance (RNP) is a type of Performance Based Navigation (PBN) that allows an aircraft to fly a specific path between two 3D-defined points in space.

Most new transport aircraft delivered today are PBN/RNP capable, but operational usage requires flight crew training, documentation and approval. Advanced RNP (A-RNP) may offer the opportunity to obtain a unified approval covering all stages of flight.

Retrofitting of transport-type military/state aircraft (including surveillance aircraft) and other PBN/RNP non-compliant aircraft might be required or incentivised, subject to positive CBA and their contribution to performance targets.

Alternative military technical performance based equivalent means should also be considered where the appropriate certification processes are available.

Interdependencies

RNP operations rely on the appropriate PBN infrastructure deployed, as covered by families 1.2.1, 1.2.3 and in longer term, 1.2.5.

PBN operations require availability of quality assured and accurate geographical data. See AF1, 1.2.2.

Synchronization Needs

The deployment of PBN in high density TMAs shall be coordinated due to the potential network performance impact of delayed implementation in the airports referred to in the geographical scope of PCP. Coordination of deployment of PBN procedures is a local issue and must include all affected parties (ANSPs, airports, AUs and military).

Furthermore, it is recognized that a minimum "critical mass" of capable aircraft will be required for benefits stemming from PBN/RNP to materialize.

From a technical perspective, the adjustment/upgrade of ATM systems and procedural changes shall be synchronized with aircraft capabilities in order to ensure that the performance objectives are timely met. The synchronization of investments shall involve multiple airport operators ANSP and airspace users.

Civil / Military Coordination

N/A

Stakeholders considered as gaps	Airspace Users, Military Authorities (AUs role)
Other stakeholders involved in the Family deployment	None

Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories B1-FRTO Improved Operations through Optimized ATS Routing B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0603 SESAR Release 2 AOM-0605 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	NAV03
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the commercial availability of a certified technical solution **(MM1 – Availability of technical solutions for aircraft types in operation)**. Procurement of suitable equipment for the aircraft shall be completed **(MM2 – Equipment procurement)**. Aircraft shall be equipped and flight crew shall be duly trained **(MM3 – Aircraft equipped and training of pilots)**. The execution of such activities is expected to lead the start of permanent operational use **(MM4 – Implementation completed)**.	

Family 1.2.5 – RNP routes connecting Free Route Airspace (FRA) with TMA

1.2.5 –RNP routes connecting Free Route Airspace (FRA) with TMA			
Main Sub-AF	S-AF 1.2 Enhanced TMA using RNP-Based Operations		
Readiness for implementation	Medium		
Initial Operational Capability	01/01/2020	**Full Operational Capability**	01/01/2024

Description and Scope

Connectivity between Free Route Airspace and TMAs through the implementation of RNP routes. The intention is to provide consistent PBN navigation capabilities from departure to landing. The most appropriate PBN type and navigation accuracy should be chosen depending on the local situation.

Aircraft and crew need to be PBN capable and approved for all navigation specifications applicable to the different phases of flight. The availability of an Advanced RNP (A-RNP) certification specification enables the operators to seek a unified approval (covered by Family 1.2.4).

Implementing stakeholders, primarily ANSPs, are encouraged to consider and implement airspace concepts that take advantage of the benefits conferred by A-RNP; primarily improved track keeping, inherent integrity monitoring and repeatable turn performance but also the optional functionalities proposed with A-RNP such as Fixed Radius Turn (FRT) and others. Emerging operational concepts make use of such functionalities.

In a PBN environment, procedures should be in place to handle non-equipped aircraft. PBN route structure below FRA should be appropriately coordinated with NM according to the standard process for CACD database validation.

Note: Advanced RNP is a recent addition to PBN and may undergo further evolution; this family will be updated accordingly once the PBN Manual Edition 5 has been published.

Interdependencies

Family 1.1.2: AMAN upgrade to include Extended Horizon function

Family 1.2.3: RNP 1 Operations in high density TMAs

Family 1.2.4: RNP Operations (aircraft capabilities)

Family 3.2.1: Upgrade of ATM systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Routing Airspace (FRA)

Family 3.2.4: Free Route Airspace

Synchronization Needs

Implementation must be coordinated/synchronized between ground (PBN routes, operational procedures and upgrade of ATM systems as necessary), NM and aircraft capabilities to ensure optimum return of investment and realisation of operational benefits.

Civil / Military Coordination

Coordination with military authorities (AU, ANSP, AD regulator) as required.

Stakeholders considered as gaps	ANSPs, Network Manager, Military Authorities
Other stakeholders involved in the Family deployment	None

Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0404 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	NAV03 Pending developments of the PBN Implementing Regulation
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View. Note that aircraft related projects concerning RNP outside the approach phase belong to Family 1.2.4.	
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATM systems and/or their installation. Such systems – Safety Nets being MTCD, STCA, CDT, CORA, APW, MSAW and FDP and CWP, etc – would also require the provision of their final acceptance and the integration with other existing systems, also considering that many of these components are already necessary for Family 3.2.1 **(MM1 – ATM systems upgrade)**. Advanced RNP routes below Free Route Airspace shall be designed, duly validated and their safety appropriately assessed, also coordinating such activities with NM and the Military Authority, as required **(MM2 – RNP Route Network Design, validation and safety assessment)**. In this respect, in order to accommodate a vertical profile, consideration should be given to the performance of representative aircraft and the effects produced by winds. Advanced RNP AIS procedures, including routes to and from all TMA entry/exit points, shall be published **(MM3 – RNP AIS Implementation (publication))** and all operational and technical staff shall be appropriately trained **(MM4 – Training)**. Finally, the finalized airspace design shall be submitted to the local NSA for approval. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

3.2 AF #2 – Airport Integration and Throughput

Family 2.1.1 – Initial DMAN

2.1.1 – Initial DMAN			
Main Sub-AF	S-AF 2.1 Departure Management Synchronised with Pre-departure sequencing		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

The aim of this Family is to implement Basic Departure Management (DMAN) functionalities to:

- ensure an efficient usage of the runway take off capacity by providing an optimum and context dependent queue at the holding points;
- improve the departure flows at airports;
- increase the predictability;
- calculate Target Take Off Times (TTOT) and the Target Start-up Approval Times (TSAT) taking into account multiple constraints and preferences out of the A-CDM processes;
- provide a planned departure sequence;
- reduce queuing at holding point and distribute the information to various stakeholders at the airport.

Operational stakeholders involved in A-CDM shall jointly establish pre-departure sequences, taking into account agreed principles to be applied for specific reasons, such as: runway holding time, slot adherence, departure routes, airspace user preferences, night curfew, evacuation of stand/gate for arriving aircraft, adverse conditions including de-icing, actual taxi/runway capacity, current constraints, inbound flights information, ...

The departure sequence at the runway shall be optimized according to the real traffic situation reflecting any relevant change off-gate or during taxi to the runway. DMAN systems shall take account of variable and updated taxi times (ref Family 2.4.1) to calculate the TTOT and TSAT.

Interdependencies

Family 2.1.2 EFS
Family 2.1.3 A-CDM
Family 2.1.4 iAOP
Family 2.2.1 A-SMGCS level 1-2
Family 2.4.1 A-SMGCS Routing and Planning Functions

Synchronization Needs

ANSPs, Airport Operators, Ground Handling Companies and Airspace Users.

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators
Other stakeholders involved in the Family deployment	Airspace Users, Military Authorities, Ground Handling Companies

Links to ICAO GANP ASBUs	B0-RSEQ (Improved Traffic Flow through Sequencing (AMAN/DMAN) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0602 Available
	ATM Master Plan Level 3 (Edition 2016)	AOP05
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended to take into consideration the three following elements of S-AF2.1: Family 2.1.1, Family 2.1.3 and Family 2.1.4 which are necessary to achieve the "Departure Management Synchronised with Pre-departure sequencing". It is further recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the DMAN system to implement Target Take Off Time (TTOT) & Target Startup Approval Time (TSAT) **(MM1 – System implemented for TTOT and TSAT)** according to PDS principles, also taking into consideration all necessary constraints (such as runway holding time, slot adherence, departure routes, airspace user preferences, night curfew, evacuation of stand/gate for arriving aircraft, adverse conditions including de-icing, actual taxi/runway capacity, current constraints, inbound flights information, etc.). Such system shall then be integrated in the local environment with the Electronic Flight Strip systems, updated as well in order to properly support the DMAN **(MM2 – Integration in local environment with EFS)**. Before the start of the operational use, DMAN operational procedures shall be elaborated and then published **(MM3 – Operational Procedures)**, all relevant staff shall be duly trained **(MM4 – Training)**, a safety assessment successfully performed and contextual report shall be made available **(MM5 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.	

Family 2.1.2 – Electronic Flight Strips (EFS)

2.1.2 – Electronic Flight Strips (EFS)			
Main Sub-AF	S-AF2.1 Departure Management Synchronised with Pre-departure sequencing		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

The operational context of Electronic Flight Strips (EFS) is the automated assistance to tower controller and where appropriate also approach and ground controller as well as the automated information exchange within and between these units. The system permits controllers to conduct screen to screen coordination within their unit and with "neighbouring" units in the process chain reducing workload associated with coordination, integration and identification tasks. The system supports coordination dialogue between controllers and transfer of flights between units or different locations within one unit (e.g. multiple Ground Control Towers at big airports), and facilitates early resolution of conflicts through automated coordination.

EFS shall integrate the instructions given by the air traffic controller with other data such as flight plan, surveillance, routing, published rules and procedures.

EFS can support the controller to manage constraints related to the surface route trajectories using A-SMGCS.

EFS can support the necessary electronic exchange of information between the Tower Runway Control, the Final Approach Control and the TBS support tool.

EFS shall support Airport Safety Nets.

Interdependencies

Family 2.1.1 Initial DMAN
Family 2.1.3 Basic A-CDM
Family 2.2.1 A-SMGCS Level 1 and 2
Family 2.3.1 Time Based Separation (TBS)
Family 2.4.1 A-SMGCS Planning and Routing Functions
Family 2.5.1 Airport Safety Nets associated with A-SMGCS (Level 2)
Family 2.5.2 Vehicle and aircraft systems contributing to Airport Safety Nets
Family 1.1.1 Basic AMAN
Family 1.1.2 AMAN Upgrade to include Extended Horizon function

Synchronization Needs

ANSPs, Airport Operators

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators
Other stakeholders involved in the Family deployment	Military Authorities

Links to ICAO GANP ASBUs	None	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0201 (only AERODROME-ATC-36 enabler) Available
	ATM Master Plan Level 3 (Edition 2016)	AOP12
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	This Family 2.1.2 is a pre-requisite for Families 2.4.1, 2.5.1 & 2.5.2, and could be seen as an enabler for Families 2.2.1 and 2.3.1. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The deployment of the Family would require the implementation of the Electronic Flight Strips (EFS) in the tower; dedicated EFS shall also be installed in the apron and approach positions for the relevant airports **(MM1 – System support to basic procedures)**. In order for the system to be properly implemented, EFS Operational Procedures shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 2.1.3 – Basic A-CDM

2.1.3 – Basic A-CDM			
Main Sub-AF	S-AF 2.1 Departure Management Synchronised with Pre-departure sequencing		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

A-CDM is the concept, which aims at improving operational efficiency at airports and improves their integration into the Air Traffic Flow and Capacity Management (ATFCM) by increasing information sharing and improving cooperation between all relevant stakeholders (local ANSP, airport operator, aircraft operators, NM, other airport service providers).

Those elements allow the airport partners to achieve a common situational awareness and improve traffic event predictability. The Airport CDM concept is built on the following elements:

- Information Sharing. The Information Sharing CDM element defines the sharing of accurate and timely information, as well as the performance objectives and KPIs, between the Airport CDM Partners. Local procedures will/can be defined and implemented according to Letters of Agreement (LoAs) and/or Memorandum of Understanding (MoU)
- Milestone Approach. The Milestone Approach CDM element describes the progress of a flight from the initial planning to the take off by defining key Milestones to enable close monitoring of significant events.
- Variable Taxi Time. The Variable Taxi Time element consists of calculating and distributing to the Airport CDM partners accurate estimates of taxi-in and taxi-out times to improve the estimates of in-block and take off times and thus to increase the quality of the departure sequence.
- Adverse conditions management allows improving the resilience of airports. An Initial Airport Operations Centre can be implemented to support these elements to reinforce the collaborative decision making process with all stakeholders. The Initial Airport Operations Centre assesses the global performance of the airport, and facilitates the Demand and Capacity Balancing monitoring.
- Once A-CDM has been implemented locally, airport shall implement flight update messages (FUM) and Departure Planning Information (DPI). . This last A-CDM element strengthens the link with the ATMN, facilitates the flow and capacity management and increases predictability as well as increases efficiency at the network level.

Interdependencies

Family 2.1.1 Initial DMAN
Family 2.1.2 EFS
Family 2.1.4 Initial AOP
Family 2.2.1 A-SMGCS L1 and L2
Family 4.2.4 AOP/NOP Information Sharing
Family 5.5.1 Upgrade / Implement Cooperative Network Information Exchange System / Service
Family 5.6.1 Flight Information System / Service in support of A-CDM and iAOP.

Synchronization Needs

ANSPs, Airport Operators, Network Manager

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Airspace Users, Network Manager, Military Authorities, Ground Handling Companies	
Links to ICAO GANP ASBUs	B0-ACDM Improved Airport Operations through Airport-CDM B1-ACDM Optimized Airport Operations through A-CDM Total Airport Management B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0501 Available AO-0601 Available AO-0602 Available AO-0603 Available
	ATM Master Plan Level 3 (Edition 2016)	AOP05
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended to take into consideration the three following elements of S-AF2.1: F211, F213 and F214 which are necessary to achieve the "Departure Management Synchronised with Pre-departure sequencing". SDM therefore strongly recommends that all projects related to Basic A-CDM shall be completed as early as possible before the defined FOC Date of the Sub-AF to allow for the deployment of subsequent solutions. It is recommended to implement Family 2.1.3 as soon as possible since Airport CDM is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require to conduct an information sharing process in order to allow the airport and local partners after signature of an MOU to achieve a common situational awareness **(MM1 – Information sharing)**. Basic A-CDM implementation shall further be supported by the execution of all the elements of the A-CDM "Milestone Approach" described in the CDM Manual **(MM2 – A-CDM "Milestone Approach")**, in conjunction with the fulfilment of all the elements of the "variabtimes", described in the A-CDM Manual as well **(MM3 – Variable taxi-times implementation)**. Furthermore, all measures whose implementation allows the mitigation of adverse situations (initial APOC, CDM cell, etc) shall be put into use **(MM4 – Adverse conditions implementation)**.	

	Following the implementation of all elements of the "Flight Update Message" described in the CDM Manual and the FUM Implementation Guide **(MM5 – FUM Implementation)**, the application of all elements of the "Departure Planning Information" messages reported on the CDM Manual and the DPI Implementation Guide shall be performed **(MM6 – DPI Implementation)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.

Family 2.1.4 – Initial Airport Operations Plan (AOP)

2.1.4 – Initial Airport Operations Plan (AOP)			
Main Sub-AF	S-AF 2.1 Departure Management Synchronised with Pre-departure sequencing		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

The Airport element that reflects the operational status of the Airport and therefore facilitates Demand and Capacity Balancing is the Airport Operations Plan (AOP). The AOP connects the relevant stakeholders, notably the Airspace Users' Flight Operations Centre (FOC).

It contains data and information relating to the different status of planning phases and is in the format of a rolling plan, which naturally evolves over time.

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 optimization can be made. The ATM stakeholders' planning processes and working methods are included in the AOP.

The AOP contains elements such as KPIs and alerts, which allow monitoring and assessing the performance of A-CDM operations. Most of the data involved in the AOP implementation is currently shared among local stakeholders and where available, through the A-CDM process.

The initial AOP is the local airport part of the AOP. The following data have to be implemented:

- 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: Airside and Landside resources such as runway capacity & configuration, or parking stands.
- Local weather data: Information sharing related to MET Information Elements of airport.

There are also strong interdependencies with S-AF4.2 Collaborative NOP as well as with S-AF5.5 Cooperative Network Information Exchange. The initial AOP shares information with the NOP which provides a rolling picture of the network situation used by stakeholders to prepare their plans and their inputs to the network CDM processes (e.g. negotiation of airspace configurations). NM Information will be freely exchanged by Operational stakeholders by means of defined cooperative network information services, using the yellow SWIM TI Profile.

Interdependencies

Family 2.1.1 Initial DMAN

Family 2.1.3 Basic A-CDM

Family 4.2.4 AOP/NOP Information Sharing

The full AOP implementation requires synchronisation with the NOP (see AF4 "interactive Rolling NOP"). The implementation of this synchronisation is targeted by Family 4.2.4 "AOP/NOP information sharing".

Family 5.3.1 Aeronautical Information Exchange / Service in support of A-CDM and iAOP

Family 5.4.1 Upgrade / Implement Meteorological Information Exchange System / Service

Family 5.5.1 Interface and data Requirements of AF4 NOP and of A-CDM and iAOP

Family 5.6.1 Flight Information System / Service in support of A-CDM and iAOP

Synchronization Needs

ANSPs, Airport Operators.

Civil / Military Coordination		
Applicable to those airports open to civil and military operations.		
Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Airspace Users, Military Authorities, Network Manager, MET Service Providers	
Links to ICAO GANP ASBUs	B1-ACDM Optimized Airport Operations through A-CDM Total Airport Management B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0801-A (AIRPORT-03) SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP11
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	Family 2.1.4 can be considered as pre-requisite to Family 4.2.4, hence should be implemented as soon as possible not waiting for Family 4.2.4 to be ready/completed. Family 2.1.4 can also be seen as an extension of the Airport Operational Database. It is recommended to take into consideration the three following elements of S-AF2.1: F211, F213 and F214 which are necessary to achieve the "Departure Management Synchronised with Pre-departure sequencing". It is recommended to implement Family 2.1.4 as soon as possible since Initial AOP is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the process of information sharing related to Flight Progress Information Elements of an inbound / outbound airport transit Trajectory to / from / at the airport, as described in the OFA 05.01.01 document **(MM1 – Flight trajectory data implementation)**. The Initial Airport Operations Plan (AOP) deployment would also need the installation of the necessary airside and landside resources, such as runway capacity, runway configuration and parking stands **(MM2 – Airport resources data implementation)**. Moreover, and information sharing process related to MET Information Elements of Airport, as outlined in the OFA 05.01.01 document, shall be duly performed **(MM3 – Local weather data implementation)**. All relevant staff shall be duly trained (**MM4 – Training**), The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 2.2.1 – A-SMGCS level 1 and 2

2.2.1 – A-SMGCS Level 1 and 2			
Main Sub-AF	S-AF 2.2 DMAN Integrating Surface Management Constraints		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

Advanced Surface Movement Guidance and Control System (A-SMGCS) is providing aerodrome surveillance as well as planning, routing and guidance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required level of safety.

A-SMGCS level 1 provides ATC with the position and identity of:

- All relevant aircraft within the movement area;
- All relevant vehicles within the manoeuvring area.

Traffic will be controlled through the use of appropriate procedures allowing the issuance of information and clearances to traffic on the basis of A-SMGCS level 1 surveillance data.

A-SMGCS level 2 is a level 1 system complemented by the A-SMGCS function to detect potential conflicts on runways, taxiways and intrusions into restricted areas and provide the controllers with appropriate alerts.

A-SMGCS integrates all surface information sources enhancing situational awareness. A-SMGCS level 1 is a prerequisite for A-SMGCS level 2 and all higher A-SMGCS functions.

Interdependencies

Family 2.1.1 Initial DMAN

Family 2.1.2 Electronic Flight Strips (EFS)

Family 2.1.3 Basic A-CDM

S-AF 2.4 A-SMGCS Level 1 is a pre-requisite for Family 2.4.1

- Airport Conformance Monitoring shall integrate A-SMGCS Surveillance data (Family 2.2.1), Surface Movement Routing and Planning (Family 2.4.1) and controller routing clearances.
- When relevant, A-SMGCS shall include the advanced routing and planning function referred to in Sub AF 2.4 to enable conformance monitoring alerts.
- A-SMGCS shall provide -optimized taxi-time and improve predictability of take-off times by monitoring of real surface traffic and by considering updated taxi times in departure management regardless of meteorological or other impacting conditions.

S-AF 2.5 A-SMGCS Level 1 and 2 is a pre-requisite for Family 2.5.1

- Airport Conformance Monitoring shall integrate A-SMGCS Surveillance data (Family 2.2.1), Surface Movement Routing and Planning (Family 2.4.1) and controller routing clearances.
- A-SMGCS shall include a function to generate and distribute the appropriate alerts. These alerts shall be implemented as an additional layer on top of the existing A-SMGCS level 2 alerts and not as a replacement of them.

Synchronization Needs

ANSPs and Airport Operators.

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-ASUR Initial Capability for Ground Surveillance B0-SURF Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0201 Available AO-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	AOP04.1, AOP04.2
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	Family 2.2.1 is a pre-requisite for further deployment, especially in Sub-AF 2.4 and 2.5. SDM therefore strongly recommends that all projects related to A-SMGCS Level 1 and 2 shall be completed as early as possible before the defined FOC Date of the Sub-AF to allow for the deployment of subsequent solutions. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the installation of the A-SMGCS Level 1 background systems (e.g. surface movement radar(s), multilateration, etc.) **(MM1 – A-SMGCS Level 1 installation)**, which shall be complemented by the set up of the A-SMGCS Level 2 system, the RIMCAS, also including the equipage of the relevant vehicles with transponders **(MM2 – A-SMGCS Level 2 installation)**. Before the start of the operational use, A-SMGCS Level 1 and 2 Operational Procedures shall be elaborated and then published **(MM3 – Operational Procedures)**, all relevant staff shall be duly trained **(MM4 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM5 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.	

Family 2.3.1 – Time Based Separation (TBS)

2.3.1 – Time Based Separation (TBS)			
Main Sub-AF	S-AF2.3 Time Based Separation for Final Approach		
Readiness for implementation	High		
Initial Operational Capability	01/01/2015	**Full Operational Capability**	01/01/2024

Description and Scope

Time Based Separation (TBS) consists in the separation of aircraft in sequence on the approach to a runway using time intervals instead of distances. It may be applied during final approach by allowing equivalent distance information to be displayed to the controller taking account of prevailing wind conditions. Radar separation minima and Wake Turbulence Separation parameters shall be integrated in a TBS support tool providing guidance to the air traffic controller to enable time-based spacing of aircraft during final approach that considers the effect of the headwind. The TBS support tool shall integrate an automatic monitoring and alerting of separation infringement safety net.

The objective is to recover loss in airport arrival capacity currently experienced in headwind conditions on final approach under distance-based wake turbulence radar separation rules. By using time-based parameters, this loss is mitigated, having a positive effect on runway throughput and runway queuing delays. Minimum radar separation is not affected.

Whilst TBS operations are not exclusive to a headwind on final approach, the current deployment proposal is specifically targeted at realizing the potential capacity benefits in these currently constraining conditions.

Radar separation minimum and new wake-vortex separation standards (such as RECAT) shall be integrated in the Time Based Separation support tool that provide guidance to the controller to achieve the time proposed spacing to counter the effect of the headwind.

Where available, ensure local MET info with actual glide-slope wind conditions are provided to the TBS Support tool. When relevant, ensure the AMAN system is compatible with the TBS support tool.

Interdependencies

Family 1.1.1 Basic AMAN.

Family 1.1.2 AMAN Upgrade to include Extended Horizon Function.

Family 2.1.2 EFS can help support the necessary electronic exchange of information between the Tower Runway Control, the Final Approach Control and the TBS support tool.

Families 5.4.1 and/or 2.1.4, for Meteorological Information.

Synchronization Needs

Aircraft operators, ANSPs and Airport Operators.

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators
Other stakeholders involved in the Family deployment	Airspace Users, Military Authorities

Links to ICAO GANP ASBUs	B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service) B2-WAKE Advanced Wake Turbulence Separation (Time-based)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0303 SESAR Release 2
	ATM Master Plan Level 3 (Edition 2016)	AOP10
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	It is recommended to implement Family 2.3.1 as soon as possible since TBS is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the integration of the Time Based Separation (TBS) tool in the local environment (including necessary upgrades for other systems, e.g. AMAN, EFS, etc.). The AMAN system compatibility with the TBS support tool shall be ensured; CWP shall be modified in order to integrate the tool with the safety net; wind conditions shall be provided to the tool as well as automatic monitoring and alerting **(MM1 – Integration in local environment)**. Before the start of operational use of the tool, TBS Operational Procedures shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, Air Traffic Controller and Flight Crews shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 2.4.1 – A-SMGCS Routing and Planning Functions

2.4.1 – A-SMGCS Routing and Planning Functions			
Main Sub-AF	S-AF 2.4 Automated Assistance to Controller for Surface Movement Planning and Routing		
Readiness for implementation	High		
Initial Operational Capability	01/01/2016	**Full Operational Capability**	01/01/2024

Description and Scope

Advanced Surface Movement Guidance and Control System (A-SMGCS) is providing aerodrome surveillance as well as routing and planning, guidance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required level of safety. A-SMGCS Routing and Planning Functions provide ATC with:

- Optimized route designation for each aircraft or vehicle within the movement area;
- The detection of all route conflicts on the movement area as well as improved routing and planning for use by controllers.

Traffic will be controlled through the use of appropriate procedures allowing the issuance of information and clearances to traffic.

A-SMGCS Level 1 is a prerequisite to A-SMGCS Routing and Planning Functions.

Ref S-AF 2.2, 2.4 and 2.5:

- Interfaces between DMAN and A-SMGCS shall be developed with the purpose to integrate departure sequencing and routing computation.
- Electronic Flight Strips (EFSs), with an advanced A-SMGCS routing function, shall be integrated into the flight data processing system.
- The routing and planning functions of A-SMGCS shall provide the automatic generation of taxi routes, with the corresponding estimated taxi time and management of potential conflicts. Taxi routes may be manually modified by the air traffic controller before being assigned to aircraft and vehicles. These routes shall be available in the flight data processing system.
- The A-SMGCS routing and planning function shall calculate the most operationally relevant route as free as possible of conflicts which permits the aircraft to go from stand to runway, from runway to stand or any other surface movement. The controller working position shall allow the air traffic controller to manage surface route trajectories. The flight data processing system shall be able to receive planned and cleared routes assigned to aircraft and vehicles and manage the status of the route for all concerned aircraft and vehicles.
- A-SMGCS Routing and Planning Functions shall integrate all surface information sources, enhance situational awareness and provide the controllers with appropriate alerts.
- Digital systems, such as EFSs, shall integrate the instructions given by the air traffic controller with other data such as flight plan, surveillance, routing, published rules and procedures.

A-SMGCS shall include the advanced routing and planning function to enable conformance monitoring alerts.

Interdependencies

Family 2.1.1, Implementation of Initial DMAN and Family 2.5.2 Implementation of vehicle and aircraft systems contributing to airport safety nets, shall contribute to Family 2.4.1

Family 2.1.2, EFS

Family 2.2.1, A-SMGCS Level 1 and airport safety nets associated with A-SMGCS Level 2 are pre-requisites for Family 2.4.1

Synchronization Needs

Aircraft Operators, Ground Handling Companies, ANSPs and Airport Operators.

Civil / Military Coordination		
Applicable to those airports open to civil and military operations		
Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Ground Handling Companies, Aircraft Operators, Military Authorities	
Links to ICAO GANP ASBUs	B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management B2-SURF Optimized Surface Routing and Safety Benefits (A-SMGCS Level 3-4 and SVS)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0205 SESAR Release 5 TS-0202 SESAR Release 4 TS-0203 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP13
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	Some functionalities of Families 2.5.1 and 2.5.2 depend on the implementation of A-SMGCS Routing and Planning Functions (Family 2.4.1) which has a later FOC date (01/01/2024). Where necessary it is therefore recommended to synchronize Families 2.5.1 and 2.5.2 with Family 2.4.1 or to integrate those relevant functionalities in the respective 2.4.1 IP. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the upgrade of the A-SMGCS routing and planning functions in order to support taxi route clearance modified by ATCOs (Sub-AF 2.4); the interface between DMAN and A-SMGCS routing functions shall be developed and also the identification of mobiles (aircraft and vehicles) shall be ensured **(MM1 – Installation and integration in local environment with A-SMGCS, EFS and DMAN)**. Before the start of the operational use, A-SMGCS Planning and Routing Operational Procedures shall be elaborated and then published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 2.5.1 – Airport Safety Nets associated with A-SMGCS level 2

2.5.1 – Airport Safety Nets associated with A-SMGCS (Level 2)			
Main Sub-AF	S-AF 2.5 Airport Safety Nets		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

Airport safety nets consist of the detection and alerting of conflicting ATC clearances to aircraft and deviation of vehicles and aircraft from their instructions, procedures or routing which may potentially put the vehicles and aircraft at risk of a collision.

The scope of this sub-functionality includes the Runway and Airfield Surface Movement area. ATC support tools at the aerodrome shall provide the detection of Conflicting ATC Clearances as well as deviations from ATC instructions, procedures or routes. This shall be performed by the ATC system based on the knowledge of data including the clearances given to aircraft and vehicles by the air traffic controller, the assigned runway and holding point. The air traffic controller shall input all clearances given to aircraft or vehicles into the ATC system using a digital system, such as the EFS (Family 2.1.2). Different types of conflicting clearances shall be identified (for example Line-Up vs. Take-Off). Some may only be based on the air traffic controller input; others may in addition use other data such as A-SMGCS surveillance data.

Airport Safety Nets tool shall alert when aircraft and vehicles deviate from ATC instructions, procedures or routes. The detection of Conflicting ATC Clearances shall aim to provide an early prediction of situations that if not corrected would end up in hazardous situations that could be detected by the runway incursion monitoring system (RIMS) if in operation.

Airport Safety Nets tool could be linked to equipment for vehicle drivers to improve situational awareness, reduce the risks of runway incursion, runway and taxiway confusions and thus contribute to the overall airport safety net for high-density airports.

Interdependencies

Family 2.1.2 EFS is a pre-requisite for Family 2.5.1

Family 2.2.1 A-SMGCS Level 1 is a pre-requisite for A-SMGCS Level 2, and A-SMGCS Level 2 is a pre-requisite for Family 2.5.1

Family 2.4.1 A-SMGCS Planning and Routing Functions can be foreseen as a pre-requisite for Families 2.5.1 and 2.5.2

Synchronization Needs

ANSPs and Airport Operators.

Civil / Military Coordination

Stakeholders considered as gaps	ANSPs, Airport Operators
Other stakeholders involved in the Family deployment	Military Authorities

Links to ICAO GANP ASBUs	B0-SURF Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0104-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP12
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	Some functionalities of this Family depend on the implementation of A-SMGCS Routing and Planning Functions (Family 2.4.1) which has a later FOC date (01/01/2024). Where necessary it is therefore recommended to synchronize with Family 2.4.1 or to integrate those functionalities in the respective 2.4.1 IP. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATC systems and their integration in the local environment, in order to support the Airport Safety Nets (Sub-AF 2.5), systems that shall also be integrated with A-SMGCS and EFS **(MM1 – Installation and integration in local environment with A-SMGCS and EFS)**. Before the start of the operational use, the Airport Safety Nets Operational Procedures associated to A-SMGCS Level 2 shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 2.5.2 – Vehicle and aircraft systems contributing to Airport Safety Nets

2.5.2 – Vehicle and aircraft systems contributing to Airport Safety Nets			
Main Sub-AF	S-AF 2.5 Airport Safety Nets		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2021

Description and Scope

This Family represents an enabler and a facilitator to the safety-focused PCP deployment. The objective is to equip aircraft and vehicles operating in the manoeuvring area of airports with safety related systems to improve situational awareness, reduce the risks of runway incursion, runway confusion and runway excursions and thus contribute to the overall airport safety net for high-density airports.

Airport safety nets consist of the detection and alerting of conflicting ATC clearances to aircraft and deviation of vehicles and aircraft from their instructions, procedures or routing which may potentially put the vehicles and aircraft at risk of a collision.

The scope of this Family includes:

- aircraft technology in the scope of avionic or electronic flight bag based systems with the objective to conclude the ground based airport safety net with specific airborne systems and technology;
- on-board vehicle displays including on-board vehicle safety nets, including alerting functions, with the objective to support the ground based airport safety net with specific vehicle systems and technology;
- under Family 2.5.2, it is not foreseen to provide the complete "aircraft picture" to the "Air Traffic Controller", nor to provide the complete "Air Traffic Controller picture" to the cockpit.

This leads to an improved situational awareness and thus improves the quality of the overall safety net. The main benefit is related to the increase of runway usage awareness, and consequently an increase of runway safety and of the whole airport manoeuvring area.

On-board aircraft and vehicle systems and technology uses airport data coupled with on-board aircraft sensors to monitor the movement of aircraft and vehicles on the airport surface and provide relevant information to the drivers, the flight crew and the ATC. The on-board aircraft and vehicle systems detect potential and actual risk of collision with other traffic on the manoeuvring area and provide the drivers and the flight crew with the appropriate alert.

An aircraft on-board airport safety net will improve safety in runway operations, mostly at airports where no safety net is provided to controllers. It should be noted that not all vehicles may need to be equipped. For instance, during snow removal, it would probably be enough to only equip the lead and end vehicle.

Interdependencies

Family 2.2.1 A-SMGCS Level 1 is a pre-requisite for A-SMGCS Level 2, and A-SMGCS Level 2 is a pre-requisite for Family 2.5.2

Family 2.4.1 A-SMGCS Planning and Routing Functions can be foreseen as a pre-requisite for Family 2.5.2

Family 2.5.1 is a pre-requisite for Family 2.5.2 to ensure full safety performance is achieved

Synchronization Needs

Aircraft operators, ANSPs and Airport Operators.

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-SURF Enhanced Safety and Efficiency of Surface Operations – SURF, SURF-IA and Enhanced Vision Systems (EVS) B2-SURF Optimized Surface Routing and Safety Benefits (A-SMGCS Level 3-4 and SVS)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AUO-0401 Available AO-0105 SESAR Release 5 AO-0204 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP04.1
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented	
Recommendation for IPs proposal	Some functionalities of this Family depend on the implementation of A-SMGCS Routing and Planning Functions (Family 2.4.1) which has a later FOC date (01/01/2024). Where necessary it is therefore recommended to synchronize with Family 2.4.1 or to integrate those functionalities in the respective 2.4.1 IP. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require to relevant equipment for vehicles and aircraft to be delivered and implemented in order to be integrated in the local environment. ATC systems shall be concurrently upgraded and installed in order to support Airport Safety Nets (Sub-AF 2.5) **(MM1 – Installation and integration)**. Before the start of the operational use, Operational Procedures related to such systems shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

3.3 AF #3 – Flexible ASM and Free Route

Family 3.1.1 – ASM tool to support AFUA

3.1.1 – ASM Tool to support AFUA			
Main Sub-AF	S-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2019

Description and Scope

Deployment of automated ASM systems and their interoperability with NM systems and neighbouring ASM systems to manage ARES shall improve civil-military co-ordination and lead to greater flexibility according to airspace users' needs.

Automated ASM support system shall:

- Improve airspace management processes and flexible airspace planning including time horizon specifications in all flight phases (strategic, pre-tactical and tactical time horizon) by providing mutual visibility on civil and military requirements;
- Support a flexible airspace planning according to civil and military ANSPs and airspace user requirements, extended also to permit cross border and use of segregated areas operations regardless of national boundaries;
- Support dynamic airspace management and flexible sector configurations;
- Address the strategic/long term, pre-tactical planning and tactical operations;
- Be compatible and ensure uninterrupted data flow with NM system and neighbouring ASM systems between the pre-tactical planning and real time airspace status;
- Include the possibility to provide data for impact assessment and share results of impact evaluation of different airspace configurations on the network;
- Be interoperable with NM systems and neighbouring ASM systems

Interdependencies

Prerequisite for:

Fam. 3.1.2 ASM management of real time airspace data

Fam. 3.1.3. Full rolling ASM/ATFCM process and ASM information sharing

Interdependency with:

S-AF 5.3 Aeronautical information exchange

S-AF 5.5 Cooperative Network Information Exchange

Synchronization Needs

Operational and technical synchronisation between NM, National Airspace Management Cells, Civil-Military AUs and Civil-Military ANSPs is required

Civil / Military Coordination

A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.

Enablers for civ-mil coordination are support systems and procedures to share ASM information and manage ASM level 2. This initiative is to deploy local ASM support systems meeting a baseline definition to manage airspace locally based on civil – military coordination. Military Air Planning entities should have an interface with ASM support system.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager and Military AUs	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0202 Available
	ATM Master Plan Level 3 (Edition 2016)	AOM19.1
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	ASM tool implementation allows data exchange with NM and neighbouring ANSPs in support of ARES coordination and it covers the pre-requisite for 3.1.2 and 3.1.3. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family requires the successful installation of the ASM Tool, as an enabler for the support of civil - military coordination **(MM1 – ASM tool installation)**. Monitoring and operational validation activities shall be completed in order to ensure interoperability (via B2B) (**MM2 – ASM tool integration**). Procedures for operational and technical use of the system shall be provided (**MM3 – Procedures available**), all safety assessments required duly executed (**MM4 – Safety assessment**). The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 3.1.2 – ASM Management of real time airspace data

3.1.2 – ASM Management of real time airspace data			
Main Sub-AF	S-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace		
Readiness for implementation	High		
Initial Operational Capability	01/01/2017	**Full Operational Capability**	01/01/2022

Description and Scope

Airspace management (ASM) is enhanced by the automated exchange services of ASM data during the tactical and execution phases, continuously in real time.

ASM information (real-time ARES status) are shared between ASM systems, civil and military ATS units/systems and communicated to the NM in the tactical and execution phases.

This data consists of pre-notification of activation, notification of activation, de-activation, modification and release.

They are collected, saved, processed and exchanged between ASM stakeholders and made available by the NM system to ATM actors and all airspace users not involved in ASM process but concerned by this data.

The scope of this family encompasses:

- Procedural and system upgrades (ASM, ATM, NM and Civil-Military AU systems-i.e. CFSP) for exchange of real time airspace status data where required;
- Integration and management of ASM real-time data into ANSPs ATM systems and into AUs (CFSP, etc.) flight planning systems where required.
- Full sharing of real time airspace status updates in planning and/or execution phases, in order to take early advantage of possible opportunities and/or to achieve real time awareness of airspace features.

Interdependencies

Pre-requisite for this family is family 3.1.1 - ASM tool to support AFUA

Other dependencies:

Family 3.1.3 - Full rolling ASM/ATFCM process and ASM information sharing

S-AF 5.3 - Aeronautical information exchange

S-AF 5.5 - Cooperative Network Information Exchange

Family 5.6.1 - Upgrade/Implement Flights Information Exchange system/service supported by Yellow Profile

Synchronization Needs

Operational and technical synchronisation between NM, National Airspace Management Cells, Military AUs and Civil-Military ANSPs is required

Civil / Military Coordination

A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.

Enablers for civ-mil coordination are support systems and procedures to share real time ASM information and manage ASM level 3.

This initiative is to upgrade the local ASM support systems or implement other means to meet the requirements of civil military coordination at level 3.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager, Military AUs	
Other stakeholders involved in the Family deployment	Airspace Users (CFSPs)	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0206-A SESAR Release 5 AOM-0202-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOM19.2
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	The scope of this family might require changes in ATM systems, AU systems and NM systems, which need to be undertaken after the deployment of ASM tools in support of real time airspace status updates, in planning and execution phase. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family requires the successful upgrade of the ASM tool **(MM1 – Upgrade of ASM tool)**, to support a continuous real time data exchange during the tactical phase in order to manage airspace data and airspace status **(MM2 – System updates for the exchange of real time airspace data)**. All the relevant data shall be integrated into ATM Systems. Interoperability with the Network Manager system and with other ASM systems shall be carefully monitored and verified **(MM3 – Systems integration with ATM, ASM and NM systems)**. Procedures for operational and technical use of the system shall be provided **(MM4 – Procedures available)**, all safety assessments required duly executed **(MM5 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.	

Family 3.1.3 – Full rolling ASM/ATFCM process and ASM information sharing

3.1.3 – Full rolling ASM/ATFCM process and ASM information sharing			
Main Sub-AF	S-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

This process focuses on airspace planning improvements and to ensure a continuous, seamless and reiterative planning, allocation and operational deployment of optimum airspace configurations, based on airspace request at any time period within strategical level 1, pre-tactical level 2 and tactical level 3. It will result in a rolling process, supporting the enhancement of the daily Network Operations Plan. This will allow airspace users to take greater benefit from changes in airspace structures in real-time.

This will be supported by the sharing of military airspace and civil data and by continuously updating Airspace Reservation information and other civil demand information among the authorized users and approved agencies. The aim is to enhance the coordination of Cross Border Operations (including Cross Border Area) with attention to military restrictions on sharing airspace data with outside alliances. This shall optimize network operations based on the richest and most up-to-date information.

ASM information sharing addresses the required system support improvements to enable a seamless data flow and their management in the framework of the enhanced CDM process. It includes requirements aiming to improve notifications to airspace users based on automation of data exchange. The scope of this family encompasses:

- Process/system upgrade supporting a full rolling ASM/ATFCM and dynamic ASM/ATFCM process allowing data sharing to all operational stakeholders, although some States with limited airspace booking needs may fully rely on NM system capabilities.
- ASM systems and AU systems upgrades to continuously exchange ASM information.
- Technical changes supporting rolling AUP and rolling UUP (including for procedure 3).
- Initial implementation of FUA/EU restriction and FBZ in NM system and local/regional ASM systems
- Full implementation of new AUP template content and format (AIXM coding definition) perspective
- Process/System improvements supporting sharing of information of airspace configurations (via AUP/UUP), full management of Airspace structure (taking into account AUP/UUP information), initial CDM and CDM in FRA network impact assessment,
- Harmonize cross border CDRs and ARES notifications
- Implement Graphical display of AUP/UUP on NOP Portal (with lateral/vertical limits indication)
- ASM management and data sharing shall be addressed where airspace is managed dynamically with no fixed-route network

Interdependencies

Fam. 3.1.1 – ASM tool to support AFUA (prerequisite)

Fam. 3.1.2 – ASM management of real-time data

Fam. 3.1.4 - Management of dynamic airspace configurations

Fam. 4.4.2 - Traffic complexity tools

S-AF 5.3 - Aeronautical Information Exchange

S-AF 5.5 – Cooperative Network Information Exchange

Fam. 5.6.1 - Upgrade/Implement Flights Information Exchange system/service supported by Yellow Profile

Family supports –as stated in the PCP IR – the introduction of DCT and FRA

Synchronization Needs		
Operational and technical synchronisation between NM, National Airspace Management Cells, AUs and Civil-Military ANSPs is required		
Civil / Military Coordination		
A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.		
Stakeholders considered as gaps	Civil-Military ANSPs, Civil-Military AUs (CFSPs), Network Manager	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0202-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOM19.3
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	This family is a key feature for the European airspace planning process and the continuous update of information about: ARES via AUP/UUP, traffic demand and necessary data among all stakeholders in a full rolling process. All involved stakeholders should submit proposals for process/systems updates in order to achieve full management of shared information. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the identification of systems upgrade in order to include the technical changes required **(MM1 – System updates for the full rolling ASM/ATFCM process and ASM information sharing)**. All Civil, Military, AU and NM Systems, shall be integrated for information and data sharing, which shall then be properly monitored and verified **(MM2 – Integration completed)**. Procedures for its operational and technical use shall be provided **(MM3 – Procedures available)**, all safety assessments required duly executed **(MM4 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 3.1.4 – Management of dynamic airspace configurations

3.1.4 – Management of Dynamic Airspace Configurations			
Main Sub-AF	S-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace		
Readiness for implementation	Medium		
Initial Operational Capability	01/01/2018	**Full Operational Capability**	01/01/2022

Description and Scope

The ASM solutions process is aimed at delivering ASM options that can help alleviate capacity problems identified in any particular area of European airspace as well as improve flight efficiency assessing impact on capacity and ensuring synchronized availability of optimized airspace structures based on traffic demand and dynamic sectors management.

The Airspace configurations are pre-defined and coordinated airspace structures (based on CDRs, DCTs, FRA, including ARES, VPA/DMA and so on) and ATC dynamic sectorisation, to meet airspace needs in terms of capacity and/or flight efficiency. Airspace configurations and ATC flexible sectors configuration are already used when the flows and constraints can be predicted well in advance (e.g. weekend routes or seasonal flows of traffic). A more efficient and dynamic process involving the NM, ATFCM, ATC and military would require new functionalities and procedures and well defined collaborative decision making processes at pre-tactical level. Dynamic Airspace Configuration focuses on defining a reference to Dynamic Airspace Configuration concept, including roles and responsibilities in an advanced CDM process. The ASM performance analysis should assess the flight efficiency gains resulting from the rolling ASM/ATFCM process implementation. The Capacity aspects need also to be addressed.

The scope of this family encompasses:

- Improved ASM solution process.
- Process/System changes for predefined airspace configurations including DCTs and FRA.
- ASM/ATFCM and ATM systems should support the full sharing of the dynamic airspace configuration inputs and outputs via specific B2B services. The notification of Airspace Configurations will be based on automatic flows of information between the different stakeholders provided by Network Manager.
- System improvements supporting the management of dynamic airspace configuration including DCTs and FRA (included implementation of ATM VoIP communications enabling dynamic airspace configuration).
- Implement supporting tools for ASM performance analysis.

Interdependencies

Pre-requisite: Fam. 3.1.3 – Full rolling ASM/ATFCM process and ASM information sharing

Fam. 3.1.2 ASM Management of real time airspace data

Fam. 4.4.2 Traffic complexity tools

S-AF 5.3 - Aeronautical Information Exchange

S-AF 5.5 – Cooperative Network Information Exchange

Fam. 5.6.1 Upgrade/Implement Flights Information Exchange system/service supported by Yellow Profile

Synchronization Needs

Operational and technical synchronisation between NM, National Airspace Management Cells, Civil and Military AUs and Civil-Military ANSPs is required.

Civil / Military Coordination

A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0102-A SESAR Release 2 AOM-0805 SESAR 2020 Second Wave AOM-0809 SESAR 2020 Second Wave
	ATM Master Plan Level 3 (Edition 2016)	AOM19.4
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	The deployment of predefined airspace configuration could start from the beginning of 2018 onwards. IP proposals should be focused on concept and study of ASM solutions achieving a more efficient process (included new system functionalities, if envisaged) supporting optimized airspace structure and availability, ATC dynamic sectors management, to enhance flight efficiency and alleviate capacity problems with reference to predefined airspace configurations. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the definition of a pre-defined airspace configuration concept, including implementation of ATM VoIP communications which supports dynamic sectorisation. This shall provide deliverables such as CONOPS, whilst also sharing roles and responsibilities in an advanced CDM perspective **(MM1 – Pre-defined airspace configuration concept definition)**. ATM systems shall be subsequently upgraded as required **(MM2 – ATM systems upgrade)**. The installation of new software and/or tools shall be successfully completed **(MM3 – SW/Tools installation)** and the ANSP-NM integration of such SWs/Tools among all Stakeholders systems shall be closely monitored and verified **(MM4 – SW/Tools integration)**. Procedures for its operational and technical use shall be provided **(MM5 – Procedures available)**, all safety assessments required duly executed. **(MM6 – Safety assessment)**. All relevant personnel involved shall be appropriately trained **(MM7 – Training of personnel)** The execution of such activities is expected to lead to the start of permanent operational use **(MM8 – Implementation completed)**.	

Family 3.2.1 – Upgrade of ATM systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Routing Airspace (FRA)

3.2.1 – Upgrade of ATM systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Route Airspace (FRA)			
Main Sub-AF	S-AF 3.2 Free Route		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

NM systems have been upgraded to support Free Route operations that can be done by means of published DCTs (initial step) or directly FRA. Only some corrections and tuning are required for DCTs. The NM system upgrades related to dynamic re-routing, ATFCM planning and execution and traffic load management are part of AF 4 families, namely 4.1.2 and 4.4.2. The AU flight plan filing systems (CFSP) should be upgraded (e.g. to support long DCT segments and handling of LAT/LONG, if required). Specific attention should be given to the management of any ASM/ATFCM constraint in a FRA environment, and to the necessary standardisation of free route implementation concerning the flight planning requirements.

The ANSP system upgrades include the FDPS (e.g. management of FPL trajectories including LAT/LONG and/or enhanced management of trajectories by EFPL), the Controller Working Position (CWP) and the HMI which need to support DCTs/FRA. ATC systems may also be upgraded, for example, with CPDLC messages handling LAT/LONG, CPDLC reception and use data from aircraft coming from ADS-C EPP when these data link services are implemented.

Although the above-mentioned requirements do not make a direct reference to Multi-Sector Planner/Extended ATC Planner (MSP/EAP) function, the indirect links do exist and MSP/EAP deployment in the context of DCTs/FRA should be considered. The system upgrades can be clustered in 3 points:

1. For State/Regional (e.g. cross-border) DCTs they shall encompass:
   - NM systems:
     - FPL processing and checking
     - Dynamic rerouting
     - Calculation and management of traffic load
   - AU systems:
     - FPL route planning for a complete flight taking into account the differences of implementation and 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.
   - ATC systems:
     - FDPS supporting airspace structure managing trajectories according to flight planning
     - CWP and HMI supporting appropriate display and functions as required by operational needs
2. For State/Regional (e.g. cross-border) FRA deployment they shall encompass the upgrades listed in point 1) plus:
   - NM systems:
     - IFPS routing proposal
     - Specific ASM improvements for FRA
     - Network impact assessment for FRA
     - CACD adaptations for FRA national deployment
   - AU systems:
     - Capability to take into account the different constraints, e.g.: ATS, DCT/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 implementation (DCT, FRA with or without partial implementation) throughout the entire flight.

- ATC systems:
  - FDP to calculate ground 4D trajectories within AoI and editing function for 4D trajectories including Cross AoR Points (COP management)
  - ASM/ATFCM for FRA management
  - MTCD (detecting conflicts between A/C and A/C)
  - CORA (conflict probe and passive conflict resolution advisor)
  - MONA (conformance monitoring aids)
  - ATC clearances beyond AoR
  - ATC to ATC Flight Data Exchange (Basic OLDI and SYSCO)
  - Dynamic sectorization and constraint management
  - Dynamic Area Proximity Warning (APW) - Integration with ASM tools
  - Provision/integration of FP and real time data related to the FRA traffic to the Military ATS units
  - Conflict Detection Tools which include the Tactical Controller Tool (TCT), using the tactical trajectory and managing the clearances along that trajectory

3. For Pan-European FRA deployment they shall encompass the upgrades listed in point 2) plus:

- NM systems:
  - CACD environmental database adaptations for FRA cross-border operations
  - B2B data exchange for cross border FRA
- ATC systems:
  - COP management for FRA supporting Cross Border COP handling
  - Tactical Controller Tool (TCT), managing the Cross Border clearances
- AU systems:
  - Optimisation of free routing trajectory taking into account the ATM constraints including possible differences of FRA lower limit implementations throughout the flight

Interdependencies

Enabler for:

- 3.2.3 – Implement published Direct Routings
- 3.2.4 - Implement Free Route Airspace

Linked with:

- 4.1.2 STAM phase 24.2.3 Interface ATM systems to NM systems
- 4.4.2 Traffic Complexity tools

For some modifications (including MSP) linked with:

- Sub AF 1.1 Arrival management extended to en-route airspace
- Sub AF 1.2 Enhanced Terminal Airspace using RNP Based Operations

Interdependencies with G/G data communications as specified in AF5 and A/G Datalink capability as specified in AF6 are facilitators for the full FRA implementation.

Synchronization Needs

Synchronisation between NM, AU and ANSPs is required.

Civil / Military Coordination

Civil-military Coordination is beneficial for, i.e. Basic Flight Data (BFD) and Change Flight Data (CFD), other. Military ATC Systems shall be capable to process all DCT Information.

Stakeholders considered as gaps	Civil-military ANSPs, Civil-Military AUs (CFSPs), Network Manager
Other stakeholders involved in the Family deployment	None

Links to ICAO GANP ASBUs	B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0202 Available CM-0203 Available AOM-0500 SESAR Release 5 AOM-0501 SESAR Release 5 AOM-0505 SESAR Release 9 CM-0102-A SESAR Release 2
	ATM Master Plan Level 3 (Edition 2016)	AOM21.1, AOM21.2, ATC02.8, ATC12.1, ATC17
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	It is recommendable that ANSPs, NM and AUs submit IPs for procurement/upgrade of their systems for DCT/FRA operations. The stakeholders that deployed the system upgrades related to DCT/FRA should be encouraged to consider further upgrades related to cross-border, National/Regional and Pan-European deployment, in the perspective that large scale deployments (e.g.: at FAB level, 24h, with minimum entry/exit conditions/constraints) are recommendable as producing most benefits, and that these would be maximized with future Pan-European deployment. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	These Milestones shall be applicable for any system upgrade or implementation of a specific function/tool required for full FRA implementation. The implementation of the family would require the definition of CONOPS for the system/functions **(MM1 – Concept of the new system/functions definition)**, the preparation of the related technical and operational specifications **(MM2 – Operational and technical requirements preparation)** and the signature of the contract(s) for the supplying, installation and integration of such system/functions (**MM3 – Procurement of new system/functions**). In order for the system/functions to be set for operational use, the Factory as well as the Site acceptance test and validation shall be successfully performed **(MM4 – Factory Acceptance Test for new system/functions, MM5 – Site Acceptance Test for new system/functions)**, both illustrated in the Family description. Such updated systems shall then be installed **(MM6 – Systems installation)** and their integration, in particular ANSP-ANSP for OLDI and SYSCO, NM-ANSP for FRA airspace definition and NM-CFSP for flight planning requirements, shall be carefully monitored and verified **(MM7 – Systems integration)**. Further activities shall be performed to make such systems available and, more in detail, tailored procedures shall be established and provided for the operational/technical use of the new SWs/tools **(MM8 – Procedures available)**, all safety assessments required shall be duly executed and all the output documents shall then be timely released **(MM9 – Safety assessment)**, all relevant personnel involved shall be appropriately trained **(MM10 – Training of personnel)**, the transition plan prepared and the related transition phase initiated **(MM11 – Transition from legacy system to new one)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM12 – Implementation completed)**.	

Family 3.2.3 – Implement Published Direct Routings (DCTs)

3.2.3 – Implement Published Direct Routings (DCTs)			
Main Sub-AF	S-AF 3.2 Free Route		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2018

Description and Scope

Implementation of Direct Routings (DCTs) is mandated from 01 January 2018. However the publication of flight plannable DCTs before 01 January 2018 represents an initial step toward Free Route Airspace implementation where full deployment of FRA, especially in high complexity environment, may not be the best solution in terms of performances. Therefore, Stakeholders may or may not deploy DCT's as an intermediate step.

DCTs may be implemented within a State or between States on a cross border basis. Within this airspace, flights remain subject to air traffic control.

DCTs shall be published in aeronautical publications as described in the European Route Network Improvement Plan (ERNIP) of the Network Manager.

To facilitate early implementation before the target deployment date, DCTs may be implemented in a limited way e.g.:

- Time constraint (fixed or depending on traffic/availability)
- Traffic Constraint (based on flow and/or level of traffic)
- Flight level
- Lateral Constraints
- Entry/exit conditions

Interdependencies

The implementation of DCTs is often dependent on airspace design and in particular airspace reservations involving civil/military coordination, including OAT (OATTS-like) routes.

S-AF-3.1 ASM and Advanced FUA

Fam. 3.2.1 - Upgrade of ATM systems (NM, ANSPs, AUs) to support DCTs and FRA (Prerequisite)

Synchronization Needs

There is the need to coordinate/synchronize efforts (operational procedures) between ANSPs, NM and Airspace users to ensure the return of investment and/or the start of operational benefits. Coordinated activities for cross-border DCT implementation at FAB and inter-FAB level are required. The implementation of DCTs is harmonized through the NM European Route Network Improvement Plan (ERNIP) and the Network Operations Plan following the Strategic Objectives and Targets set in the Network Strategic Plan and in the Network Manager Performance Plan.

Civil / Military Coordination

Civil-Military Coordination is beneficial for correct publication of the routes, to have ARES data available as soon as possible for planning and navigation purposes, for interfaces upgrade and full interoperability.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager
Other stakeholders involved in the Family deployment	Civil-Military AUs

Links to ICAO GANP ASBUs	B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0500 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOM21.1
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	DCTs deadline is 1 January 2018 since it is considered being an intermediate step (not mandatory) towards FRA implementation. Only stakeholders that haven't already deployed or are not currently deploying FRA should submit IPs for this family. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the identification of DCTs and the airspace where they will be implemented. Coordination with the Military Authority and NM shall be performed and with FAB partners/neighboring states when necessary **(MM1 – DCT airspace definition)**; fast and real time simulations should be executed, if required, to assess and validate the impact of DCTs. Where its involvement is envisaged, NM could cooperate and validate these simulations **(MM2 – Fast and Realtime Simulation)**. Operational procedures shall be provided **(MM3 – Procedures available)** and Direct Routings shall be published into the relevant aeronautical documents **(MM4 – Publication of Direct Routings)**, all safety assessments required duly executed **(MM5 – Safety assessment),** appropriate training of ATCOs, where required, should be performed **(MM6 Training of personnel)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.	

Family 3.2.4 – Implement Free Route Airspace

3.2.4 – Implement Free Route Airspace			
Main Sub-AF	S-AF 3.2 Free Route		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

Free Route is an operational concept that enables airspace users to fly as close as possible to what they consider the optimal trajectory without the constraints of fixed route network structure.

Free Route Airspace (FRA) is a specified airspace within which users may freely plan a route between defined FRA entry points and defined FRA exit points, 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. Reg. 716/2014 requires FRA deployment, at national level above FL305 by end of 2021.

To facilitate early implementations before the target deployment date, FRA may be implemented through intermediate steps (Fam. 3.2.3 - DCTs implementation is considered one of them) that allow best practice before full readiness for FRA implementation as specified in the PCP. This may be achieved with some limitations, for example:

- laterally and vertically;
- during specific periods;
- with a set of entry/exit conditions
- with initial system upgrades, etc.

FRA shall be published in aeronautical publications as described in the European Route Network Improvement Plan of the Network Manager. FRA shall be deployed at national level and may progress to FAB Regional level and express most benefits at Pan-European level deployment.

The implementation of FRA operations should be based on performance indicators.

Interdependencies

The implementation of FRA is dependent on airspace design and in particular airspace reservations involving civil/military coordination including OAT (OATTS-like) routes.

S-AF-3.1 – ASM and Advanced FUA

Fam. 3.2.1 - Upgrade of ATM systems (NM, ANSPs, AUs) to support DCTs and FRA (Prerequisite)

Synchronization Needs

There is the need to coordinate/synchronize efforts (operational procedure and aircraft capabilities) between ANSPs, NM, Military and Airspace Users to ensure the return of investment and/or the start of operational benefits. Coordinated activities and implementation at State, FAB, Regional or Pan-European level are required.

The implementation of FRA is harmonized through the NM European Route Network Improvement Plan (ERNIP) and the Network Operations Plan following the Strategic Objectives and Targets set in the Network Strategic Plan and in the Network Manager Performance Plan. Free Route implementation strategy is a local decision coordinated at Network, FAB and Regional level.

Civil / Military Coordination

Civil-Military Coordination is beneficial for, i.e. Basic Flight Data (BFD) and Change Flight Data (CFD), other. Military ATC Systems shall be capable to process all required FRA Information.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Civil-Military AUs	
Links to ICAO GANP ASBUs	B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0501 SESAR Release 5 AOM-0500 SESAR Release 5 AOM-0505 SESAR Release 9
	ATM Master Plan Level 3 (Edition 2016)	AOM21.2
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	FRA deployment is mandatory above FL305 at national level. Large scale deployments (e.g.: at FAB level, 24h, with minimum entry /exit conditions/constraints) are recommendable as producing most benefits that would be maximized considering future Pan-European FRA deployment. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The initial implementation of FRA deployment with limitations e.g. FL, dimension, timing, functions and tools, may be planned as intermediate steps. However, this limited implementation cannot be considered as fulfilling the PCP requirements. To achieve the maximum benefits expected from FRA (even if not required from the PCP nor from this DP), implementation of FRA should be envisaged as fully completed only when cross-border implementation capability is available with all EU and participating neighboring States. The implementation of the Family would require the identification and definition of features and operational concepts of the airspace, at least above FL305, where FRA will be implemented. Coordination with the Military Authority and NM shall be performed and with FAB partners/neighboring states as necessary. **(MM1 – Free Route Airspace definition)**. In order for the Free Route Airspace to be implemented, fast and real time simulations should be executed, if required, to assess and validate the impact of FRA. Whether its involvement is envisaged, NM could cooperate and validate these simulations **(MM2 – Fast and Realtime Simulation)**. Operational procedures shall be provided **(MM3 – Procedures available)** and Free Route Airspace shall be published into the relevant aeronautical documents **(MM4 – Publication of Free Route Airspace)**, all safety assessments required duly executed **(MM5 – Safety assessment),** appropriate training of ATCOs, shall be performed **(MM6 Training of personnel)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.	

3.4 AF #4 – Network Collaborative Management

Family 4.1.1 – STAM phase 1

4.1.1 – STAM Phase 1			
Main Sub-AF	S-AF 4.1 Enhanced Short Term ATFCM measures		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/11/2017

Description and Scope

The rigid application of ATFM regulations based on standard capacity thresholds as the pre-dominant tactical capacity measure needs to be replaced by a close working relationship between ANSP/FMP, NM and AU, which would monitor both the real demand, the effective capacity of sectors and their dynamic management by mean of different suitable configurations having taken into account the complexity of expected traffic situation.

In order to close the gap between ATC and ATFCM, local operational procedures need to be developed. The aim is to improve the efficiency of the system using flow management techniques close to the real time operations with direct impact on tactical capacity management, occupancy counts and tactical action on traffic. The target of the Short Term ATFCM Measures (STAM) phase 1 is to replace En Route CASA regulations for situations when imbalances are manageable via STAM phase 1.

STAM phase 1 is mainly procedural implementation using the occupancy counts instead of entry counts for a better evaluation of overload, hot spot detection, limiting the need for regulations and implementation of STAM measure at local level. Each FMP needs to develop the STAM FCM procedure.

Additional tasks relevant to the STAM phase 1 scope shall encompass:

- development of consolidated STAM phase 1 concept of operation
- development of operational guidance documentation
- development of training package
- development of harmonized operational procedures

Interdependencies

STAM phase 1 is a predecessor of STAM phase 2, but the deployment of STAM phase 1 is not a mandatory task due to the fact that STAM phase 2 focuses on network workflow procedures and STAM phase 1 is more locally focussed.

Fam. 4.4.2 - Traffic Complexity tools

Synchronization Needs

Completed from NM side, STAM phase 1 is available to all FMPs via CHMI.

Civil / Military Coordination

Yes, depending on the civil-military ATS organization

Stakeholders considered as gaps	ANSPs, Network Manager
Other stakeholders involved in the Family deployment	Airspace Users, Airports, Military Authorities

Links to ICAO GANP ASBUs	B0-NOPS Improved Flow Performance through Planning based on a Network-wide view	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0205 Available
	ATM Master Plan Level 3 (Edition 2016)	FCM04.1
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	STAM Phase 1 would deliver additional capacity just relying on better utilisation of the available resources by moving from the hourly sector capacity rates to the occupancy counts. However, STAM phase 1 is not a mandatory step towards STAM phase 2. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the development of the STAM phase 1 concept of operations, including the identification of local measures. Such development will potentially include the use of occupancy from NM tool (including the definition of OTMV), to be performed in coordination with Network Manager **(MM1 – STAM phase 1 concept of operations development)**. Following the concept of operations development, local procedures shall be developed and made available for operational use; such activity could be performed in coordination with neighbouring ACC and/or NM **(MM2 – Procedures available)**. The local operational documentation shall also be developed **(MM3 – Operational guidance documentation development)**. All safety assessments required duly executed **(MM4 – Safety Assessment).** All operational personnel shall be duly trained **(MM5– Training).** The execution of such activities is expected to lead to the start of permanent operational use **(MM6– Implementation completed)**.	

Family 4.1.2 – STAM Phase 2

4.1.2 – STAM Phase 2			
Main Sub-AF	S-AF 4.1 Enhanced Short Term ATFCM measures		
Readiness for implementation	High		
Initial Operational Capability	01/11/2017	**Full Operational Capability**	01/01/2022

Description and Scope

Tactical capacity management using STAM phase 2 requires the deployment of additional tool and procedures in order to ensure a close and efficient working relationship between NM, FMP and airspace users. The STAM phase 2 tool should include occupancy traffic monitoring values (OTMV), hotspot detection and coordination. The enhancements shall mainly focus on:

- Enhanced monitoring techniques (including hotspot management and complexity indicators)
- Coordination systems (including B2B with local tools)
- What-if function (local measures, flight based, flow based and multiple measure alternative)
- Network impact assessment

Additional tasks relevant to the STAM Phase 2 scope shall encompass:

- Development of consolidated STAM phase 2 concept of operation;
- Development of operational guidance documentation;
- Development of training package;
- Development of harmonized operational procedures

ANSPs and AUs shall deploy:

- An interface between local STAM support systems (including AU trajectory optimisation) and the NM systems
- and/or the STAM phase 2 application and services developed by NM
- apply harmonized operational procedures, taking into account the STAM Phase 2 pre-requisites such as the traffic information and flight predictability.

Interdependencies

NM system readiness is a prerequisite for ANSP/AUs STAM phase 2 deployment. STAM phase 1 is a predecessor of STAM phase 2, but the deployment of STAM phase 1 is not a mandatory task due to the fact that STAM phase 2 focuses on the network STAM workflow procedures where STAM phase 1 focuses on local STAM procedures.

Fam. 3.2.1 Upgrade of ATM systems (NM, ANSPs, AUs) to support DCT and Free Route.

Synchronization Needs

Upgrade of NM systems is required for STAM phase 2.

Synchronisation is necessary between neighbouring ACCs.

Civil / Military Coordination

Yes, depending on civil/military organization

Stakeholders considered as gaps	Network Manager, ANSPs, Airport Operators, Airspace Users (CFSP)
Other stakeholders involved in the Family deployment	Military Authorities

Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0308 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	FCM04.2
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	The proposal should refer to the further NM developments for STAM phase 2. ANSPs and eventually AUs should consider submitting proposals for STAM phase 2 deployments (local tool and/or NM tool utilisation). It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the development of the STAM phase 2 concept of operations, including the definition of roles and responsibilities of all actors, as well as the identification of the overall process. If required, local coordination with the military and/or with the airport should be performed **(MM1 – STAM phase 2 concept of operations development)**. The Network Manager should implement system improvements based on operational requirements in order to facilitate the coordination with local stakeholders **(MM2 – Upgrade of NM-systems)**. ANSPs shall install local tools capable to support STAM measure or to ensure the local implementation of the NM STAM stool. Military and airports could be involved in such installation **(MM3 – Installation of STAM support tool)**. ANSPs shall then issue local/sub regional procedures for the use of the local tool, in coordination with NM (and - if required - Airport and Military) **(MM4 – Local/sub regional procedures available)**. Network Manager shall define common procedure for coordination and consequentially develop operational guidance documentation for this purpose **(MM5 – Development of operational guidance documentation for coordination)**. ANSPs and NM shall adapt and integrate their systems in order to allow the required data exchange and functionalities; it is worth noting that such activities are not required if NM tool is used **(MM6 – Integration of local STAM support systems with NM)**. All safety assessments required duly executed **(MM7 – Safety Assessment).** All involved operational staff from ANSPs and NM shall be duly trained **(MM8 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM9 – Implementation completed)**.	

Family 4.2.2 – Interactive Rolling NOP

4.2.2 – Interactive Rolling NOP			
Main Sub-AF	S-AF 4.2 Collaborative NOP		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

Network operations are driven by enhanced stakeholders' participation in a rolling cooperative process (Civil & Military airspace users, ANSPs, Airports, NM, outside EUR interfaces).

By continuously sharing latest flight intentions resulting in demand and available capacity, defining measures in the network operations plan, realising the plan as a target by all actors taking into account operational updates, evaluating operations against performance targets and updating the plan.

This rolling view of the network situation (rolling NOP) 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 for sharing of evaluations and issues) 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, providing a limited initial view of the Network Situation, with very limited collaboration and tailoring capabilities.

The scope of this Family consists in the implementation of a platform that uses the state-of-the-art technologies for creation of a Virtual Operations Room for the physically distributed European ATM Network Operations, in support of the Collaborative NOP.

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. Also, the platform provides access to post-operational data for offline analysis and performance reporting.

The platform shall provide SLA management capabilities, based on a holistic view of the users and their organisations, their interaction with the system and on the monitoring of the SLA adherence by the different parties.

The platform will provide both a workplace tool, as well as B2B interfaces following SWIM standards, to allow integration in the stakeholders' own systems.

Information and dialogue tools shall be accessed anytime, anywhere via an ATM Information Portal. Access to information is done in a secure way, tailored according the stakeholders needs and subject to access control rules, so that only those who have an operational need to access particular information are able to do so.

Interdependencies

Family 4.2.4 AOP/NOP information sharing

Family 4.1.2 STAM phase 2 need the new platform to be deployed.

Family 1.1.2 (extended AMAN) and other AF1, AF2, AF3, AF4, AF5 and AF6

Dependency on AF5 for the SWIM infrastructure and SWIM interfaces

Synchronization Needs

The deployment of Network Collaborative Management functionality shall be coordinated due to the potential network performance impact of delayed implementation in a wide geographical scope involving a number of stakeholders.

From a technical perspective, the deployment of targeted system and procedural changes shall be synchronized to ensure that the performance objectives are met.

Civil / Military Coordination		
Yes, especially for interface requirement		
Stakeholders considered as gaps	Network Manager, ANSPs, Airspace Users (CFSP)	
Other stakeholders involved in the Family deployment	Airport Operators, Military Authorities	
Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0103-A SESAR Release 5 DCB-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	FCM05
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	It will be a basic platform for info sharing between all stakeholders. IPs proposals are expected by NM (as provider of the platform) but in terms of deployment the different stakeholders are impacted, as processes need to be put in place locally to use the platform. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the Network Manager to provide B2B and HMI interfaces with other OPS actors for any relevant data exchange needed for ATM Functionalities 4 **(MM1 – NM to deploy Interactive Rolling NOP platform)**. Network Manager shall also define procedures and provide documentation for the use of the system **(MM2 – NM to develop guidance material)**. ANPSs shall then define and make available procedures for the use of interfaces; it is worth noting that airport and military could be also involved if required **(MM3 – Procedures available at local side)**. All involved operational staff from ANSPs, NM and – if required airports and militaries – shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 4.2.3 – Interface ATM systems to NM systems

4.2.3 – Interface ATM systems to NM systems			
Main Sub-AF	Sub-AF 4.2 Collaborative NOP		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

This Family addresses the message exchange between NM systems, ANSPs ATM system and AU/FOC /WOC flight plan filing systems in respect of collaborative flight planning, improving flight plan distribution and enhanced tactical flow management. The exchanges of following messages between NM, ATM and AU/FOC systems are addressed by this Family as:

- ATC Flight Plan Proposal (AFP)
- ATC Flight Plan Change message (ACH)
- ATC Flight Plan message (APL)
- First System Activation (FSA)
- Correlated Position Report (CPR)
- Extended Flight Plan (EFPL)
- Improved OAT Flight Plan

The EFPL will include the planned 4D trajectory of the flight as well as flight performance data in addition to ICAO 2012 FPL data. The first phase that will be implemented should address only the exchange of EFPL information between AUs and NM. The transmission of EFPL data to ANSP (flight plan distribution) will be implemented when transition to FF-ICE provisions is achieved. ANSPs automatically provide AFP message to NM for following events:

- Missing flight plan
- Change of route
- Diversion
- Change of flight rules or flight type
- Change of requested cruising level
- Change of aircraft type
- Change of aircraft equipment

The local ATM system shall be capable to process APL and ACH messages sent by IFPS in order to exploit the full benefits of AFP distribution to NM. NM needs to integrate the received AFP within NM systems. ANSPs need also to provide CPR and FSA messages to NM system (only a few pending ANSPs). EFPL will be processed by the AU flight planning systems and sent to IFPS. Initially the EFPL exchange will be implemented using the flight data model developed by the NM for B2B and that is currently used for operations.

Subsequently, as the FIXM version corresponding to FF-ICE/1 becomes available, the EFPL will be migrated to FIXM. As a first step towards the implementation of the Mission Trajectory concept, military environmental data will be processed by FDPS and IFPS (reference Sub-Family 3.1). Despite not being in the PCP, an Improved OAT FPL should be considered as an enabler processed by IFPS to describe the trajectory including the information about ARES to be used, this is in order to have a more comprehensive view of airspace demand.

Interdependencies

Fam. 4.4.2 – Traffic Complexity tools

Dependency on AF5 for the SWIM Infrastructure and SWIM interfaces. Link with AF6 (EPP)

Synchronization Needs

Synchronisation is required for AFP between NM and ANSPs. For EFPL deployment, the synchronisation between NM, AU and ANSP is required for the development and deployment phase.

Civil / Military Coordination		
Yes, required.		
Stakeholders considered as gaps	ANSPs, Airspace Users (CFSPs), Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0102 Available AUO-0203 SESAR Release 5 AUO-0215 SESAR Release 9
	ATM Master Plan Level 3 (Edition 2016)	FCM03, FCM08
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	The exchanges of collaborative flight planning messages are essential for improving the Pan-European flight predictability. It should be considered to prime importance to address the existing gaps for the provision of CPRs, AFP and FSA messages to NM. ANSPs which not yet provide these messages to NM should consider submitting IP proposal. NM and AUs should consider submitting IP proposal for EFPL and iOAT flight plan. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require ANSPs (and - when needed – airports and Airspace Users) to upgrade their systems in order to generate messages to NM and for NM to receive and process, and distribute as required (including FSA, CPR, AFP, APL, ACH messages) and EFPL from Airspace Users. The involvement of militaries is necessary for GAT (EFPL) and OAT FPL **(MM1 – System upgrade to send messages to NM)**. ANSPs (and - if needed - airports) are also required to upgrade their systems in order to receive and process messages coming from Network Manager, using the guidance material developed by NM for Family 4.2.2 **(MM2 – System upgrade to receive messages from NM)**. ANSPs (and airports - if needed) shall perform pre-implementation trials **(MM3 – Integration test with NM)**. Operational procedures for the use of new messages shall be defined and made available **(MM4 – Procedures available)**. All safety assessments required duly executed **(MM5 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM6 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.	

Family 4.2.4 – AOP/NOP information sharing

4.2.4 –AOP/NOP information sharing			
Main Sub-AF	Sub-AF 4.2 Collaborative NOP		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

The Airport element that reflects the operational status of the Airport and therefore facilitates Demand and Capacity Balancing is the Airport Operations Plan (AOP), described in Family 2.1.4. The AOP connects the relevant stakeholders, notably the Airspace Users' Flight Operations Centres (FOC) and Wing Operations Centres (WOC). It contains data and information relating to the different status of planning phases and is in the format of a rolling plan, which naturally evolves over time.

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 optimization can be made.

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 (Network Operation Plan). The integration of AOP and NOP provides a rolling picture of the network situation used by stakeholders to prepare their plans and their inputs to the network CDM processes (e.g. negotiation of airspace configurations). As such the collaborative NOP will be fully integrated in ATM stakeholders' planning processes and working methods.

The creation and maintenance of the AOP as well as the integration and the consistency with the NOP involves a large number of stakeholders, with different roles and responsibilities: the airspace users including the flight crews and the AU FOC/WOC, the Airport Operators, the Air Navigation Service Providers, the Network Manager and the MET services.

The AOP/NOP information sharing is the technical data layer on the collaborative NOP. The output of SESAR is relatively mature and further refinement is on-going driven by NM. Currently data-exchange is achieved via AFTN, which is to be replaced over time by cooperative network information services, using the yellow SWIM Profile. Details have to be defined in collaboration between the NM and the implementing stakeholders.

Interdependencies

Family 4.2.2 and Family 2.1.4

Family 5.4.1

Synchronization Needs

4.2.4 is to be synchronized between NM, the Airport and the ANSPs.

Civil / Military Coordination

Yes, depending on civil/military ATS organization

Stakeholders considered as gaps	Network Manager, Airport Operators
Other stakeholders involved in the Family deployment	ANSPs, Military Authorities, MET Service Providers,

Links to ICAO GANP ASBUs	B0-NOPS Improved Flow Performance through Planning based on a Network-wide view	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0103-A SESAR Release 5 AO-0801-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	FCM05
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	In order to achieve full performance of Family 4.2.4, it is recommended to implement Family 2.1.4 since it is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. For that reason, it is highly recommended that NM define the interface between AOP and NOP to be in a position to deploy AOP/NOP integration as soon as AOP is available. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View, considering also the Gap Analysis of Family 2.1.4.	
Deployment Approach	The implementation of the Family would require the Network Manager to adapt their system to receive and process information coming from AOP and distribute as required to operational stakeholders **(MM1 – NM to develop interface for AOP integration)**. Network Manager shall also develop the required procedures and the associated documentation to support the utilisation of interfaces **(MM2 – NM to develop operational guidance documentation)**. All interested systems shall be updated in order to allow the system-to-system data exchange and to enable all necessary functionalities. Military could be involved in such activities **(MM3 – Integration of AOP with NOP)**. The procedures for generating and/or using messages shall be elaborated, with the involvement of ANSPs and Militaries, if necessary **(MM4 – Procedures available)**. All involved operational staff shall be duly trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.	

Family 4.3.1 – Target Time for ATFCM purposes

4.3.1 – Target Time for ATFCM purposes			
Main Sub-AF	Sub-AF 4.3 CTOT to Target Time for ATFCM Purposes		
Readiness for implementation	High		
Initial Operational Capability	01/01/2017	**Full Operational Capability**	01/01/2022
Description and Scope			
First Step: NM systems should transmit the calculated target time at the most penalising regulation reference point in addition to CTOT to all concerned users. Those users should be able to manage this new feature and potential system upgrades should be foreseen. **Second step (to be validated in 2016):** This second step, particularly in case of unique Airport regulation, either linked to ground (AOP) or arrival sequencing (AMAN, extended-AMAN), will permit an early partial optimisation from a local point of view via the transmission of local TTA/TTO to NM. NM will be in charge of assessing the network impact leading eventually to coordination with the originator, and of transmission of CTOT and TTA/TTO to the concerned flight. This process will be limited to the planning phase and transmission of CTOT and updated CTOT as per standard processes. It will also enhance the slot swapping process.			
Interdependencies			
Fam 4.1.2 STAM phase 2 (coordination with originator of TT) Fam 1.1.2 Extended AMAN Fam 2.1.4 Initial AOP			
Synchronization Needs			
Coordination between NM and other stakeholders for eventual local implementation			
Civil / Military Coordination			
Not foreseen			
Stakeholders considered as gaps	Network Manager, Airspace Users (CFSP)		
Other stakeholders involved in the Family deployment	ANSPs, Airport Operators, Military Authorities		
Links to ICAO GANP ASBUs	B0-NOPS Improved Flow Performance through Planning based on a Network-wide view		
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0208 SESAR Release 5	
	ATM Master Plan Level 3 (Edition 2016)	FCM07	

Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.
Recommendation for IPs proposal	After a first step for the transmission by NM of target time on the constrained area on top of CTOT, airport and ANSP could consider submitting IP's proposal for the deployment of this Family. AUs need to update their system to take target times into account in their planning procedure. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.
Deployment Approach	The implementation of the Family would require the Network Manager to provide description and guidance upon the interfaces between the NM systems and other systems (e.g. AU), as well as the related procedures **(MM1 – NM to provide guidance on use of target time)**. All systems of the involved stakeholder dedicated to Target Times processing and use shall also be updated **(MM2 – System upgrades)**. Procedures for all involved actors (NM/ANSPs and airports for planning purposes) to facilitate Target Times for ATFCM purposes shall be developed and made available **(MM3 – Procedures available)**. All safety assessments required duly executed **(MM4 Safety Assessment)**. All involved operational staff shall be duly trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

Family 4.3.2 – Reconciled target times for ATFCM and arrival sequencing

4.3.2 – Reconciled Target Times for ATFCM and Arrival Sequencing			
Main Sub-AF	Sub-AF 4.3 CTOT to Target Time for ATFCM Purposes		
Readiness for implementation	Low		
Initial Operational Capability	01/01/2019	**Full Operational Capability**	01/01/2022
Description and Scope			
The scope of this Family contains the process, procedure and system upgrades related to the reconciliation of multiple local Target Time constraints, coming from Airport (AOP), ANSP (either AMAN/extended AMAN or en-Route) or Network DCB process. To this end, the potential solution will be coordinated and disseminated to the different stakeholders (supported by the Network CDM Information Platform and within the context of the NOP) at the Local and Network levels. Once coherence and agreement is achieved, the implementation will be initiated. Considering the current status of development work, the concept still needs to be validated at SJU level.			
Interdependencies			
Family 1.1.2 (extended AMAN), Family 2.1.4 (iAOP), Family 4.1.2 (STAM phase 2), Family 4.3.1 - Target Time for ATFCM purposes			
Synchronization Needs			
Synchronisation required between NM, airport and ANSP			
Civil / Military Coordination			
Yes, depending on civil/military ATS organization and concept of operation.			
Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users(CFSP), Network Manager		
Other stakeholders involved in the Family deployment	Military Authorities		
Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning		
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0213 SESAR 2020 Second Wave DCB-0208 SESAR Release 5	
	ATM Master Plan Level 3 (Edition 2016)	FCM07	
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.		

Recommendation for IPs proposal	Considering the current status of development work, SDM considers that the concept still needs to be validated at SJU level.
Deployment Approach	This Family is not yet fully validated The implementation of the Family would require the definition of the concept of operations for reconciled target times for ATFCM and arrival sequencing; such activities shall include - where necessary - the local coordination with the military **(MM1 – Concept of operation defined)**. NM shall upgrade their system to re-conciliate the different target time, as required by the defined concept **(MM2 – NM system upgrade for re-conciliated TT)**. NM shall also produce the proper guidance documentation on the use of re-conciliated target time and the definition of the interfaces for system-to-system data exchange **(MM3 – NM to develop guidance material for re-conciliated TT)**. System shall be upgraded in order to process re-conciliated Target Time and to allow their use **(MM4 – System upgrades available to process re-conciliated target time)**. Procedures for all involved operational stakeholders to operate re-conciliated Target Times for ATFCM purposes shall be made available **(MM5 – Procedures available)**. A safety assessment for associated operational and system changes shall be performed successfully **(MM6 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM7 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM8 – Implementation completed)**.

Family 4.4.2 – Traffic Complexity tools

4.4.2 – Traffic Complexity Tools			
Main Sub-AF	Sub-AF 4.4 Automated Support For Traffic Complexity Assessment		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2022

Description and Scope

The traffic complexity tools continuously monitor sector demand and evaluate traffic complexity (by applying predefined complexity metrics) according to a predetermined qualitative scale. The predicted complexity coupled with traffic demand enables ATFCM to take timely action to adjust capacity, or request the traffic profile changes in coordination with ATC and airspace users.

The rigid application of ATFCM regulations based on standard capacity thresholds as the pre-dominant tactical capacity measure needs to be replaced by a close working relationship between ANSPs and Network Manager, which would monitor the real demand, the sector capacity and their dynamic management.

The scope of this Family shall include:

- ANSP to implement Local Traffic Complexity tools and procedures. 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 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 provided by NM. This is required in order to supplement the local traffic counts with the flight plan data from ETFMS;
- The NM systems adaptation activities deal with improving the quality of the planned trajectory (processing of ATC information part of 4.2.3 Family, processing of EFPL and improved OAT FPL information part of 4.2.3 Family, support to mixed mode operations, Implementation of traffic count methodologies that do not impact trajectory calculation) thus enhancing NM complexity assessment.

Implementation of scenario management 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.

Interdependencies

Fam. 4.1.1 - STAM Phase 1

Fam. 4.1.2 - STAM Phase 2

Fam. 4.2.3 - Interface ATM system to NMS and 4.2.4 AOP/NOP integration

Fam. 3.2.1 – Upgrade of ATM systems (NM, ANSPs, AUs) to support DCT and Free Route and Fam 3.1.4 Dynamic Airspace Configuration

Synchronization Needs

Synchronisation between NM and ANSPs is required

Civil / Military Coordination

Yes, depending on civil/military ATS organization

Stakeholders considered as gaps	ANSPs, Network Manager
Other stakeholders involved in the Family deployment	Military Authorities

Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0103-A SESAR Release 5 CM-0101 Available IS-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	FCM06
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Taking into account that complexity tools need to be deployed in collaboration between ANSPs and NM, particularly at ATC planning level, the IP proposal should be mainly focused on ANSPs and NM system upgrades. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The implementation of the Family would require the development and definition of the concept of operations, encompassing the overall process, including roles and responsibilities of the involved stakeholders. Such activity could require local coordination with the military, if necessary **(MM1 – Concept of operations developed)**. Network Manager shall develop and provide guidance documentation as basis for required operational procedures and systems **(MM2 – Operational guidance documentation developed)**. NM shall adapt its systems in support of complexity assessments, including the exchange of associated data **(MM3 – Adaptation of NM-systems)**. Local stakeholders shall implement complexity tool in the local systems, or adapt the NM tool for the required usage **(MM4 – Installation of local complexity tool)**. If required for a smooth exchange of data and information, the implementation of system-to-system interfaces (including EFD) shall be performed **(MM5 – Integration of local tool with NM)**. Procedures for operational stakeholders for facilitating the use of the tool shall be defined and made available **(MM6 – Procedures available)**. All involved operational staff shall be duly trained **(MM7 - Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM8 – Implementation completed)**.	

3.5 AF #5 – Initial SWIM

Family 5.1.1 – PENS 1: Pan-European Network Service version 1

5.1.1 – PENS1: Pan-European Network Service version 1			
Main Sub-AF	Sub-AF 5.1 Common Infrastructure Components		
Readiness for implementation	High		
Initial Operational Capability	Before 2014 PENS1 has been deployed from 2009 by NM and ANSPs	**Full Operational Capability**	31/12/2019 PENS1 is expected to end in December 2019 before to be replaced by NewPENS

Description and Scope

An Internet Protocol (version 6) Network connectivity is necessary to support the SWIM Exchanges. The current PENS (Pan European Network Service), called PENS1, supports the exchanges of the current ATM information based on Internet Protocol (versions 4, 6).

PENS1, provided by SITA, is expected to terminate in December 2019, but a new PENS, called NewPENS, is planned to be deployed from beginning 2018 to replace PENS1 with a transition period (2018-end 2019) to guarantee the continuity of operations.

The PCP stipulates *"To support the blue SWIM TI Profile (for Flight Object), very high and high capacity centres shall be connected to Pan-European Network Services (PENS)".* So ANSPs, planning to implement IOP FO, have to be or become PENS user.

The scope of this Projects Family aims at implementing projects for ANSPs not yet PENS1 user and having planned to implement IOP / FO before December 2019. The coordination with similar initiatives in other ICAO Regions is required for worldwide interoperability, especially with the US and Canada.

Interdependencies

5.1.1 is the first Family dealing with PENS implementation replaced by 5.1.2 (NewPENS) as from end 2019 after a transition period.

PENS is a prerequisite for exchanging Flight Object (FO) as required by the PCP.

The Operational Stakeholders may use PENS for information exchanges related to aeronautical information, meteorological information, cooperative network information and flight information (Families 5.3.1, 5.4.1, 5.5.1, 5.6.1).

PENS shall be able to manage ATM VoIP communications proposed as an enabler in Family 3.1.4

Synchronization Needs

The synchronization and coordination is performed by the PSSG (PENS Steering Group) and the PMU (PENS Management Unit), the main bodies of the PENS1 Governance. Any PENS user has, when entering PENS by signing the PENS CPA (Common Procurement Agreement) and the dedicated Amendment, a representative in PSSG.

Civil / Military Coordination

Where States have agreed or intend to share information between civil and military ANSPs via the PENS it is essential that migrations to IP Network Services are coordinated between all parties.

Stakeholders considered as gaps	ANSPs, Network Manager, Military ANSPs who require direct interconnections to civil ANSPs
Other stakeholders involved in the Family deployment	None

Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CTE-C06a-PENS-Phase 1 Available
	ATM Master Plan Level 3 (Edition 2016)	None
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Any ANSP, not yet PENS user, planning to implement IOP FO before end 2019 is invited to present a project to become a PENS1 user. PENS is also able to support all the ATM information exchanges even if the Commission Implementing Regulation (EU) No 716/2014 is requiring PENS only for the Blue Profile required for Flight Object. So any OS, not yet PENS user, could present an IP to become a PENS user.	
Deployment Approach	The implementation of the Family would require the signature of both the PENS1 CPA (Common Procurement Agreement) with EUROCONTROL and the Amendment with the Network Service Provider **(MM1 – PENS1 CPA (Common Procurement Agreement and Amendment signed)**. The Network Service Provider shall then install its routers in the Operational Stakeholder premises in order for the OS to gain access(es) to PENS1 **(MM2 – PENS1 access(es) installed)**, connect with the Operational Stakeholder IP Network in a secure manner **(MM3 – PENS1 connection(s) installed integrated including security measures)**. Before the start of operational use, the planning of end-to-end network services deployment (test, validation, operation) shall be completed with other Operational Stakeholders, such as NM, ANSPs, AUs, Airport Operators, etc **(MM4 – Planning of the Network Services)**. The execution of such activities is expected to lead to the start of permanent operational use meaning that all end-to-end network services shall be in operation, supporting Yellow and Blue Profiles **(MM5 – Network Services in Operation)**. When implementing SWIM and its prerequisites each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.	

Family 5.1.2 – NewPENS: New Pan-European Network Service

5.1.2 – NewPENS: New Pan-European Network Service			
Main Sub-AF	Sub-AF 5.1 Common Infrastructure Components		
Readiness for implementation	High		
Initial Operational Capability	01/06/2018	**Full Operational Capability**	01/01/2025

Description and Scope

An Internet Protocol (version6) Network connectivity is necessary to support the SWIM Exchanges. NewPENS (New Pan European Network Service) will exchange information based on Internet Protocol.

NewPENS will replace PENS1 terminating in December 2019. The PCP stipulates "*To support the blue SWIM TI Profile (for Flight Object), very high and high capacity centres shall be connected to Pan-European Network Services (PENS)*". So civil and military ANSPs, planning to implement IOP FO, have to be NewPENS users.

Although the Yellow Profile has less demanding QoS requirements than the Blue Profile, it can also be supported by NewPENS instead of Public Internet. It will be up to Stakeholders, according to their requirements, to select the Public Internet Protocol Network or NewPENS.

After the signature end 2015 of the NewPENS CPA (Common Procurement Agreement) by Operational Stakeholders, NewPENS had been set-up with a dedicated Governance. The NewPENS governance comprises:

1. Three bodies, representing all the Operational Stakeholders having signed the CPA, at the executive level, from the top to the down:
   a. A Top Management Body (TMB) at the CEOs levels
   b. A PENS Executive Board (PEB) at the Directors level
   c. PENS Boards at the Operational and Technical level representing the different types of Operational Stakeholders (NM, ANSPs, …)
2. One EUROCONTROL unit at the Management level, the PMU (PENS Management Unit) responsible to perform the necessary procurements and to manage the related contracts with the future providers of Network Services and interfacing the NewPENS users.
3. One PENS Technical Center (PTC) composed of some Operational Stakeholders Representatives responsible to define and drive the technical and operational NewPENS evolutions.
4. PENS Operational Centers responsible to provide the help desk services between the NewPENS users and the NewPENS Providers to guarantee a safe and secure continuity of service 24/7/365.
5. Network Service Provider(s) (contractor(s)) providing the Internet Protocol Services to the PENS Users according to the required SLAs (Service Level Agreements).

A CPTF (Common Procurement task Force), composed of 15 Operational Stakeholders representatives and steered by the PEB, was set-up beginning 2016 to establish the related Procurement documents supporting the on-going Call for Tender (mid 2016) to be managed by EUROCONTROL on behalf of the CPA signatories to select in 2017 the future Network Service Provider(s) (NSP).

A transition phase to migrate from PENS1 to NewPENS is then expected from 2018 to end 2019, date of the full operation of NewPENS and of the PENS1 termination.

The coordination with similar initiatives in other ICAO Regions is required for worldwide interoperability, especially with the US and Canada.

Interdependencies

5.1.2 is the Family dealing with New PENS implementation replacing 5.1.1 (PENS1) as from end 2019 after a transition period. PENS is a prerequisite for exchanging Flight Object (FO) as required by the PCP. The Operational Stakeholders may use PENS for information exchanges related to aeronautical information, meteorological information, cooperative network information and flight information (Families 5.3.1, 5.4.1, 5.5.1, 5.6.1). PENS shall be able to manage ATM VoIP communications proposed as an enabler in Family 3.1.4

Synchronization Needs
The synchronization and coordination will be performed by the NewPENS Governance bodies in place from the beginning 2016. Any NewPENS user has, when entering NewPENS by signing the NewPENS CPA (Common Procurement Agreement) and later, after the contract awarding, the dedicated Amendment, a representative in the NewPENS Governance bodies (TMB, PEB, PENS Boards).
Civil / Military Coordination
Where States have agreed or intend to share information between civil and military ANSPs via the NewPENS it is essential that migrations to IP Network Services are coordinated between all parties.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CTE-C06b-PENS-Phase 2 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	COM12
Cyber security Requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Within the framework of the CEF 2015 and CEF 2016 several Stakeholders have become NewPENS users. Now any operational stakeholder not yet NewPENS user is invited to propose an IP for becoming a NewPENS user. NewPENS is able to support all the ATM information exchanges even if the Commission Implementing Regulation (EU) No 716/2014 is requiring PENS only for the Blue Profile intended for the exchange of Flight Object.	
Deployment Approach	The implementation of the Family would require the signature of both the NewPENS CPA (Common Procurement Agreement) with EUROCONTROL and the Amendment with the Network Service Provider **(MM1 – NewPENS CPA (Common Procurement Agreement and Amendment signed**). The Network Service Provider shall then install its routers in the Operational Stakeholder premises in order for the OS to gain access(es) to NewPENS **(MM2 – NewPENS access(es) installed)**, connect with the Operational Stakeholder IP Network in a secure manner **(MM3 – NewPENS connection(s) installed integrated including security measures)**. Before the start of operational use, the planning of end-to-end network services deployment including the possible transitions from PENS1 to NewPENS (test, validation, operation) shall be completed with other Operational Stakeholders, such as NM, ANSPs, AUs, Airport Operators, etc **(MM4 – Planning of the Network Services)**. The execution of such activities is expected to lead to the start of permanent operational use, meaning that all end-to-end network services shall be in operation, supporting Yellow and Blue Profiles **(MM5 – Network Services in Operation)**. When implementing SWIM and its prerequisites each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.	

Family 5.1.3 – Common SWIM Infrastructure Components

5.1.3 – Common SWIM Infrastructure Components			
Main Sub-AF	Sub-AF 5.1 Common Infrastructure Components		
Readiness for implementation	High		
Initial Operational Capability	01/06/2016 For starting the SWIM Governance Structure and Processes and SWIM Registry	**Full Operational Capability**	01/01/2025

Description and Scope

Within the Commission Implementing Regulation (EU) No716/2014 the SWIM Infrastructure has been split in two parts:

- The common components § 5.1.1. Common infrastructure components
- The stakeholders' components § 5.1.2. SWIM Technical Infrastructure and Profiles

According to Commission Implementing Regulation (EU) No 716/2014 § 5.1.1. the **Common SWIM Infrastructure Components** are:

— ***The registry****, which shall be used for publication and discovery of information regarding service consumers and providers, the logical service and information models, SWIM enabled services (Service Implementations), business, technical, and policy information*

— ***Public Key Infrastructure*** *(PKI), which shall be used for signing, emitting and maintaining certificates and revocation lists; The PKI ensures that information can be securely transferred*

The Commission Implementing Regulation (EU) No 716/2014 stipulates also that *SWIM comprises standards, infrastructure and **governance** enabling the management of information and its exchange between operational stakeholders via interoperable services*.

The current Family is dealing with the **common** components of SWIM, where "Common" refers to one common system or one common set of rules is to be deployed for to the **entire** geographical scope mandated by the Commission Implementing Regulation (EU) No 716/2014.[9] This family comprises the **SWIM Governance and the SWIM registry** (Family 5.2.2 "Stakeholder SWIM Infrastructure Components" (5.2.2) is dealing with the dedicated **stakeholders**' components).

The **Public Key and Security Infrastructure** is dealt with in two separate Families, Family 5.1.4 for the common part and Family 5.2.3 for the stakeholder implementation.

The scope of this Family is the implementation of the SWIM common components SWIM Governance and SWIM registry. The **SWIM Governance** consists of bodies including civil and military stakeholders and of processes that together steer the operation of SWIM and ensure its controlled evolution. SWIM governance

- manages the common components, in particular the registry
- contributes to the elaboration of SWIM standards
- maintains the SWIM Compliance Framework and governs the compliance assessments
- devises the policies for the provision and the consumption of the SWIM services, i.e.
  - the compliance policy,
  - the information security policy and
  - the service policy.
- Coordinates the service implementation
- Coordinates the migration from legacy protocols
- Devises and carries out the processes for the evolution of SWIM, e.g. change management, the service lifecycle, etc.

A **SWIM registry** managed by the SWIM Governance bodies, is the common information repository. It allows the discovery of existing services by providing the service catalogue (list of service models and service implementations).

[9] Note that by contrast, components that are common to several sites or systems of one stakeholder belong to Sub-AF 5.2

Furthermore, it supports the implementation of SWIM by providing reference documents such as the ATM Information Reference Model (AIRM), the AIRM and the ISRM Foundations, SWIM TI Profile definitions, compliance framework and criteria, SWIM Governance policies, etc.

For worldwide interoperability, the coordination with similar initiatives in other ICAO Regions is required, especially with the US that are very advanced in this area.

In particular coordination on the following activities is considered essential:

- Interoperable SWIM registries
- Services that are in common
- An agreed service lifecycle
- Mediation services able to translate information syntactically or semantically between different regions

Interdependencies

Family 5.1.3, dealing with common SWIM components, is complemented

- for each Stakeholder by Family 5.2.2,
- for security by Families 5.1.4 and 5.2.3

and is a prerequisite for the full implementation of Families 5.3.1, 5.4.1, 5.5.1 and 5.6.1 even if their implementation has already started based on the material provided by SESAR 1 and the NM.

Synchronization Needs

Strong coordination is necessary between all stakeholders to implement the common components starting with agreed SWIM Governance (consisting of the structure and the processes) and then further components – in particular the registry – under the steering of the SWIM Governance. Coordination with other ICAO regions is required since a majority of the information exchanged via SWIM requires exchange beyond Europe.

Civil / Military Coordination

Military must be represented in the SWIM Governance bodies and their specific needs must be considered in the identified processes

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	An implementation initiative engaging a wide number of stakeholders from all categories (ANSPs, AOs, AUs) has already been launched, addressing the setup and initial operation of a SWIM Governance structure and the associated processes.	

	This initiative will refine and implement the entire SWIM Governance framework initiated in SESAR1, which has a direct impact on all IPs related to the implementation of AF5, specifically the Families 5.1.3, 5.1.4, 5.2.2, 5.2.3, 5.3.1, 5.4.1, 5.5.1, 5.6.1 and 5.6.2. For this reason, stakeholders are invited to express their interest in joining the SWIM Governance structure.
Deployment Approach	For implementing the European SWIM Governance, a group of stakeholders has joined forces and has submitted an implementation project to INEA in response to CEF Transport Calls 2016. It is the task of this project to lay the groundwork for a common European SWIM Governance for the sake of all stakeholders. The project will prepare the deployment of SWIM Governance and put the organization and its processes in place. Once this is finished, the project will close and the SWIM Governance shall be operated. The implementation of the Family requires collaboration between the above-mentioned European SWIM Governance organization on the one hand and the operational stakeholders deploying SWIM locally on the other hand. A number of implementation steps and associated milestones have to be undertaken solely by the SWIM Governance project; these are complemented by implementation steps and associated milestones to be undertaken by each operational stakeholder who is mandated by PCP to implement SWIM. In order to give a clear picture of the deployment, the milestones are explained below separately for the two groups. 1) **Milestones relevant for SWIM Governance project** The refinement of the structure of the SWIM Governance and the processes for performing governance developed during SESAR 1, in order to meet the needs of iSWIM deployment. This structure and the related processes shall subsequently be put in operation. (MM.1 – SWIM governance structure and processes set up). Stakeholders shall be given the possibility to comment on the policies and processes put in place by the SWIM Governance. (MM.2 - Stakeholder consultation regarding SWIM Governance on policies and processes completed). The concept of the design-time registry for SWIM devised during SESAR 1 shall be refined to meet the requirements of iSWIM deployment. (MM.3 – SWIM Registry refined (concept) and adopted by the SWIM Governance). The SWIM Registry as a tool shall be developed and then tested. (MM.4 – SWIM Registry developed and adopted by the SWIM Governance). The SWIM Registry tool shall be deployed and made available for Operational Stakeholders to use. (MM.5 – SWIM Registry deployed and declared ready for use by the SWIM Governance). 2) **Milestones relevant for implementing operational stakeholders** For full implementation of the Family the Stakeholder is expected to actively use the registry, i.e. to register his own services, use the registry to discover services, use the registry to retrieve SWIM standards and guidance material. (MM.6 – SWIM Registry used by concerned OS). When implementing SWIM and its prerequisites each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.1.4 – Common SWIM PKI and Cybersecurity

5.1.4 – Common SWIM PKI and cyber security			
Main Sub-AF	Sub-AF 5.1 Common Infrastructure Components		
Readiness for implementation	Medium		
Initial Operational Capability	01/06/2017	**Full Operational Capability**	01/01/2025

Description and Scope

Within the Commission Implementing Regulation (EU) No716/2014 the SWIM Infrastructure has been split in two parts:

- The common components § 5.1.1. Common infrastructure components
- The stakeholders' components § 5.1.2. SWIM Technical Infrastructure and Profiles

According to Commission Implementing Regulation (EU) No 716/2014 § 5.1.1. the **Common SWIM Infrastructure Components** are:

— ***The registry****, which shall be used for publication and discovery of information regarding service consumers and providers, the logical service and information models, SWIM enabled services (Service Implementations), business, technical, and policy information*

— ***Public Key Infrastructure*** *(PKI), which shall be used for signing, emitting and maintaining certificates and revocation lists; The PKI ensures that information can be securely transferred*

The Commission Implementing Regulation (EU) No 716/2014 stipulates also that *SWIM comprises standards, infrastructure and* ***governance*** *enabling the management of information and its exchange between operational stakeholders via interoperable services*.

The Public Key Infrastructure and cyber security are dealt with in two separate Families, Family 5.1.4 for the common part covering PKI governance and cyber security objectives, while Family 5.2.3 addresses the stakeholder implementation.

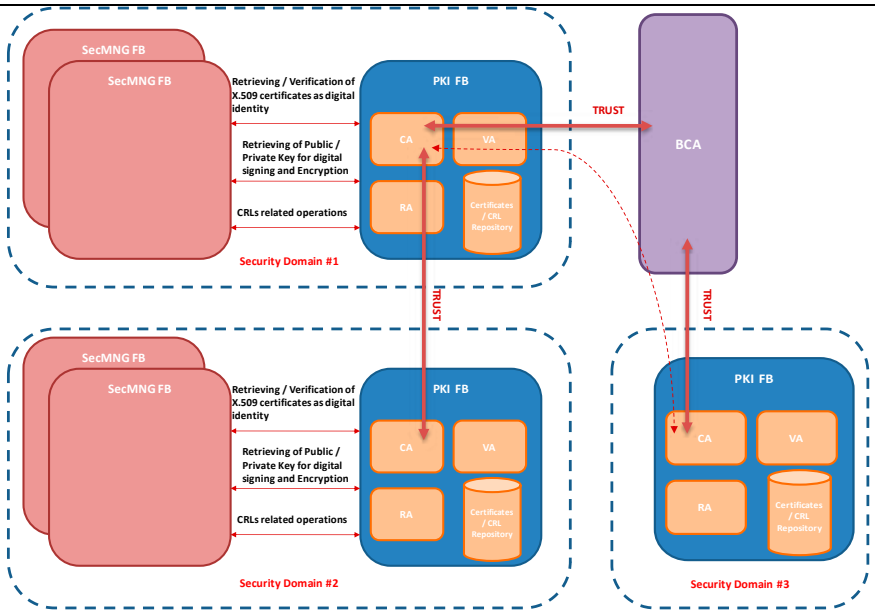
The scope of this Family is the implementation of the SWIM common components covering cyber security and PKI governance. This Family addresses the overall European PKI governance, which the local implementations shall comply with.

The outcome of this family shall support users from all civil and military stakeholders.

The technical implementation of PKI is a stakeholder issue and is covered by Family 5.2.3 while the common specifications relating to PKI and its governance are developed in this Family:

- Processes related to signing, emitting, maintaining and revoking certificates
- Objectives and requirements for:
  - Confidentiality
  - Integrity
  - Non-repudiation
  - Accountability
  - Authenticity
  - Safety
- Rules and processes for delegating a certificate in order to meet national/local requirements
- Establishment and tasks of bridge authorities (if used)
- Establishment and tasks of a root certification authority

Global coordination to ensure secure information exchange on a world-wide scale.



FB: Functional Block

CA: Certificate Authority

VA: Validation Authority

RA: Registration Authority

CRL: Certificate Revocation Lists

BCA: Bridge Certificate Authority

Interdependencies

Families 5.1.4 and 5.2.3 are prerequisites for the full secure implementation of Families 5.2.2, 5.3.1, 5.4.1, 5.5.1, 5.6.1 and 5.6.2 even if their implementation has already started with some current draft, mature enough, material provided by SESAR 1 and the NM.

Synchronization Needs

Strong coordination is necessary between all stakeholders to implement the common components starting with an agreed SWIM Governance (consisting of the structure and the processes) – under the steering of the SWIM Governance.

Civil / Military Coordination

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

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2

Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.
Recommendation for IPs proposal	For the CEF 2016 call a group of stakeholders has proposed a common SWIM Governance project, dealing with the topics of security and cyber security of SWIM. While the technical specification of PKI is mature, its application (organizational setup, processes etc.) in the ATM domain is not, hence the project will tackle the completion of this topic to ensure its implementation by all stakeholders within the FOC date stipulated by the Commission Implementing Regulation (EU) No 716/2014.
Deployment Approach	5.1.4 is similar to 5.1.3 as the outcome of the project is to lay the groundwork for a common European SWIM PKI Governance for the sake of all stakeholders. The task also includes coordination with FAA in order to ensure global interoperability. The project will prepare the deployment of European SWIM PKI Governance similar to family 5.1.3. Once this task is finished, the project will close and the European SWIM PKI Governance shall be operated in regular mode by all stakeholders. The European SWIM PKI Governance is not to be confused with local PKI Governance (family 5.2.3), as this implementation is specific to the local infrastructure, however adhering the European SWIM PKI Governance. A number of implementation steps and associated milestones have to be undertaken solely by the European SWIM Governance organization; these are complemented by implementation steps and associated milestones to be undertaken by each operational stakeholder who is mandated by PCP to implement SWIM. In order to give a clear picture of the deployment, the milestones are explained below separately for the two groups. **1) Milestones relevant for the overall SWIM PKI Governance** The implementation of this Family at first requires the setup of the SWIM Governance structure and the establishment of the governance processes **(MM.1 - SWIM governance structure and processes set up)**. Stakeholders shall be given the possibility to comment on the policies and processes put in place by the SWIM PKI Governance, in particular the security policy and minimum security objectives. Secondly coordination with FAA is needed to ensure global interoperability. **(MM.2 - Stakeholder consultation regarding SWIM PKI Governance principles completed)**. Based on the consultation, the SWIM PKI Governance can ensure and steer the implementation of PKI. In a first step the concept and policies for PKI needs to be refined to meet the requirements for SWIM deployment **(MM.3- PKI refined (concept/policies) and adopted by the SWIM Governance)** and **(MM.4 - PKI deployed and declared ready for use by the SWIM Governance)**. **2) Milestones relevant for implementing operational stakeholders** The Family implementation is finished once the PKI concept is used operationally by the stakeholders **(MM.5 - PKI used by concerned OS)**. When implementing SWIM each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.2.1 – Stakeholders Internet Protocol Compliance

5.2.1 – Stakeholders Internet Protocol Compliance			
Main Sub-AF	Sub-AF 5.2 SWIM Infrastructure and Profiles		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2018

Description and Scope

The Commission Implementing Regulation (EU) No 716/2014 stipulates *"Initial System Wide Information Management (iSWIM) supports information exchanges that are built on standards and delivered through an internet protocol (IP)-based network by SWIM enabled systems"*.

So, the availability of an IP-compliant network capable of supporting the Yellow and Blue SWIM Profiles is a prerequisite for iSWIM deployment. This Family deals with implementing an Internet Protocol-compliant network for each civil and military stakeholder to be able to support future information exchanges through SWIM Yellow and Blue profiles.

The final specification of the Blue Profile is foreseen to be published in 2020, i.e. after the FOC date of this Family. Thus, the implementation of this Family can only be based on the information of the Blue Profile available during project implementation. Updates and changes to the IP network stemming from the exact requirements of the Blue Profile after the publication of the specification will be accommodated in Family 5.2.2.

Interdependencies

5.2.1 is considered to be a prerequisite to implement SWIM (particularly the SWIM Yellow and Blue profiles) and so for Families 5.2.2, 5.2.3, 5.3.1, 5.4.1, 5.5.1, 5.6.1, 5.6.2.

Synchronization Needs

Each civil and military stakeholder not yet Internet Protocol compliant should plan to transition to Internet Protocol version 6 connectivity in order to be in a position to exchange information with other stakeholder in the near future through SWIM Network with the adequate SWIM Profiles.

Civil / Military Coordination

There are clear benefits to all stakeholders to coordinate and synchronize the deployment of SWIM infrastructure in order to exploit the efficient sharing of information between civil and military stakeholders. Therefore, all stakeholders planning migration to IP connectivity are encouraged to coordinate between civil and military authorities.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CTE-C06 Available
	ATM Master Plan Level 3 (Edition 2016)	INF08.2

Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.
Recommendation for IPs proposal	Stakeholders not yet compliant are highly invited to present implementation projects for achieving IP compliance. It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.
Deployment Approach	The implementation of the Family would require the deployment of the Internet Protocol Services in order to ensure the handling of the Yellow Profile. References: SESAR 14.01.04.D43-004-SWIM-TI Yellow Profile Technical Specification 3.1, 14.01.04.D43-005-SWIM-TI Blue Profile Technical Specification 3.1, 14.01.04.D43-SWIM Profiles Interface Bindings Catalogue. (**MM1 – Internet Protocol based Network supporting Yellow Profile**). The Internet Protocol Services shall then be deployed in order to support the Blue Profile. References: SESAR 14.01.04.D43-004-SWIM-TI Yellow Profile Technical Specification 3.1, 14.01.04.D43-005-SWIM-TI Blue Profile Technical Specification 3.1, 14.01.04.D43-SWIM Profiles Interface Bindings Catalogue. (**MM2 – Internet Protocol based Network supporting Blue Profile**). When implementing SWIM each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.2.2 – Stakeholders SWIM Infrastructures Components

5.2.2 – Stakeholders' SWIM Infrastructures Components			
Main Sub-AF	Sub-AF 5.2 SWIM Infrastructure and Profiles		
Readiness for implementation	High for implementation of Yellow and medium for Blue TI profile regardless of link to actual information exchange implementation.		
Initial Operational Capability	Before 2014 Even if the common SWIM Infrastructure is not yet formally set-up, some Stakeholders have already started the implementation of SWIM by using the first deliverables of SESAR1.	**Full Operational Capability**	01/01/2025

Description and Scope

Within the Commission Implementing Regulation (EU) No 716/2014 the SWIM Infrastructure has been split in two parts:

- The common components § *5.1.1. Common infrastructure components*
- The stakeholders' components § *5.1.2. SWIM Technical Infrastructure and Profiles*

According to §*5.1.2. SWIM Technical Infrastructure and Profiles* of ATM stakeholders shall be driven by the following requirements:

A SWIM Technical Infrastructure (TI) Profile implementation shall be based on standards and interoperable products and services. Information exchange services shall be implemented on one of the following profiles:

— Blue SWIM TI Profile, which shall be used for exchanging flight information between ATC centres and between ATC and Network Manager. Blue TI profile is intended for Flight Object exchange services as defined in 5.1.6.

— Yellow SWIM TI Profile, which shall be used for any other ATM data (aeronautical, meteorological, airport, etc.) Yellow TI profile applies for information exchange services defined in 5.3.1, 5.4.1, 5.5.1 and 5.6.1

This Family is dealing with the **Stakeholders SWIM Infrastructure Components** while the Family "Common SWIM Infrastructure Components" (5.1.3) is dealing with the common SWIM components. PKI and security are covered by Families 5.1.4 and 5.2.3 respectively. The scope of this Projects Family aims at implementing in each civil or military Stakeholder the following SWIM components:

- Blue Profile
- Yellow Profile
- Training and certification of technical personnel
- All other components necessary for stakeholder SWIM implementation (supervision, monitoring and control)

This Family has also to address the Stakeholder transition issues from legacy protocol (AFTN, AMHS, FMTP,) to SWIM environment. The specification of the Blue Profile is foreseen to be published in 2020. Its exact requirements for the underlying IP network are not comprehensively known before the publication. For this reason, Family 5.2.2 also includes potential upgrades to the IP network that might be required in order to implement the Blue Profile. Note that the definition of the Yellow Profile does not target contexts, in which

- real-time or near real-time use or
- extreme high availability

are required. These constraints mainly apply if Yellow Profile is deployed using public internet as the transport medium, which cannot guarantee an appropriate QoS level.

For this reason, it is recommended to analyse the QoS requirements of the services deployed on top vis-à-vis the QoS level available by the public internet and to use a service with guaranteed QoS**,** for example PENS/NewPENS, as underlying transport medium if the required QoS level is not achievable by public internet.

Interdependencies
Family 5.2.2 is based on the common SWIM components in Family 5.1.3 and requires the completion of this family for its full implementation. It is complemented by 5.2.3 for the stakeholder security components.
Synchronization Needs
It is essential that appropriate SWIM Governance Structure and Processes are established to develop and monitor an agreed SWIM implementation roadmap. Strong coordination and synchronisation is necessary between all stakeholders (including military) to implement their SWIM infrastructure according to the agreed SWIM roadmap.
Civil / Military Coordination
Yes, civil/military coordination is required

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 CM-0201-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	According to their SWIM implementation planning, stakeholders are invited to propose IPs to implement their SWIM infrastructure as basis for the implementation of ATM information exchanges according to the PCP (aeronautical, meteorological, cooperative network and flight information exchange).	
Deployment Approach	The implementation of the Family requires the definition of the future system architecture able to cover information exchanges in compliance with SWIM Governance policies: the relevant profiles Blue or Yellow shall be supported as well as technical monitoring and control. The concept shall also include SWIM enabled applications defined in AF1, AF2, AF3 and AF4 (**MM1 – Transition / architecture concept from legacy protocol (AFTN…) to SWIM environment available**). The SWIM information exchange implementation plan shall be defined in order to cover all information currently exchanged, but also include a plan for necessary changes or definition of procurement requirements to applications (AF1, AF2, AF3 and AF4). The implementation plan shall in detail describe the realization of the architecture defined in the previous milestone and it must be compliant with the relevant SWIM Governance policies.	

	Furthermore, the plan shall specifically address the transition, ensuring flight safety and minimizing negative network effects (Part of Safety Case) and it may be linked to concrete implementation of SWIM-enabled applications (**MM2 – SWIM information exchange implementation plan available**). The SWIM TI profile middleware and, depending on QoS requirements and the applicable profile, Public Internet Protocol Network or PENS access points shall be implemented; supporting technical monitoring and control shall be in place and operational; all relevant technical personnel (ATSEP) shall be duly trained and new S/E ratings shall be issued (**MM3 – Installation of local Infrastructure Components to support SWIM communications**). Before the start of operational use, the local infrastructure shall be both verified and validated, ready to support communication between SWIM-enabled applications. For the Blue TI profile, special care must be taken to ensure that all safety objectives from the safety case are met and documented. The local infrastructure must be compliant to the relevant SWIM Governance policies to guarantee interoperability within the SWIM network. The execution of such activities will lead to the start of permanent operational use (**MM4 – Implementation completed**). When implementing SWIM, each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.2.3 – Stakeholders SWIM PKI and Cybersecurity

5.2.3 – Stakeholders' SWIM PKI and cyber security			
Main Sub-AF	Sub-AF 5.2 SWIM Infrastructure and Profiles		
Readiness for implementation	SWIM Public Key Infrastructure (PKI) is rated medium due to the maturity / readiness of the actual SWIM standards and governance available for implementation. However PKI standards and technology and NM security infrastructure are very mature.		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2025

Description and Scope

This Family is dealing with the **Stakeholder's SWIM PKI and cyber security** while the Family covers PKI governance and cyber security objectives. The scope of this Family aims at 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. The local implementation may differ depending on whatever the stakeholder will become a CA themselves or use a common or external CA.

This PKI management includes:

- Certificate emitting
- Certificate signing
- Certificate distribution
- Certificate renewal
- Certificate revocation
- Certificate suspension
- Certificate verification
- Certificate storing

Key lifecycle Management includes:

- Creation of key pairs
- Updating keys
- Archiving keys
- Backup and recovery
  - Training and certification of technical personnel
  - Monitoring and control, in particular, establish a Security Operations Center to monitor and protect the IT systems against cyber attacks
  - Procedure development covering normal and degraded operation. Technical standard operating procedures (SOPS) shall also cover certificate management.
  - Local policies for authorising and mandating local organization to do certificate management.
  - Definition of policies and procedures ensuring compliant certificate usage with respect to both common (AF 5.1.4) and local standards.
  - Implementation of audit programmes ensuring continuous compliance with common and local policies and standards.

Interdependencies

Family 5.2.3 is based on the PKI Governance and cyber security objectives in Family 5.1.4 and requires the completion of this family for its full implementation.

It is complemented by 5.2.2 for the stakeholder infrastructure components.

Synchronization Needs

It is essential that appropriate SWIM Governance Structure and Processes are established to develop and monitor an agreed SWIM implementation roadmap.

Civil / Military Coordination

Yes, civil/military coordination is required

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 CM-0201-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Stakeholders are invited to launch projects implementing local PKI and cyber security measures in line with requirements from SWIM Governance. Though changes to the use of PKI in the SWIM context are expected, PKI is very mature both regarding technology and management. The advantages of early implementation of PKI outweigh later changes to SWIM standards.	
Deployment Approach	The implementation of the Family requires the definition of the future system architecture able to cover security for the information exchanges in compliance with SWIM Governance policies. The concept shall also take into account SWIM-enabled applications defined in AF1, AF2, AF3 and AF4 **(MM1 – Transition / architecture concept from legacy protocol (AFTN…) to SWIM environment available)**. The SWIM information exchange implementation plan shall be defined or enhanced in order to cover the security required for all information exchanges. The implementation plan shall in detail describe the realization of the PKI defined in the previous milestone and it must be compliant with the relevant SWIM Governance policies. Furthermore, the plan shall specifically address the transition, ensuring flight safety and minimizing negative network effects (Part of Safety Case) and it may be linked to concrete implementation of the communication between SWIM-compliant applications **(MM2 – SWIM information exchange implementation plan available)**. The PKI and further security measures defined within the Yellow SWIM TI profile shall be implemented; all relevant technical personnel shall be duly trained **(MM3 – Installation of local Infrastructure Components to support Yellow profile communications)**. Before the start of operational use, the local security infrastructure shall be both verified and validated, ready to support communication between SWIM-enabled applications. The local security infrastructure must be compliant to the relevant SWIM Governance policies to guarantee interoperability within the SWIM network. The execution of these activities will lead to the start of permanent operational **use (MM4 – Implementation completed)**. When implementing SWIM each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA and particularly the NSA-approved security management system.	

Family 5.3.1 – Upgrade / Implement Aeronautical Information Exchange system / service

5.3.1 – Upgrade / Implement Aeronautical Information Exchange system / service			
Main Sub-AF	Sub-AF 5.3 SWIM Aeronautical Information Exchange		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2025

Description and Scope

Commission Implementing Regulation (EU) No 716/2014 stipulates the following with regard to Aeronautical Information exchange: *Operational stakeholders shall implement services which support the exchange of the following aeronautical information using the yellow SWIM TI Profile:*

- *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)*
- *Aeronautical information feature on request. Filtering possible by feature type, name and an advanced filter with spatial, temporal and logical operators.*
- *Query Airspace Reservation/Restriction (ARES) information*
- *Provide Aerodrome mapping data and Airport Maps* (including eTOD: electronic Terrain and Obstacle Data)
- *Airspace Usage Plans (AUP, UUP) — ASM level 1, 2 and 3*
- *D-NOTAMs*

Service implementations shall be compliant with the applicable version of Aeronautical Information Reference Model (AIRM), the AIRM Foundation Material and the Information Service Reference Model (ISRM) Foundation Material.

This Family aims at upgrading or implementing Aeronautical Information Exchange systems and services in accordance with SWIM principles.

The systems shall be upgraded or implemented to support the Aeronautical Information exchange as service provider or service consumer; the service implementation shall comply with the Yellow SWIM TI Profile, either using the Public Internet or PENS1/NewPENS. The service implementations shall further be compliant with the applicable version of the standardisation material which corresponds to the material mentioned in the Implementing Rule (AIRM, the AIRM Foundation Material and the ISRM Foundation Material). The applicable version of these documents will at any time be available in the SWIM registry, which is maintained by the SWIM Governance.

Appendix 1 contains a list of services that provide partial coverage of the Commission Implementing Regulation (EU) No 716/2014 based on services developed in the context of SESAR 1 or services deployed or planned by NM.

Once established, the SWIM Governance will be charged with maintenance and publication of this list to finally cover the whole PCP scope; the actual list of services will be available at any time in the registry managed by the SWIM Governance. The registry will also contain the detailed specifications of the services (SDD – Service Design Document) and the technical specifications related to the implementation (TI Profile specification etc.), allowing the consumers to develop applications that use those services. The Stakeholders systems shall be adapted to support simultaneously the legacy messaging exchanges (e.g. AFTN, AMHS …) and the Yellow SWIM profile information exchange, allowing a smooth migration of the stakeholders to SWIM. Security and availability shall be upgraded to support the strong dependencies caused by the system to system interactions. Stakeholder security shall be improved by conducting a risk assessment and by establishing security monitoring and management tools and procedures. The related ATM systems requiring aeronautical information shall be able to use the Aeronautical information exchange services.

Interdependencies
Interdependency with Family 5.1.3 since SWIM Governance processes and bodies will be used to define the list of services required to fulfil the Commission Implementing Regulation (EU) No 716/2014. The completion of the deployment of the Families 5.1.3, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components is required for the full implementation of Family 5.3.1. For Operational Stakeholders (almost all the ANSPs) having decided to use PENS for the Yellow Profile the deployment of 5.1.1/5.1.2 is also required. Interdependencies with all Families of S-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace as well as with Family 3.2.1 - Upgrade of ATM systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Routing Airspace (FRA). Potential interdependency with all Families requiring aeronautical information for their full implementation.
Synchronization Needs
Synchronization will be needed between IPs intending to exchange data with the European Aeronautical Database (EAD) and the providers of EAD to ensure that the required functionality is available at the right point in time.
Civil / Military Coordination
ARES information sharing needs coordination

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-DATM Service Improvement through Integration of all Digital ATM Information	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Stakeholders are invited to deploy the services according to the SWIM Governance decisions by using Appendix 1 as a starting point. For Services previously deployed, the Stakeholders have to upgrade, if necessary, according to the SWIM Governance material.	
Deployment Approach	The implementation of this Family requires an analysis of upgrades and new implementations of services to be performed, as well as the development of a concept on how to tackle the transition for this Family. This analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) (**MM1 – Transition concept from legacy protocol (AFTN…) to SWIM**). While the transition concept is expected to be produced once for all concerned services, the individual services may have different implementation roadmaps. Thus, they can reach the milestones at different points in time.	

	Before the start of operational use, the services required to fulfil Family 5.3.1 objectives shall be developed (**MM2 – New implementation or upgrade of Service developed**) and then validated (**MM3 – New implementation or upgrade of Service validated**). The deployment of the new or upgraded services shall be planned, in terms of test, validation, operation with other Stakeholders who are providers or consumers of the services: NM, ANSPs, AUs, Airport Operators, etc. (**MM4 – Planning of communications deployment**). The execution of these activities will lead to the start of permanent operational use for the Operational Stakeholders (**MM5 – Implementation completed**). When implementing SWIM each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.4.1 – Upgrade / Implement Meteorological Information Exchange system / service

5.4.1 – Upgrade / Implement Meteorological Information Exchange system / service			
Main Sub-AF	Sub-AF 5.4 SWIM Meteorological Information Exchange		
Readiness for implementation	High		
Initial Operational Capability	01/01/2016	**Full Operational Capability**	01/01/2025

Description and Scope

Commission Implementing Regulation (EU) No 716/2014 stipulates the following with regard to Meteorological Information exchange: *Operational stakeholders shall implement services which support the exchange of the following meteorological information using the yellow SWIM TI Profile:*

- *Meteorological prediction of the weather at the airport concerned, at a small interval in the future:*
  - *wind speed and direction*
  - *the air temperature*
  - *the altimeter pressure setting*
  - *the runway visual range (RVR)*
- *Provide Volcanic Ash Mass Concentration*
- *Specific MET info feature service*
- *Winds aloft information service*
- *Meteorological information supporting Aerodrome ATC & Airport Landside process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact; the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days.*
- *Meteorological information supporting En Route/Approach ATC process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact; the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days*
- *Meteorological information supporting Network Information Management process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact* (by making use of probabilistic models to aid decision support*); the system capability mainly targets a 'time to decision' horizon between 20 minutes and 7 days*

This Family aims at upgrading or implementing Meteorological Information Exchange systems and services in accordance with SWIM principles. All Meteorological Information required for the implementation of the Families in AF1, AF3 and AF4[10] has to be provided by services situated in Family 5.4.1; in this sense Family 5.4.1 constitutes the gateway between the meteorological and the ATM world. The systems shall be upgraded or implemented to support the exchange of Meteorological Information as service provider or service consumer in IWXXM, GRIB2 or HDF5 data formats; the service implementation shall comply with the Yellow SWIM TI Profile, either using the Public Internet or PENS1/NewPENS. The different communications paradigms of this profile shall be adapted for supporting the different levels of technical compliance of the stakeholders.

The service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material. The applicable version of these documents will at any time be available in the SWIM registry, which is maintained by the SWIM Governance.

Appendix 1 contains a list of services that provide partial coverage of the Commission Implementing Regulation (EU) No 716/2014 based on services developed in the context of SESAR 1 or services deployed or planned by NM.

Once established, the SWIM Governance will be charged with maintenance and publication of this list to finally cover the whole PCP scope; the actual list of services will be available at any time in the registry managed by the SWIM Governance.

[10] The implementation of AF2 will also require meteorological information, however the use of SWIM for retrieving meteorological information is not mandated for AF2 by the PCP IR

The registry will also contain the detailed specifications of the services (SDD – Service Design Document) and the technical specifications related to the implementation (TI Profile specification etc.), allowing the consumers to develop applications that use those services. The Stakeholders systems shall be adapted to support simultaneously the legacy messaging exchanges and the yellow SWIM profile information exchange, allowing a smooth migration of the stakeholders to SWIM.

Security and availability shall be upgraded to support the strong dependencies caused by the system to system interactions. Stakeholder security shall be improved by conducting a risk assessment and by establishing security monitoring and management tools and procedures. The related ATM systems requiring meteorological information shall be able to use the Meteorological information exchange services.

Interdependencies

Interdependency with Family 5.1.3 since SWIM Governance processes and bodies will be used to define the list of services required to fulfil the Commission Implementing Regulation (EU) No 716/2014.

The completion of the deployment of the Families 5.1.3, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components is required for the full implementation of Family 5.4.1. For Operational Stakeholders (almost all the ANSPs) having decided to use PENS for the Yellow Profile the deployment of 5.1.1/5.1.2 is also required. Interdependencies with Families 2.1.4 – Initial Airport Operations Plan (AOP), 2.3.1 – Time Based Separation and 4.2.4 - AOP/NOP information Sharing regarding meteorological information and systems.

Further interdependencies with all Families requiring meteorological information for their full implementation, including but not limited to Families 1.1.1, 1.1.2, 3.1.4, 4.1.1, 4.1.2, 4.2.2 and 4.4.2.

Synchronization Needs

Civil / Military Coordination

Yes, civil/military coordination is required

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 MET-0101 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Stakeholders are invited to deploy the services according to the SWIM Governance decisions by using Appendix 1 as a starting point. For Services previously deployed, the Stakeholders have to upgrade, if necessary, according to the SWIM Governance material.	

Deployment Approach	The implementation of this Family requires an analysis of upgrades and new implementations of services to be performed, as well as the development of a concept on how to tackle the transition for this Family. This analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) (**MM1 – Transition concept from legacy protocol (AFTN…) to SWIM**). While the transition concept is expected to be produced once for all concerned services, the individual services may have different implementation roadmaps. Thus, they can reach the milestones at different points in time. Before the start of operational use, the services required to fulfil Family 5.4.1 objectives shall be developed (**MM2 – New implementation or upgrade of Service developed**) and then validated (**MM3 – New implementation or upgrade of Service validated**). The deployment of the new or upgraded services shall be planned, in terms of test, validation, operation with other Stakeholders who are providers or consumers of the services: NM, ANSPs, AUs, Airport Operators, etc. (**MM4 – Planning of communications deployment**). The execution of these activities will lead to the start of permanent operational use for the Operational Stakeholders (**MM5 – Implementation completed**). When implementing SWIM, each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.5.1 – Upgrade / Implement Cooperative Network Information Exchange system/service

5.5.1 – Upgrade / Implement Cooperative Network Information Exchange system / service			
Main Sub-AF	Sub-AF 5.5 Cooperative Network Information Exchange		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2025 The Network Operation Plan plans a completion of this Family by end of 2019 as the Cooperative Network Information exchanges are based on mature technologies and services.

Description and Scope

The Network Information will be freely exchanged between the systems of the operational stakeholders by means of defined cooperative network information B2B services, using the Yellow SWIM TI Profile. The scope of the Family is the implementation by the operational stakeholders of the cooperative network information exchange with NM using the Yellow SWIM TI Profile for the sake of Air Traffic Flow and Capacity Management.
The information to be exchanged according to the PCP comprises:

- Maximum airport capacity based on current and near term weather conditions,
- Synchronization of Network Operations Plan and all Airport Operations Plans,
- Departure and arrival planning information,
- ATFCM pre-tactical and tactical plans (regulations, re-routings, sector configurations, runway updates, monitoring values, capacities, traffic volume activations, scenarios, etc.),
- Short term ATFCM measures,
- ATFCM congestion points,
- Network events,
- Rerouting opportunities,
- Restrictions,
- Traffic counts information,
- Demand data (civil, military),
- Flow and Flight message exchange (flight exchanges are meant for ATFCM purpose),
- Airspace structure, availability and utilisation,
- Network and En-Route/Approach Operation Plans,
- Network impact assessment,
- Service availability information,
- General information messages (ATFCM Information Messages and headline news),

The systems shall be upgraded to support the exchange of information in compliance with the Yellow SWIM TI Profile, either through the Public Internet, PENS or other communication service. The choice of communication service depends on a business criticality assessment from where minimum performance requirements are identified. The different communications paradigms of this profile shall be provided by the Network Manager, supporting the different levels of technical compliance of the stakeholders. The list of SWIM services developed by NM and already available in operations that are in scope of 5.5.1 is the following.

- Airspace structure, availability and utilisation:
  - Download of complete AIXM 5.1 datasets with the following entities: AS, PT, RT, UT, AD, AZ, TV, TZ, RL, FW, RS
  - Incremental AIXM 5.1 data sets
  - Creation and update of Airspace Use Plan service for AMCs
  - Publication of the European Airspace Use Plan
- ATFCM pre-tactical and tactical plans
  - Retrieve regulation list and details, sector configuration plans, runways configuration plan, monitoring values, capacity plan, traffic volume activations
  - Create and update sector configurations plan, runways configuration plan, monitoring values, capacity plan, traffic volume activations

- Restrictions
  - Part of the airspace structure service
- Traffic counts information
  - Traffic counts (entry or occupancy, where relevant) by AO, by AD, by AZ, by AS, by PT, by TV
- General Information Messages
  - Retrieve ATFCM Information messages
- Flow and Flight message exchange (flight exchanges are meant for ATFCM purposes)
  - Retrieve flight lists by AO, AD, PT, AS, TV, AZ
  - Retrieve flight details

The Service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material. The applicable version of these documents will at any time be available in the SWIM registry, which is maintained by the SWIM Governance.

Appendix 1 provides a mapping between the PCP required information exchanges and the NM B2B services already operational (see above) and planned till 2018 that support those exchanges. The Network Manager systems shall be adapted to support simultaneously the legacy messaging exchanges and the yellow SWIM profile information exchange, allowing for a progressive migration of the stakeholders to SWIM. The exchange of data with NM via an HMI is covered in Family 4.2.2. Security and availability shall be upgraded to support the strong dependencies caused by the system to system interactions.

Interdependencies

System-to–system interfaces for access to Network Information in other AFs (AF2.1.1, AF2.1.3, AF2.1.4, AF3.1.1, AF3.1.2, AF3.1.3, AF3.1.4, AF3.2.1, AF4.1.2, AF4.2.2, AF4.2.4, AF4.3.1, AF4.3.2 and AF4.4.2). Interdependencies with families 5.1.1, 5.1.2, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components.

Synchronization Needs

NM shall coordinate and support the stakeholders for the deployment of the information exchange with NM via the NM B2B services.

Civil / Military Coordination

Yes, civil/military coordination is required

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	

Recommendation for IPs proposal	This is a multi-stakeholder initiative (NM and various Network users), thus stakeholders' initiatives should be synchronized to foster benefits. NM shall coordinate and support the stakeholders for the deployments of the NM services but it is not recommended to package deployments in a unique project.
Deployment Approach	The priority of each service implementation is dictated by the other AFs identified in the "Interdependencies" section. For each service the following implementation milestones, involving NM and the stakeholders, were identified: - Development of a concept and plan for how to migrate from current situation with legacy protocols to SWIM service implementation. Such analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts, including aspects of safety and security and compliance. The transition plan involves the impacted stakeholders via the Network Manager governance bodies **(MM1 – Transition concept from legacy protocol (AFTN…) to SWIM)**. - Specifications for each service shall be provided by the Network Manager allowing the stakeholders to start their development. This includes specification of performance requirements for the communication service. **(MM2 – Specification from NM available)** - Development and validation of the services by NM and corresponding developments and validations by the stakeholders **(MM3 – New implementation or upgrade of Service developed** and **MM4 – New implementation or upgrade of Service validated)** - Deployment plan shall be communicated and executed by NM **(MM5 – Planning of NM Communications deployment)** and by the stakeholders **(MM6 – Planning of communications deployment with NM completed)** - Start of permanent operational use of the service by the stakeholders **(MM7 – Implementation completed)**. When implementing SWIM, each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.6.1 – Upgrade / Implement Flights Information Exchange system / service supported by Yellow Profile

5.6.1 – Upgrade / Implement Flights Information Exchange system / service supported by Yellow Profile			
Main Sub-AF	Sub-AF 5.6 SWIM Flights Information Exchange		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	01/01/2025

Description and Scope

PCP content: [...] Operational stakeholders shall implement the following services for exchange of flight information using the yellow SWIM TI Profile:

- Validate flight plan and routes

- Flight plans, 4D trajectory, flight performance data, flight status

- Flights lists and detailed flight data

- Flight update message related (departure information)

Service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material.

This Family aims at upgrading or implementing Flight Information Exchange systems and services supported by the Yellow Profile in accordance with SWIM principles.

The systems shall be upgraded or implemented to support the Flight Information exchange as service provider or service consumer; the service implementation shall comply with the Yellow SWIM TI Profile, either using the Public Internet or PENS1/NewPENS. The service implementations shall further be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material. The applicable version of these documents will at any time be available in the SWIM registry, which is maintained by the SWIM Governance.

This family is also intended to provide the prerequisites for trajectory management, which in addition to the Flight Object (Family 5.6.2) requires the sharing of information regarding

- Aircraft performance,
- Trajectory, and
- Meteorological data.

While the last type of information is covered by family 5.4.1, the other 2 information categories are considered part of this family dealing with, among other topics, as stated in the PCP, "*4D trajectory, flight performance data*".

Appendix 1 contains a list of services that provide partial coverage of the Commission Implementing Regulation (EU) No 716/2014 based on services developed in the context of SESAR 1 or services deployed or planned by NM.

Once established, the SWIM Governance will be charged with maintenance and publication of this list to finally cover the whole PCP scope; the actual list of services will be available at any time in the registry managed by the SWIM Governance.

The registry will also contain the detailed specifications of the services (SDD – Service Design Document) and the technical specifications related to the implementation (TI Profile specification etc.), allowing the consumers to develop applications that use those services.

The Stakeholders systems shall be adapted to support simultaneously the legacy messaging exchanges (e.g. AFTN, AMHS …) and the Yellow SWIM profile information exchange, allowing a smooth migration of the stakeholders to SWIM. Security and availability shall be upgraded to support the strong dependencies caused by the system to system interactions. Stakeholder security shall be improved by conducting a risk assessment and by establishing security monitoring and management tools and procedures.

The related ATM systems requiring Flight information shall be able to use the Flight information exchange services.

Interdependencies
The completion of the deployment of the Families 5.1.3, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components is required for the full implementation of Family 5.6.1. For Operational Stakeholders (almost all the ANSPs) having decided to use PENS for the Yellow Profile the deployment of 5.1.1/5.1.2 is also required. Interdependencies with AF1, AF2, AF3 and AF4.
Synchronization Needs
The coordination could be performed by the NM for the information exchanges performed with the NM.
Civil / Military Coordination
Particular needs from the military must be considered, when justified by civil-military interoperability needs. Where for operational security reasons there are restrictions to share the information specific mitigating measures must be introduced including higher level security measures or alternative exchange mechanisms.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B2-FICE Improved Coordination through Multi-centre Ground-Ground Integration (FF ICE, Step 1 and Flight Object, SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Stakeholders are expected to submit IPs for the exchange of flight information via the SWIM Yellow Profile, either proposals that include the use of the NM B2B Flight Services or proposals for the provision of services in this domain. As stated above there are several information exchanges required as prerequisite for trajectory management. SDM explicitly encourages projects dealing with these information exchanges in preparation for the deployment of the families related to trajectory management.	
Deployment Approach	The implementation of the Family would require the SWIM implementation analysis of transitions and new implementations to be performed, as well as the development of a concept on how to tackle the transition for this Family. Such analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) **(MM1 – Transition concept from legacy protocol (AFTN…) to SWIM)**.	

	While the transition concept is expected to be produced once for all concerned services, the individual services may have different implementation roadmaps. Thus, they can reach the milestones at different points in time. The services required by Family 5.6.1 using Yellow Profile **(MM2 – New implementation or upgrade of services for Yellow Profile developed)** shall be developed. The services required by Family 5.6.1 using Yellow Profile **(MM3 – New implementation or upgrade of services for Yellow Profile validated)** shall be validated. The deployment of the services required by Family 5.6.1 using Yellow Profile shall be planned, in terms of test, validation, operation, with other Stakeholders, such as NM, ANSPs, AUs, Airport Operators, etc. **(MM4 – Planning of communications Yellow Profile deployment completed)**. The execution of such activities is expected to lead to the start of operational use by the Operational Stakeholders Yellow Profile **(MM5 – Implementation Yellow Profile completed)**. When implementing SWIM, each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

Family 5.6.2 – Upgrade / Implement Flights Information Exchange system / service supported by Blue Profile

5.6.2 – Upgrade / Implement Flights Information Exchange system / service supported by Blue Profile			
Main Sub-AF	Sub-AF 5.6 SWIM Flights Information Exchange		
Readiness for implementation	Medium: the readiness will become High after the validation of the IOP solution based on the ED 133 versions and the Blue Profile		
Initial Operational Capability	01/06/2018	**Full Operational Capability**	01/01/2025

Description and Scope

PCP content: [...] Flight information shall be exchanged during the pre-tactical and tactical phases by ATC systems and Network Manager. Operational stakeholders shall implement services which support the exchange of the following flight information as indicated in the table below using the blue SWIM TI Profile:

- Various operations on a flight object: Acknowledge reception, Acknowledge agreement to FO, End subscription of a FO distribution, Subscribe to FO distribution, Modify FO constraints, Modify route, Set arrival runway, Update coordination related information, Modify SSR code, Set STAR, Skip ATSU in coordination dialogue

- Share Flight Object information. Flight Object includes the flight script composed of the ATC constraints and the 4D trajectory [...] Service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material.

System requirements:

- ATC systems shall make use of the flight information exchange services

This Family aims at implementing Flight Object Exchange systems and services in accordance with SWIM principles. The systems shall be implemented to support the Flight Object exchange in compliance with the Blue SWIM TI Profile over PENS1/NewPENS and the official versions of ED133. The service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material. The applicable version of these documents will at any time be available in the SWIM registry, which is maintained by the SWIM Governance. Appendix 1 contains a list of services that provide partial coverage of the Commission Implementing Regulation (EU) No 716/2014 based on services developed in the context of SESAR 1 or services deployed or planned by NM.

Two SESAR1 services, ATC Flight Object Control Service and Shared Flight Object Service in line with the ED133 draft versions, are currently covering partially the services related to Flight Object.

After the closure of SESAR1 in 2016 this list will be amended through the SWIM Governance to finally cover the whole PCP scope; the actual list of services will be available at any time in the registry managed by the SWIM Governance. The registry will also contain the detailed specifications of the services (SDD – Service Design Document) and the technical specifications related to the implementation (TI Profile specification etc.), allowing the consumers to develop applications that use those services.

The civil Stakeholders systems shall be adapted to support simultaneously the legacy messaging exchanges (e.g. AFTN, AMHS, FMTP …) and the Blue SWIM profile information exchange, allowing a smooth migration of the stakeholders to SWIM. Security and availability shall be upgraded to support the strong dependencies caused by the system to system interactions. Stakeholder security shall be improved by conducting a risk assessment and by establishing security monitoring and management tools and procedures.

The related ATM systems requiring Flight information shall be able to use the Flight information exchange services. Particular needs from the military must be considered, especially where for operational security reasons the information cannot and will not be shared.

Interdependencies

The completion of the deployment of the Families 5.1.1/5.1.2 (PENS), 5.1.3, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components is required for the full implementation of Family 5.6.2.

SWIM services related to FO enable flight data processing systems to flight data processing systems exchange of down-linked trajectory information between ATS units required by Initial Trajectory Information Sharing functionality referred in AF6. Interdependencies with AF3 and AF4.		
Synchronization Needs		
The implementation of the Flight Object distribution and consumption shall be synchronized and coordinated at least by big area like FAB or neighbouring ANSPs. To implement Flight Object only in one ANSP has a limited interest. It could be relevant that a cluster of ANSPs presents IP to implement FO in their Airspace, especially synchronized with e.g. Free Route implementation.		
Civil / Military Coordination		
A civil-military coordination to exchange flight object data is beneficial to perform 4D trajectory management as well as identification process		
Stakeholders considered as gaps	ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B2-FICE Improved Coordination through Multi-centre Ground-Ground Integration (FF ICE, Step 1 and Flight Object, SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0201-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.2
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	It could be relevant that a cluster of ANSPs, a FAB or neighbouring ANSPs, present common Implementing Projects to implement FO - based on the two SWIM services ATC Flight Object Control Service and Shared Flight Object Service and ED133 versions - in their Airspace especially synchronized with Free Route implementation. SDM is available to help ANSPs and NM for building implementation scenarios.	
Deployment Approach	This family is subject of validation under the SESAR 2020 Programme wave 1. Final validation results are expected by June 2020. The implementation of the Family would require the IOP implementation analysis of transitions and new implementations to be performed, as well as the development of a concept on how to tackle the transition for this Family. Such analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) **(MM1 – Transition concept from OLDI-FMTP to FO)**. While the transition concept is expected to be produced once for all concerned services, the individual services may have different implementation roadmaps. Thus, they can reach the milestones at different points in time.	

	The services required by Family 5.6.2 using Blue Profile **(MM2 – New implementation or upgrade of services for Blue Profile developed)** shall be developed. The services required by Family 5.6.2 using Blue Profile **(MM3 – New implementation or upgrade of services for Blue Profile validated)** shall be validated. The deployment of the services required by Family 5.6.2 using Blue Profile shall be planned, in terms of test, validation, operation, with other Stakeholders, being NM and ANSPs and potentially other stakeholders planning to deploy Blue Profile even if not mandated **(MM4 – Planning of communications Blue Profile deployment completed)**. The execution of such activities is expected to lead to the start of operational use by the Operational Stakeholders for Blue Profile **(MM5 – Implementation Blue Profile completed)**. When implementing SWIM, each stakeholder has to take into account the requirements stemming from the safety and security assessment at functional level required by their respective NSA.

3.6 AF #6 – Initial Trajectory Information Sharing

Family 6.1.1 – ATN B1 based services in ATSP domain

6.1.1 - ATN B1 based services in ATSP domain			
Main Sub-AF	Sub-AF 6.1 Initial Trajectory Information Sharing		
Readiness for implementation	High		
Initial Operational Capability	Before 2014	**Full Operational Capability**	05/02/2018

Description and Scope

Air Ground Data Link capability according to Commission Regulation (EC) No 29/2009 on data link services is an essential prerequisite for Baseline 2 and particularly for Initial Trajectory Information Sharing. This regulation has been updated by Commission Implementing Regulation (EU) No 310/2015 and is complemented by Commission Regulation (EC) No 30/2009 on exchange of flight data (ground/ground) in support of data link services.

This Family encompasses:

- ATM system upgrades (FDP, HMI, Recording, Front end processor):
  - Processing of data link related flight plan information by the flight data processing system to support the association of data link communication with flight plans
  - Processing and display of Data Link Initiation Capabilities (DLIC) service messages to support the establishment of CPDLC communication with the airborne systems, as well as the transfer of air/ground data link communication to other ATSUs
  - Processing and display of Logon Forward (LOF) and Next Authority Notified (NAN) messages by the flight data processing system to support the transfer of air/ground data link communication between ATSUs,
  - Processing and display of ATC Communications Management (ACM) service messages to support the transfer of voice and data communications between sectors of the same ATSU and between different ATSUs
  - Processing and display of ATC Clearances (ACL) service messages, including monitoring and supervision of dialogue states.
  - Processing of ATC Microphone Check (AMC) service messages to support controllers to simultaneously instruct all (data link connected) flight crews to check the status of their voice communication systems
- Implementation of DLS performance monitoring system
- ATN Interface providing connection to the air/ground communication network (see Family 6.1.3)
- Operations manuals updates to include working methods and operating procedures for the use of CPDLC
- Training of ATCOs and technical staff

Interdependencies

Family 6.1.3: Family 6.1.1 can only be implemented in conjunction with Family 6.1.3, which is providing the corresponding communication infrastructure for air/ground data link.

Synchronization Needs

Family 6.1.4 targets the implementation of avionic systems supporting ATN B1 applications. Therefore, synchronisation between ANSPs and AUs is necessary.

Civil / Military Coordination

In certain circumstances, military ANSPs may provide ATS services to traffic where DLS is implemented. In those cases, military ATM systems must be also adapted (taking into account their specificity).

Stakeholders considered as gaps	ANSPs	
Other stakeholders involved in the Family deployment	Military authorities, when relevant	
Links to ICAO GANP ASBUs	B0-TBO Improved Safety and Efficiency through the Initial Application of Data Link En-route	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AUO-0301 Available
	ATM Master Plan Level 3 (Edition 2016)	ITY-AGDL
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	It is recommended to take into consideration Family 6.1.3 which is necessary to provide the required communication infrastructure. It is further recommended to take into consideration the results of the DLS survey, as reported within Section 5.1	
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATM systems and/or installation of new systems (e.g., data link front end processor). Such systems would also require the provision of their final acceptance and the integration with other existing systems, considering that some of these components are included in Family 6.1.3 **(MM1 – ATM systems upgrade)**. The applicable concept of operations shall also be broken down into documented and approved work procedures **(MM2 – Procedures available)**. Before the start of the operational use of CPDLC based services, a safety assessment shall be performed successfully **(MM3 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

Family 6.1.2 – ATN B2 based services in ATSP domain

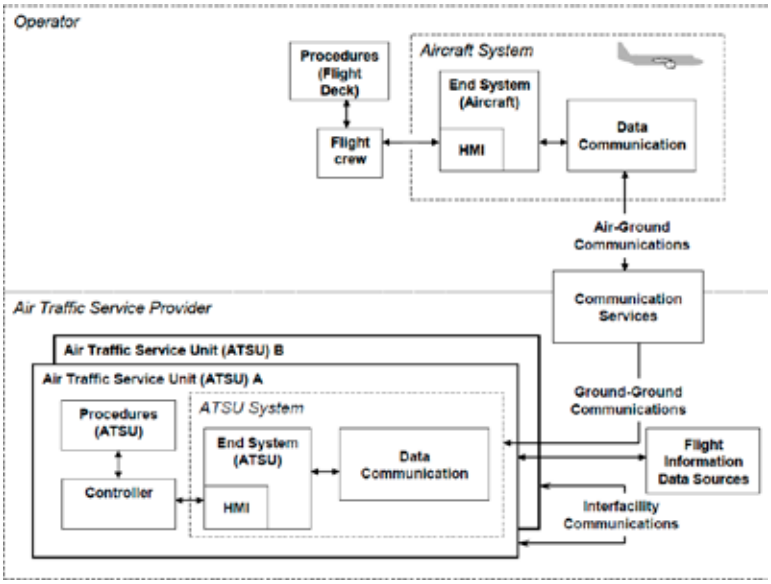
6.1.2 ATN B2 based services in ATSP domain			
Main Sub-AF	Sub-AF 6.1 Initial Trajectory Information Sharing		
Readiness for implementation	Low		
Initial Operational Capability	01/01/2020	**Full Operational Capability**	01/01/2025

Description and Scope

Adapt ANSP/NM ATM systems to process the air derived flight data provided by EPP. The new capabilities of the ATM system are:

- establishing and operating the appropriate ADS-C contract;
- processing and integration of EPP information in the ATM system; and
- exchanging EPP enhanced ground trajectory with other ATSUs

These new functionalities will be allocated according to local architectures. The figure below represents an overview of the CNS/ATM system as per RTCA/EUROCAE.



On the basis of this model the following allocations can be assumed:

- ATSU (Air Traffic Service Unit) System:
  - Determine parameters for the appropriate ADS-C Contract Request
  - Process EPP data in FDP to derive performance benefits (includes FDP Trajectory Prediction, HMI, Controller support tools, Safety Nets as appropriate)
- NM Systems:
  - Process and integrate EPP data to derive network performance benefits
- ATSU Data Communication
  - Establish the appropriate ADS-C Contract with Aircraft System either directly or through delegation to an appropriate external function of Communication Services (involves Datalink Front End Processor (DL-FEP) and/or interfaces to external functions as appropriate) Note: The use of a central ADS-C server rather than using a local FEP at each ANSP should be considered.
  - Provide support for SWIM enabled interfacility sharing of EPP or EPP enhanced ground trajectory data.
- Communication Services

Interdependencies

6.1.3 is a necessary prerequisite providing the physical and logical network infrastructure. Families 5.6.1 and 5.6.2 provide the vehicle for interfacility exchange of EPP data

Synchronization Needs		
6.1.5 is a mutual interdependency with this family, providing the airborne segment of the chain.		
Civil / Military Coordination		
This family must also support interoperability needs of military/state transport-type aircraft deemed to be ADS-C EPP capable		
Stakeholders considered as gaps	ANSP, NM	
Other stakeholders involved in the Family deployment	Military authorities when relevant	
Links to ICAO GANP ASBUs	B1-TBO Improved Traffic Synchronization and Initial Trajectory-based Operation	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0303-A (ER APP ATC 149a, ER APP ATC 119) SESAR Release 5 IS-0303-A (ER APP ATC 100) SESAR Release 9
	ATM Master Plan Level 3 (Edition 2016)	None
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Considering the current status of development work, SDM considers that the concept of EPP usage still needs to be validated at SJU level. It is recommended to take into consideration Family 6.1.3 which is necessary to provide the required VDL Mode 2 communication infrastructure. It is further recommended to take into consideration the results of the DLS survey, as reported within Section 5.1	
Deployment Approach	Implementing partners shall equip their respective systems with the required functionalities **(MM.1 - System Upgrade to support the acquisition and management of EPP data in the ground systems)**. This step shall be followed with a safety assessment campaign concluding on a safety assessment report providing a basis for an operational approval **(MM.2 – Safety Assessment)**. Upgraded systems shall be integrated in the existing systems **(MM.3 – Integration)**. The applicable concept of operations shall also be broken down into documented and approved work procedures **(MM.4 – Procedures available)** and all operational/technical staff involved shall be duly trained **(MM.5 – Training of OPS and technical staff)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM.6 – Implementation completed)**.	

Family 6.1.3 – A/G and G/G Multi Frequency DL Network in defined European Service Areas

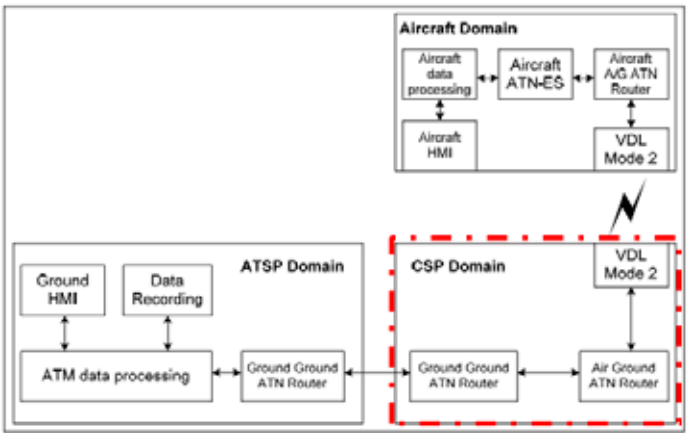
6.1.3 A/G and G/G Network Multi Frequency DL Network in defined European Service Areas			
Main Sub-AF	Sub-AF 6.1 Initial Trajectory Information Sharing		
Readiness for implementation	High		
Initial Operational Capability	01/01/2017	**Full Operational Capability**	31/12/2022

Description and Scope

Based on the results of the ELSA study, SDM developed the "Data Link Services (DLS) Implementation Strategy towards Initial Trajectory Information Sharing", that was further elaborated into the "Data Link Services (DLS) Recovery Plan". This DLS Recovery Plan focuses on the implementation of the ELSA recommendations that take effect in the communication domain (family 6.1.3) and aircraft domain (family 6.1.4).

Based on the DLS Recovery Plan, EC mandated SDM to act as the Data Link Services (DLS) Implementation Project Manager. To support the implementation of the DLS Recovery plan, EC has also requested EASA, EUROCAE and NM to act on specific gaps identified by ELSA.

The Family 6.1.3 is related to the A/G and G/G Multi Frequency (MF) DL Network in defined European Service Areas[11], consisting in the European implementation of the A/G and G/G Network based on European Service Areas and VDL Mode 2 as part of ATN COM (COMmunication) domain components as identified in the following ETSI Architecture (highlighted in red in the picture):



ATN Data Link System Architecture (ETSI EN 303 214)

The ATN COM domain, identified in the previous picture, supports ATN B1 services and trajectory downlinks with EPP (part of ATN B2 services) and is composed by:

- the VDL M2 network;
- the ATN routing components (Ground/Ground ATN and Air/Ground ATN Routers).

The related ATN COM infrastructure can be split in two segments:

- Air-Ground (A/G) network that is the Radio Frequency (RF) network based on VDL M2[12] and,
- Ground-Ground (G/G) network[13] that is composed by:
  - ATN routing components and
  - ATS data distribution network needed to connect:
    - the ATN routing components among them
    - the ATN routing components with the A/G network and with ATSP domain.

Currently, ATN Data Link systems, based on VDL M2, are already implemented in some European Countries, but performance issues (provider and user aborts) have been experienced during the operational use of ATN B1 services making it difficult to continue to use them in the current configuration.

[11] Portions of airspace, homogeneous in terms of operational and technical needs to provide data-link services in a safe, secure and efficient way. They could be identical with FABs or as new entities established regardless of state boundaries.
[12] This network is used also for ACARS messages (ACARS over AVLC - AoA) as in each aircraft is possible to open only one VDL M2 communication session for both ATS and AOC services).
[13] The AOC messages transport is not considered here.

With this regard, the EC has requested:

- a technical investigation to EASA, resulting in the elaboration of a specific Report (Technical Issues in the implementation of Regulation EC 29/2009) which identifies the causes of the current DLS issues;
- a technical study to SJU - ELSA Study (VDL Mode 2 Measurement, Analysis and Simulation Campaign) - in order to analyze the causes of the current DLS issues and identify solutions.

The EASA Report clearly identified that the use of a single frequency (the CSC channel alone, used for AOC as well as ATS data) was one of the most important root causes of the technical problems. So, the needs to meet the ATS performances have led the aeronautical community to consider upgrading the current single frequency VDL M2 networks by developing and deploying multi-frequency infrastructures, as requested by ICAO standards (also the SJU Capacity Study confirmed the single frequency saturation in core Europe starting from 2015).

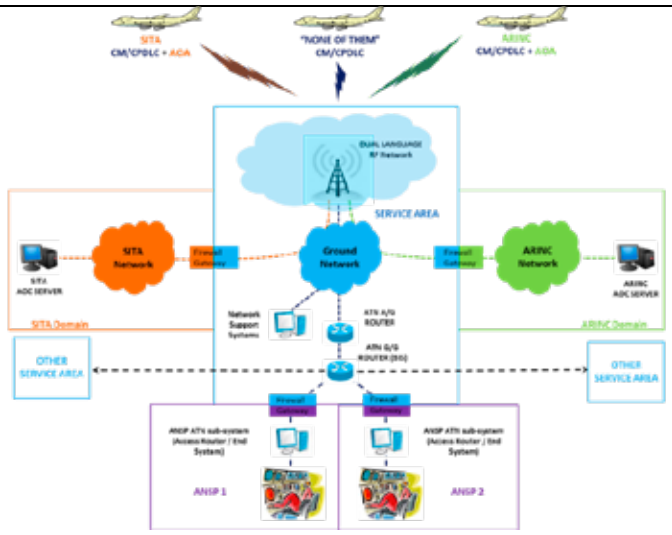
Starting from the EASA report, the following Ground Network recommendations have been elaborated by ELSA:

- improve the VHF Ground Station (VGS) network and fix the ground system issues:
  - use a dedicated channel for transmissions at the airport in regions with high traffic levels in en-route;
  - use alternative communication means for AOC in the airport domain (e.g., Wi-Fi, cellular, AeroMACS) to off-load the frequencies used for CPDLC;
  - progressively implement additional VDL2 frequencies in accordance with the traffic level;
  - optimise the en-route VGS network coverage;
  - ensure the availability of a fifth VDL2 frequency (at a minimum);
  - use the CSC as common control channel only, unless traffic level is very low;
  - implement ELSA recommended protocol optimisation: limit AVLC frame size;
  - fix the ELSA identified ground system problem;
- start implementing the transition roadmap to the MF VDL2 target technical solution: introduction of alternate channels using reserved frequencies[14], addition of frequencies, and transition to one managed MF VDL2 network per Service area.

With reference to the last, ELSA Study, after a technical assessment of the various MF deployment identified options, concluded that **the best model for MF deployment in Europe is a model comprising a number of Service Areas, where all VDL M2 Ground Stations (VGS) operating on VDL frequencies in a given Service Area work together under one unique frequency licensee responsible for managing the traffic on the RF network**. Thus the European architecture is based on a "Service Areas" approach that, from a pure technical point of view, means a European distributed architecture.

Such model – named ***Model D*** - represents the target high level architecture solution for the ATN COM infrastructure outlined in the following picture:

[14] Means that all ground stations operating on that VDL frequency in a given Service area work together under one unique frequency licensee responsible for managing the traffic on the RF network.



Target high level architecture solution for the ATN COM infrastructure

Model D description:

As outlined in the previous figure, the model D consists of a European distributed architecture based on Service Areas.

For each Service Area, the following components are included:

- RF network: MF VDL M2 VGS implementing Dual Language[15] technology
- Ground network: IP network for internal and external components connections (the AOC transport is not considered in the family scope)
- ATN Ground Network: composed by ATN A/G and G/G routers in a dedicated ATN domain
- Network support systems: monitoring, recording, billing and network management systems
- Network interfaces: Firewall/Gateways for external interfaces.

It is worth noting that, at European Level, Network Support Systems should be envisaged to ensure an overall monitoring supporting the Common DL Service provision.

One of the most important element of the Model D is its scalability, that means the possibility to add new frequency, also only one, each time the available bandwidth becomes insufficient in the Service Area as well as in the Country/Region within the Service Area (the number of frequencies "linearly" grows with the traffic increase).

Regarding to the ground networking (Ground Network and ATN Ground Network), a possible common approach is to implement the G/G network ATN rationalization for DLS based on PENS use and considering also the Service Area approach as defined in the TEN-T study "New European Common Service Provision for PENS 2 and DLS".

Towards Model D:

Having defined the European target solution architecture for the ATN COM infrastructure, also the transition from the current situation to the target solution has been studied by ELSA. The European current situation can be represented by three different statuses which can be assumed as starting points for the transition:

- **"Model A":** a country/region with a multiple VDL M2 networks implemented in the same airspace, using a One-GSIF[16] system on common frequencies;
- **"Model C":** a country/region with a single VDL M2 network implemented in the same airspace, using a Two-GSIF system on reserved frequencies;
- **No implementation yet**: a country/region that has not implemented any ATN COM infrastructure.

15 "Single Language" means that any VGS broadcasts the ID (Identifier) of only one (Single) Digital Service Providers . "Dual Language" means that any VGS broadcasts the IDs (Identifier) of multiple (Dual) Digital Service Providers in its Ground Station Information Frames (GSIF) on the RF channel.

16 A One-GSIF system implements the "Single Language". A Two-GSIF system implements the "Dual Language".

Due to the need to consider:

- the existing infrastructure;
- the time required to move forward the technical target solution (assuming that some of the current infrastructures are in operation;)

a transition model, named "Model B", has been introduced.

Model B description:

Model B consists of **Multiple VDL M2 networks implemented in the same airspace using a One-GSIF system on reserved frequencies with MF implementation.**

To make it possible to implement the Model B in a way suitable to meet the requirements, five frequencies have been assigned to VDL Mode 2 by the ICAO EANPG FMG. **The Model B has to be considered as a temporary step to reach the Model D.**

The following table recaps the Models described above:

Model	VDL RF operating Networks	VDL RF Frequency Use	GSIF on each Frequency announced by each Network	Note
A	MULTIPLE	COMMON	ONE	Original Central EU model
B	MULTIPLE	RESERVED	ONE	**Target Short term evolution**
C	SINGLE	RESERVED	TWO	Model originally deployed in a limited area[17]
D	SINGLE	RESERVED	TWO	**Target Long term model for EU VDL network evolution**

Stakeholders involved:

The stakeholders involved in the Family implementation are *ANSPs and CSPs* that are asked to provide:

- in the short term, coverage and performance required to satisfy the DLS IR 29/2009 (ATN B1 services), amended by IR 310/2015 and considered as pre-requisite for PCP;
- in the medium term, capacity to support the increased data volume expected with the introduction of trajectory downlinks with EPP (part of ATN B2 services) for Initial trajectory information sharing (i4D) as requested by PCP.

In this perspective, the SDM DL strategy has proposed to EC to achieve the target Model D by December 2022.

Interdependencies

Family 6.1.3 can only be implemented in conjunction with Family 6.1.1 and 6.1.2, which are providing the corresponding ATM infrastructures for data link services.

Synchronization Needs

Family 6.1.4 and 6.1.5 target the implementation of avionic systems supporting ATN B1 and ATN B2 applications. Therefore, synchronisation between ANSPs/CSPs and AUs is necessary.

Civil / Military Coordination

No special requirements.

[17] Currently deployed by ENAV on Italian airspace.

Stakeholders considered as gaps	ANSPs	
Other stakeholders involved in the Family deployment	CSPs	
Links to ICAO GANP ASBUs	B0-TBO Improved Safety and Efficiency through the Initial Application of Data Link En-route	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	N/A
	ATM Master Plan Level 3 (Edition 2016)	ITY-AGDL
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	Refer to *DLS Recovery Plan*.	
Deployment Approach	Deployment of family 6.1.3 is divided into two phases: Transition from Model A or C to Model B or C with MF in the first phase, and the transition from model B or Model C with MF to Model D. <u>For the phase one transition to Model B and Model C with MF:</u> Based on the current distribution of VGSs and frequencies, a target design for the deployment of new VGSs and frequencies is developed (**MM1 – A/G network design completed**). The same analysis and design is performed for the ground network components required to support the A/G network (**MM2 – Ground system components design completed**). This is followed by the procurement and deployment of the VGSs (**MM3 – VGSs deployed**) and ground network components (**MM4 – Ground system components deployed**). At the end of phase one, the modified/additional components are integrated into the operational network (**MM5 – Operational transition completed**). <u>For Model D implementation</u> Based on the design from phase 1 and taking into account the single network design in a service area, the layout of service areas is defined and an optimized target design for the (re)deployment of VGSs and frequencies is developed (**MM6 – A/G network design at Service Area level completed**). The same analysis and design is performed for the ground network components required to support the A/G network (**MM7 – Ground system components design at Service Area level completed**). Based on the overall layout of the service areas, refinement of the design for the (re)deployment of VGSs and frequencies in boundary areas is developed (where necessary) (**MM8 – A/G network design at European level completed**). The analysis and design to interconnect the service areas at a European level is performed (**MM9 – Ground system components design at European level completed**). As a result of the A/G network design at European level, VGSs and frequencies may have to (re)distributed in boundary areas (**MM10 – VGSs upgraded at Service Area level**).	

	The ground system components required to interconnect the service areas are deployed or upgraded (**MM11 – Ground system components upgraded at Service Area level**). A/G and G/G components optimized for the service areas are connected/integrated into the operational network (**MM12 – Operational transition at Service Area level**). The service areas have to be interconnected to operate at a European level (**MM13 – Integration of Service Areas at European level**). At the end of phase two, the optimized components are integrated into an operational pan-European network (**MM14 – Operational transition completed**).

Family 6.1.4 – ATN B1 capability in Multi Frequency environment in Aircraft domain

6.1.4 - ATN B1 capability in Multi Frequency environment in Aircraft domain			
Main Sub-AF	Sub-AF 6.1 Initial Trajectory Information Sharing		
Readiness for implementation	High		
Initial Operational Capability	01/09/2016	**Full Operational Capability**	05/02/2020

Description and Scope

Based on the results of the ELSA study, SDM developed the "Data Link Services (DLS) Implementation Strategy towards Initial Trajectory Information Sharing", that was further elaborated into the "Data Link Services (DLS) Recovery Plan". This DLS Recovery Plan focuses on the implementation of the ELSA recommendations that take effect in the communication domain (family 6.1.3) and aircraft domain (family 6.1.4). Based on the DLS Recovery Plan, EC mandated SDM to act as the Data Link Services (DLS) Implementation Project Manager. To support the implementation of the DLS Recovery plan, EC has also requested EASA, EUROCAE and NM to act on specific gaps identified by ELSA.

The purpose of this family is for civil and military aircraft operators concerned by DLS IR to upgrade to "best in class" avionic configurations as prescribed by ELSA and/or those having successfully passed subsequent and equivalent test and certification activities. One of the outcomes of ELSA was a set of avionic configurations that were tested and demonstrated as sufficient to comply with the ATN/VDL2 performance expectations in multi-frequency (MF) environment. ELSA Final report (D11) refers to this set as "best in class"; select aircraft type families are covered, see below.

ELSA identified the need to continue testing efforts beyond the lifespan of the study itself to cover both newly emerging avionic configurations as well as other existing configurations that were not covered in the ELSA study. ELSA proposed that ultimately, an effective end to end certification process for both ground and air components should be defined and implemented. The current airborne routers and VHF Data Radio already labelled as "best in class" in the frame of the ELSA project are listed below:

1) Data Link Management Units (airborne routers)

- AIRBUS FANS B+ ATSU CSB8
- HONEYWELL
  - MkII+ CMU upgrade from -501 and -521 to -522
  - EPIC CMF upgrade to Block 3.xx or later
  - B787 CMF upgrade to BPV3
  - B777 CMF upgrade to BPv17A BLE
- Rockwell Collins CMU-900 operators should upgrade to CMU Core software 815-5679-505 (refer to CMU-900 Service Information Letter 15-1) in order to fix a software bug impacting the VDL2 Multi-Frequency operations.

2) On board VDR (VHF Data Radio)

- Honeywell
  - RTA-50D PN 965-1696-0F1
  - RTA-44D PN 064-50000-2052 or with service bulletin SB23-1570 installed
  - EPIC avionics fitted with mod D or greater for the VDR element.
- Rockwell Collins
  - VHF-920: P/N 822-1250-002w/SB16 or 822-1250-020w/SB17
  - VHF-2100: P/N 822-1287-101/180w/SB7 or 822-1287-121/141
  - VHF-2200 P/N 822-2763-020 or VHF-2200 P/N 822-2763-050

Note: Regardless of the family's readiness for deployment, one outcome of the ELSA study is the need for an effective end-to-end system certification process including both ground and air components and reference material for the ground network infrastructure. Need to accelerate the delivery of supporting material.

Interdependencies		
None		
Synchronization Needs		
6.1.1 and 6.1.3 addressing ground system capabilities for ATN B1 services		
Civil / Military Coordination		
Particular needs from the military must be considered, when justified by civil-military interoperability needs.		
Stakeholders considered as gaps	Airspace Users	
Other stakeholders involved in the Family deployment	Military authorities, when relevant (as AU)	
Links to ICAO GANP ASBUs	B0-TBO Improved Safety and Efficiency through the Initial Application of Data Link En-route	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AUO-0301 Available
	ATM Master Plan Level 3 (Edition 2016)	ITY-AGDL
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.	
Deployment Approach	The deployment of this family is envisaged to commence with the procurement of required equipment or upgrade packages; this step is completed when the operator has taken delivery of all necessary hardware and software components **(MM.1 - Equipment procured)**. This step is followed by installation and integration in onboard systems of all aircraft in the respective fleet **(MM.2 - Aircraft equipped)**. Next step involves the elaboration and approval process of operational procedures and training packages **(MM.3 – Procedures and training available)**. Crews must undergo appropriate training with respect to the use of the equipment **(MM.4 – Training completed)**. Finally, the family is fully implemented when regular operations have commenced on a permanent basis **(MM.5 – Implementation completed)**.	

Family 6.1.5 – ATN B2 in Aircraft domain

6.1.5 – ATN B2 in Aircraft domain			
Main Sub-AF	Sub-AF 6.1 Initial Trajectory Information Sharing		
Readiness for implementation	Low		
Initial Operational Capability	01/01/2020	**Full Operational Capability**	01/01/2026

Description and Scope
According to the PCP, one objective of AF6 is that "at least 20 % of the aircraft operating within the airspace of European Civil Aviation Conference (ECAC) countries in the ICAO EUR region corresponding to at least 45 % of flights operating in those countries, are equipped with the capability to downlink aircraft trajectory using ADS-C EPP as from 1 January 2026". This family aims at adapting aircraft systems to receive and process a ground initiated ADS-C Contract Request for EPP data. The avionic system shall, at the minimum, implement all EPP Data Operational Requirements [EPP DATA OR] listed in Annex B of ED-228A. This family encompasses: - Aircraft equipage - Procedures and training
Interdependencies
6.1.4 is a prerequisite.
Synchronization Needs
6.1.2, 6.1.3 addressing ground system capabilities for EPP exchange
Civil / Military Coordination
Particular needs from the military must be considered, when justified by civil-military interoperability needs.

Stakeholders considered as gaps	Airspace Users	
Other stakeholders involved in the Family deployment	Military authorities, when relevant (as AU)	
Links to ICAO GANP ASBUs	B1-TBO Improved Traffic Synchronization and Initial Trajectory-based Operation	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0303-A (A/C-37a) SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	None
Cyber security requirements	SDM believes that 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 shall assess these risks and apply appropriate security controls to mitigate them. The risk assessments and the resulting mitigations must be documented.	

Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis provided within the DP Monitoring View.
Deployment Approach	The deployment of this family is envisaged to commence with the procurement of required equipment or upgrade packages; this step is completed when the operator has taken delivery of all necessary hardware and software components **(MM.1 - Equipment procured)**. This step is followed by installation and integration in on-board systems of all aircraft in the respective fleet **(MM.2 - Aircraft equipped)**. Next step involves the elaboration and approval process of operational procedures and training packages **(MM.3 – Procedures and training available)**. Crews must undergo appropriate training with respect to the use of the equipment **(MM.4 – Training completed)**. Finally, the family is fully implemented when regular operations have commenced on a permanent basis **(MM.5 – Implementation completed)**.

3.7 Appendix 1 – List of services covering Reg. (EU) No. 716/2014

This Appendix contains a list of services that provide partial coverage of the Commission Implementing Regulation (EU) No 716/2014. It links the information exchanges listed in the regulation to the services developed in the context of SESAR 1 or to the services deployed or planned by NM, where applicable. The list is based on an interpretation of the PCP. It is compiled as guidance for stakeholders. These services are considered a starting point for PCP coverage in AF5. Note that it lies in the nature of SWIM that the service definitions will evolve through SWIM Governance based on stakeholder requirements. Thus, adaptations of the service implementations could be needed.

Information exchange requirement stated in PCP	DP Family	Service resulting from SESAR 1	NM B2B service in Release 21 / NM B2B service in the NM Roadmap (Release 21 - 2017, Release 22 - 2018)
AIM Domain			
Notification of the activation of an Airspace Reservation/Restriction (ARES)	#5.3.1 #3.1.1/2/3	ARES Activation	
Notification of the de-activation of an Airspace Reservation/Restriction (ARES)	#5.3.1 #3.1.1/2/3	ARES Deactivation	
Pre-notification of the activation of an Airspace Reservation/Restriction (ARES)	#5.3.1 #3.1.1/2/3	ARES Preactivation	
Notification of the release of an Airspace Reservation/Restriction (ARES)	#5.3.1 #3.1.1/2/3	ARES Release	
Query Airspace Reservation/Restriction (ARES) information	#5.3.1 #3.1.1/2/3	ARES Query	
Airspace Usage Plans (AUP, UUP) - ASM level 1, 2 and 3	#5.3.1 #3.1.1/2/3		ASM Level 1 part 1: Airspace/Airspace Structure already available
			ASM Level 2 fully covered by Airspace/Airspace Availability services
			ASM Level 1 part 2: Event Planning service planned for future Release ASM level 3 planned for future Release
Provides aeronautical information feature on request. Filtering possible by feature type, name and an advanced filter with spatial, temporal and logical operators.	#5.3.1 #1.2.2	Aeronautical Information Feature	
Provide Aerodrome mapping data	#5.3.1 #1.2.2	Aerodrome Map Information	
D-Notams	#5.3.1		

Information exchange requirement stated in PCP	DP Family	Service resulting from SESAR 1	NM B2B service in Release 21 / NM B2B service in the NM Roadmap (Release 21 - 2017, Release 22 - 2018)
MET Domain			
Meteorological prediction of the weather at the airport concerned, at a small interval in the future: - wind speed and direction - the air temperature - the altimeter pressure setting - the runway visual range (RVR)	#5.4.1	AirportMETNowcast[18] (ICAOMETLocalReport) (METAR) (TAF)	
Provide Volcanic Ash Mass Concentration	#5.4.1	VAMCInformation[19]	
Specific MET info feature service	#5.4.1	[20]	
Winds aloft information service	#5.4.1	MET Gridded Forecast	
Meteorological information supporting Aerodrome ATC & Airport Landside process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact. The system capability mainly targets a "time to decision" horizon between 20 minutes and 7 days.	#5.4.1	SNOWTAM METAR ICAOMETLocalReport AirportMETObservation AirportMETForecast AirportMETNowcast TAF AirportMETAlert AirportMETInducedCapacityReduction	
Meteorological information supporting En Route / Approach ATC process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact. The system capability mainly targets a "time to decision" horizon between 20 minutes and 7 days.	#5.4.1	METHazardEnrouteForecast METHazardEnrouteObservation MET Gridded Forecast	
Meteorological information supporting Network Information Management process or aids involving the relevant MET information, translation processes to derive constraints for weather and converting this information in an ATM impact. The system capability mainly targets a "time to decision" horizon between 20 minutes and 7 days.	#5.4.1	SNOWTAM METAR ICAOMETLocalReport AirportMETObservation AirportMETForecast AirportMETNowcast TAF AirportMETAlert METHazardEnrouteForecast METHazardEnrouteObservation MET Gridded Forecast	

[18] Only the AirportMETNowcast service covers all the parameters mentioned in the regulation. Note that EUMETNET does not use Nowcasts anymore, so the service might be replaced.
[19] This service has only been identified and was not implemented

Information exchange requirement stated in PCP	DP Family	Service resulting from SESAR 1	NM B2B service in Release 21 / NM B2B service in the NM Roadmap (Release 21 - 2017, Release 22 - 2018)
Network Domain			
Regulations	#5.5.1		Flow/Measures services provide read access to regulations and allow to create, update, revoke regulation proposals (MCP and normal regulations)
			Services for scenarios planned for Release 22
Slots	#5.5.1		ATFM slot data exchange services planned for future release.
Short term ATFCM measures (STAM) -- see also AF #4.1.1	#5.5.1 #4.1.1/2		Flow/Measures services for the management of MCP regulations and Flow/MCDM services
ATFCM congestion points	#5.5.1		Flow/TacticalUpdates hotspot management service (trial mode)
Restrictions	#5.5.1		Airspace/AirspaceStructure/Restrictions feature
Network and En-Route Approach Operation Plans	#5.5.1		Flow/TacticalUpdates Airspace/AirspaceStructure/ - Sector Configuration Plan - Runway Configuration Plan - OTMV Plan - Capacity Plan - Traffic Volume Activation Plan
			Network Events planned for future release.
Maximum airport capacity based on current and near-term weather	#5.5.1	Airport MET Induced Capacity Reduction	
AOP NOP synchronisation	#5.5.1 #4.2.4 #2.1.3 #2.1.4		Flight/Flight Management/DPI[21] services
			Arrival Planning Information, Extended Departure Planning Information, AOP strategic plan services are planned for Release 22
Airspace Structure, Availability and Utilisation	#5.5.1		Airspace/Airspace Structure
			Airspace/Airspace Availability

[20] While the *Specific MET Info Feature* service is mentioned explicitly in the regulation, it overlaps with the 3 generic MET information categories below.
[21] These services are considered to be a starting point. It will evolve based on AF2 (family 2.1.4 Initial AOP) and AF4 (family 4.2.2 Interactive Rolling NOP and family 4.2.4 AOP-NOP Information Sharing).

Information exchange requirement stated in PCP	DP Family	Service resulting from SESAR 1	NM B2B service in Release 21 / NM B2B service in the NM Roadmap (Release 21 - 2017, Release 22 - 2018)
Flight Domain			
Various operations on a flight object: Acknowledge reception, Acknowledge agreement to FO, End subscription of a FO distribution, Subscribe to FO distribution, Modify FO constraints, Modify route, Set arrival runway, Update coordination related information, Modify SSR code, Set STAR, Skip ATSU in coordination dialogue.	#5.6.2	ATC Flight Object Control	
Share Flight Object information. Flight Object includes the flight script composed of the ATC constraints and the 4D trajectory.	#5.6.2	Shared Flight Object	
Validate flight plan and routes	#5.6.1		Flight/FlightPreparation services available in ICAO 2012 format and EFPL format and FIXM 4.0
			FIXM 4.0 services planned for Release 21
Flight plans, 4D trajectory, flight performance data, flight status	#5.6.1 #4.2.3		Flight/FlightFiling services in ICAO 2012 format EFPL and FIXM 4.0
Flights lists and detailed flight data	#5.6.1		Flight/FlightManagement services
Flight update message related (departure information)	#5.6.1		Flight update messages Flight/Flight Management/DPI services
Link to other AFs			
Arrival constraints exchange between ATS Units	#1.1.2	Arrival Management Information	
		Departure Planning Information	
ADS EPP downlink and distribution	#6.1.2	Report Aircraft Trajectory	
		Shared Flight Object	

4. List of Acronyms

Acronym	Meaning
A/G	Air / Ground
ACC	Area Control Center
A-CDM	Airport – Collaborative Decision Making
ACH	ATC flight plan Change Message
ACL	ATC Clearance
ACM	ATC Communications Management
ADS-C	Automatic Dependent Surveillance – Contract
AF	ATM Functionality
AFP	ATC Flight Plan
AFTN	Aeronautical fixed telecommunication network
AFUA	Advanced Flexible Use of Airspace
AIM	Aeronautical Information Management
AIRM	Aeronautical Information Reference Model
AIXM	Aeronautical Information Exchange Model
AMA	Arrival Management Message
AMAN	Arrival Manager
AMC	ATC Microphone Check
AMHS	ATS Messages Handling System
ANSP	Air Navigation Service Provider
AoR	Area of Responsibility
APCH	Approach
APL	ATC Flight PLan message
APOC	Airport Operations Centre
APW	Area Proximity Warning
ARES	Airspace Restrictions
ASBU	Aviation System Block Upgrades
ASM	AirSpace Management
A-SMGCS	Advanced Surface Movement Guidance and Control Systems
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	Air Traffic Service Unit
AU	Airspace Users
AUP	Airspace Usage Plan
AVOL	Aerodrome Visibility Operational Level
B2B	Business 2 Business
BCA	Bridge Certificate Authority
BFD	Basic Flight Data
CA	Certificate Authority
CACD	Central Airspace and Capacity Database
CBA	Cost Benefit Analysis
CDI	Course Deviation Indicator
CDM	Collaborative Decision Making
CDR	Conditional Route

Acronym	Meaning
CEF	Connecting Europe Facility
CFD	Change Flight Data
CFSP	Computer Flight Planning Service Providers
CONOPS	Concept of Operations
COP	Coordination Point
CORA	Conflict Resolution Assistant
CPA	Common Procurement Agreement
CPDLC	Controller Pilot Data Link Communications
CPR	Correlated Position Report/Correlative Position Radar
CPTF	Common Procurement Task Force
CRL	Certificate Revocation Lists
CSP	Communication Service Providers
CTD	Constant Time Delay
CTOT	Calculated Take-off Time
CWP	Controller Working Position
DCT	Direct Routings
DLIC	Data Link Initiation Capabilities
DLS	Data Link Services
DMA	Dynamic Mobile Area
DMAN	Departure Management
DP	Deployment Programme
DPI	Departure Planning Information
EAD	European AIS Database
EASA	European Aviation Safety Agency
ECAC	European Civil Aviation Conference
EFD	EFTMS Flight Data
eFPL	Extended Flight Plan
EFS	Electronic Flight Strips
ETFMS	Enhanced Tactical Flow Management System
EGNOS	European Geostationary Navigation Overlay Service
EPP	Extended Project Profile
ERNIP	European Route Network Improvement Plan
ESOs	European Standardization Organizations
eTOD	electronic Terrain and Obstacle Data
EU	European Union
FAB	Functional Airspace Blocks
FANS	Future Air Navigation System
FB	Functional Block
FBZ	Flight Plan Buffer Zones
FDP	Flight Data Processing
FEP	Front End Processor
FL	Flight Level
FMP	Flow Management Position
FOC	Full Operational Capability
FPL	Flight Plan
FRA	Free Route Airspace
FRT	Fixed Radius Turn
FSA	First System Activation

Acronym	Meaning
FUA	Flexible Use of Airspace
FUM	Flight Update Message
G/G	Ground / Ground
GANP	Global Air Navigation Plan
GNSS	Global Navigation Satellite System
HMI	Human Machine Interface
i4D	Initial 4-D
iAOP	Initial Airport Operations Plan
ICAO	International Civil Aviation Organization
IFPS	Integrated Initial Flight Plan Processing System
ILS	Instrument Landing System
IOC	Initial Operational Capability
IOP	Interoperability
IP	Implementation Project
ISRM	Information Service Reference Model
iSWIM	Initial System Wide Information Management
IWXXM	ICAO Meteorological Information Exchange Model
KPI	Key Performance Indicator
LNAV	Lateral Navigation
LOA	Letter of Agreement
LPV	Localizer Performance with Vertical guidance
MF	Multi Frequency
MoC	Memorandum of Cooperation
MONA	Monitoring Aids
MoU	Memorandum of Understanding
MSAW	Minimum Safe Altitude Warning
MTCD	Medium Term Conflict Detection
NDB	Non-Directional Beacon
NM	Network Manager
NOP	Network Operations Plan
NOTAM	Notification to Air Man
NSA	National Supervisory Authority
OAT	Operational Air Traffic
OFA	Operational Focus Area
OI	Operational Improvement
OLDI	On-Line Data Interchange
OTMV	Occupancy Traffic Monitoring Values
OSs	Operational Stakeholders
PBN	Performance Based Navigation
PCP	Pilot Common Project
PEB	PENS Executive Board
PENS	Pan European Network Service
PKI	Public Key Infrastructure
PMU	PENS Management Unit
PSSG	PENS Steering Group
RA	Registration Authority
RIMS	Runway Incursion Monitoring System
RNP	Required Navigation Performance

Acronym	Meaning
RVR	Runway Visual Range
SBAS	Satellite Based Augmentation System
SCP	Stakeholder Consultation Platform
SDD	Service Design Document
SDP	Static Data Procedures
SESAR	Single European Sky ATM Research
SID	Standard Instrument Departure
SOPS	Standard Operation Procedures
STAM	Short Term ATFCM Measures
STAR	Standard Arrival Routes
STCA	Short Term Conflict Alert
SWIM	System Wide Information Management
SYSCO	System Supported Coordination
TBS	Time Based Separation
TCT	Tactical Controller Tool
TI	Technical Infrastructure
TMA	Terminal Manoeuvring Area
TMB	Top Management Body
TSAT	Target Start Up Approval Time
TTG	Time To Gain
TTL	Time To Lose
TTOT	Target Take Off Time
UUP	Updated Airspace Use Plan
VA	Validation Authority
VAMC	Volcanic Ash Mass Conditions
VDL	VHF Data Link
VGS	VHF Ground Station
VLD	VHF Digital Link
VNAV	Vertical Navigation
VoIP	Voice over IP
VOR	VHF Omnidirectional Range
WOC	Wing Operations Center
WXXM	Weather Information Exchange Model

5. Notes

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